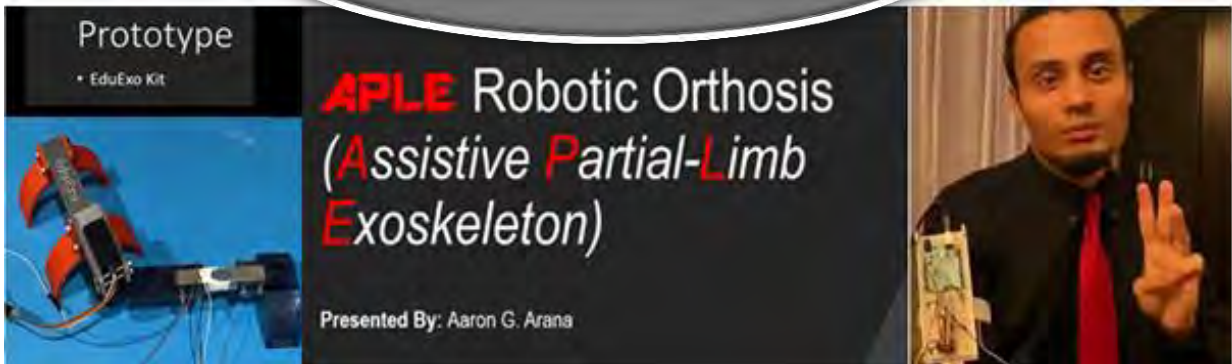


Vaughn College Journal of Engineering and Technology

May 2022



PERSEVERANCE



“The key to success is action and the essential in action is perseverance” Sun Yat Sen

The Vaughn College Journal of Engineering and Technology (VCJET) is published annually in preparation for the Technology Day Conference. It includes events and activities of the Department of Engineering and Technology such as faculty professional development, student engagements, robotics competitions, UAV activities, poster competitions, conference presentations, and the best student research papers.

Given the rapid pace of technological change, the Journal is intended to assist Vaughn engineering students in the development of an appreciation of lifelong learning to meet their future professional challenges. The ultimate goal of the journal is to engage and prepare students for their future in engineering research and innovation. VCJET further strengthens student learning outcomes related to critical thinking, problem solving, communication, and teamwork. These learning outcomes, embedded in engineering and engineering technology programs are further developed through the activities outlined in this publication. The events reported in this journal also contribute to student development of leadership and entrepreneurial skills.

A journal paper project must be produced and investigated in a manner that satisfies the learning objectives of engineering education. Some of the learning objectives emphasized in the development of a technical paper are:

1. Intention plan (Abstract): Developing a proposal that outlines the details of a project and its impact on local and global society
2. Application: Identifying the use and application of the project in global society
3. Methodology: Providing a brief description of methods and solutions
4. Teamwork: Identifying team members and their responsibilities in the project's development
5. Modeling: Providing a complete and precise drawing of the project
6. Analysis: Providing all necessary analysis and analytical tools used to satisfy the system's safety and computing requirements
7. Conclusion: Discussing the result(s) and the contribution of the project to local and global society
8. Reference: Identifying research references
9. Presentation: Presenting the selected design paper in a Microsoft PowerPoint format to the industry advisory members, faculty, and other members in the audience during the Technology Day Conference

The Journal's topics include technical papers related to computational mechanics, solid mechanics, mechatronics, robotics, avionics, electronics, and other topics pertinent to the engineering and engineering technology fields.

Author and Technical Editor: Dr. Hossein Rahemi

Journal Editor: Dr. Margaret Ducharme

STEM Activity Liaison: Prof. Manuel Jesus

Contributors: Dr. Amir Elzawawy, Prof. Manuel Jesus, Dr. Shouling He, Dr. Mohammed Benalla, Dr. Douglas Jahnke, Dr. Miguel Bustamante, Dr. Oluwaseyi Ajayi, Dr. Yougashwar Budhoo, Prof. Jonathan Sypeck, Dr. Ghania Benbelkacem, Prof. Khalid Mouaouya, Prof. Bobby Tang, Prof. Harrison Carranza, Prof. Donald Jimmo, Dr. Dwight E. Wermert, Alaric Hyland, Rachid Nafaa.

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A Brief Review of Vaughn College's Thirteenth Annual Technology Day Conference, May 28, 2021

Vaughn students, faculty, alumni, and industry professionals convened on May 28, 2021 for the Virtual Thirteenth Annual Industry Advisory Meeting and Technology Day Conference through a Zoom meeting. Advisory Council members were given updates on recent developments in the Engineering and Technology Department such as: fall 2020 EAC-ABET virtual visit for the purpose of initial EAC accreditation of ME and EE programs; HSI-STEM grant activities including the development of stackable manufacturing certificate programs in CNC machining, Composite, and 3D additive and subtractive manufacturing and UAS design; application and operation as well as establishment of manufacturing centers (CNC machining, composite, additive manufacturing PLC & automation and UAS) to support courses within these certificate programs. Project Director of title III HSI-STEM grant updated advisory members with grant supported STEM activities, student engagement and outreach activities. Also, he talked about the development process of a new computer engineering program that is supported by Title V HSI grant. Each technical club (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE, SHPE, and NSBE) provided their annual activities and accomplishments to the audience of the 2021 Virtual Tech-Day Conference, and capstone degree presenters talked about their innovative research project. The top 3 research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper awards of this session.

Prof. Manuel Jesus hosted this Virtual event and introduced all presenters; he also served as the moderator for the clubs and capstone presentation sessions of this annual gathering.

Vaughn College's President, Dr. Sharon DeVivo, welcomed the guests and thanked our advisory members and alumni for their active participation and support of the institution and student success and encouraged our advisory board and alumni to continue helping Vaughn's graduating students with internship and position opportunities during these challenging times.

Dr. Hossein Rahemi, Chair of Engineering and Technology Department, thanked the advisory members for their continuous support and valuable feedback in every aspect of the department's programs and students' success. He updated the advisory members about the fall 2020 EAC-ABET virtual visit for the purpose of the initial EAC accreditation of ME and EE programs. He explained how in July 2020 the department uploaded self-study reports for both programs in the ABET site and all supporting materials have been uploaded to a sharepoint for review by the ABET visiting team. From November 15 through November 17, EAC ABET had a zoom virtual visit with Vaughn's faculty, students, alumni, senior administration, and industry advisory members, and during Tuesday's exit briefing they informed us that both programs are in compliance with all of ABET's requirements. We expect to receive ABET's final accreditation statement for both of these programs in August 2021. He provided an overview regarding program assessment and the continuous improvement process based on both direct and indirect measures that resulted a successful review of both ME and EE programs by the ABET visiting team.

Dr. Rahemi updated advisory members about the Department of Education title III HSI-STEM grant funded activities including the establishment of four manufacturing centers (PLC &

Automation, 3D additive manufacturing, composite, and CNC machining), completion of four stackable certificate programs in Computer Aided Design & Additive Manufacturing, Composite Manufacturing, CNC machining, UAS design, application & operation and their current approval by New York State Education Department (NYSED). Dr. Rahemi's presentation provided an insight into students' professional and scholarly activities, including the success of the Vaughn College Robotics team at the 2020-2021 regional VEX U Robotics competitions, as well as their qualification to participate in the 2021 VEX U World Championship. He also discussed the participation of Vaughn's UAV team as finalists **for the virtual Design-Build-Vertical Flight competition** of the 2021 Vertical Flight Society. Among all participating teams, Vaughn's UAV team was recognized by Boeing for having a compact design and being able to have a great lift capacity with the given design. Vaughn's UAV team won "Honorable Mention with the most Manufacturable Award" of this virtual presentation session. This is the fourth year in a row that Vaughn's UAV team has won the top award in this challenging competition. Also, he talked about student involvement and success in scholarly activities including participation, presentation, and publication in technical conferences such as SWE, LACCEI, SHPE, and Southern Biomedical Engineering.

Dr. Rahemi informed advisory members about the new Title V grant funding support for developing and implementing a BS in computer engineering program, with two tracks in Cybersecurity and AI. He added, the computer engineering proposal with external reviewer evaluation and all other supporting documentation are in the process of being submitted to NYSED for their review and final approval.

Vaughn College Journal of Engineering and Technology
May 2021

Industry Advisory Members
 Bakery Innovative Technologies
 Circoor Aerospace and Defense
 Corning Inc.
 CYIENT
 CPI Aero
 COX and Company
 Dassault Systems
 East Coast Orthotic & Prosthetic Corp.
 Federal Aviation Administration (FAA)
 NASA
 Pavon Manufacturing Group
 PLX Inc.
 Pratt and Whitney
 Rockwell Collins
 SciMax Technologies, LLC
 Sikorsky, a Lockheed Martin Company
 The Naval Sea Systems Command
 City Tech, CUNY
 US Didactic

Engineering Workshops
 • 4th Annual Manufacturing Day
 • Girls Scouts Workshop
 • High School Workshops
 • Community College Workshops

“The greatest glory in living lies not in never falling, but in rising every time we fall.” - Nelson Mandela

Title III HSI-STEM Grant

➤ Student Engagement in STEM related activities

- Technical Clubs

1. UAV Club (a total of 14 active members)
2. Robotics Club (a total of 25 active members)
3. NASA Rover Club (a total of 8 active students)

- Student Chapter of Professional Society

1. Vaughn's Society of Women Engineers – SWE (24 active members)
3. Vaughn's National Society of Black Engineers - NSBE (12 active members)
4. Vaughn's Society of Hispanic Professional Engineers – SHPE (22 active members)

- **Supplemental Instruction (SI):** The current HSI-STEM title III grant provides additional funding (12 to 15 SIs per semester) to further enhance student performance through fundamental courses and improve the attainment of student learning outcomes in all STEM related programs. The student SI is assigned the task of reviewing class lectures, conducting problem solving sessions and communicating with the faculty member about the areas where students need reinforcement for successful course completion.



Engineering Department's Annual Activities Presentation

Dr. Rahemi's presentation covered student participation and success in Robotics and UAV competitions as well as their involvement and accomplishments in scholarly activities. Below is a list of students' accomplishments during the academic year 2020-2021

- ✓ In April 16, 2021, for the fifth year in a row Vaughn's UAV team was invited **as a finalist for the virtual Design-Build-Vertical Flight competition** of the Vertical Flight Society. Among all participating teams, Vaughn's UAV team was recognized by Boeing for having a compact design and being able to have a great lift capacity with the given design.
- ✓ Vaughn's Robotics team received qualification to participate in the VEX U Robotic World Championship, Greenville, Texas, June 25-26. For eight years in a row, Vaughn's robotics team has advanced to the world robotics championship. Invitation to the VEX U Robotics World championship is granted only to a team that is a tournament Champion, Finalist or "Excellence" award recipient of a regional competition as well as top place in "Robot Skills". Vaughn's Robotics team won both "Robot Skills" award of the Vaughn College and received "**Excellence Award**" of West Virginia VEX U Robotics Regional Qualifier Competition. .
- ✓ From July 27-31, 2020, Three Engineering Students' research projects were selected as finalists for the student paper session of LACCEI International Virtual conference. Vaughn College students **received 1st place award for student paper session competition** as well

as the **first place award for the poster session** of 2020 LACCEI international annual conference.

- ✓ From October 26-31, 2020, Vaughn's chapter of Society of Hispanic Professional Engineers participated in 2020 Virtual SHPE annual conference. Vaughn College students were selected as **finalists for the virtual design competition** of this annual conference. This is the **fourth year in a row that Vaughn's team has been selected as finalists for the SHPE design competition**.
- ✓ From November 2–13, 2020, Vaughn's chapter of SWE students attended in 2020 Virtual Society of Woman Engineers annual conference. Besides Career Fair session, Vaughn's SWE team attended STEM workshops and poster session competition of this virtual annual gathering.
- ✓ **Robotics Outreach** - On Saturday Jan 16, 2021, Vaughn College Robotics team hosted Virtual VEX U College Regional Skills Robotics and During the skills challenge matches, Vaughn's **team finished first in Robot Skills** with a total of 204 points..
- ✓ **Robotics Outreach** - On Sunday Jan 17, 2021, PD along with Vaughn College Robotics team hosted Virtual High School VEX skills Robotics Tournament. A total of 9 regional high schools from Queens, Brooklyn, Bronx, Nassau, and Suffolk and other NY counties attended the February VEX state qualifier at Vaughn College.
- ✓ On Saturday, February 20th 2021, Vaughn College's Robotics team participated at the Fairmount State University VEX U Robotics Remote Skills-Only Tournament. Vaughn's team **finished 2nd** and won the **"Excellence Award"** for their tremendous attention to the engineering design process. With Excellence Award, VCAT team is qualified to participate in the 2021 VEX U world championship.

Latin American and Caribbean Consortium of Engineering Institutions,
LACCEI2020 Virtual Conference, July 27-31, 2020



Finalist for LACCEI Paper Session

1. **"Autonomous Medication Distributor Through Implementation of Bresenham's Line Algorithm"**, by Brandon Duran, Diego Villegas, and Sebastian Valencia
2. **"Modular Torque Wrench Extension with Heads-up Display"**, by Atif Saeed, Juan Aguirre Rodrigues, and Juan Castano
3. **Development of an Advanced Robotics Program for Middle and High School Vex Robotics Students"** by Ryan Tang Dan and Maharshi Patel

Vaughn's Students Take First Place at LACCEI 2021 Paper session Competition and First Place of Poster Session Competition



2020 LACCEI Virtual Conference



2020 Virtual Women Engineers Conference, November 2 – 13, 2020

8 Vaughn's chapter of SWE students attended 2020 Virtual Society of Woman Engineers annual conference. Vaughn's SWE team attended STEM workshops and poster session competition of this virtual annual gathering.



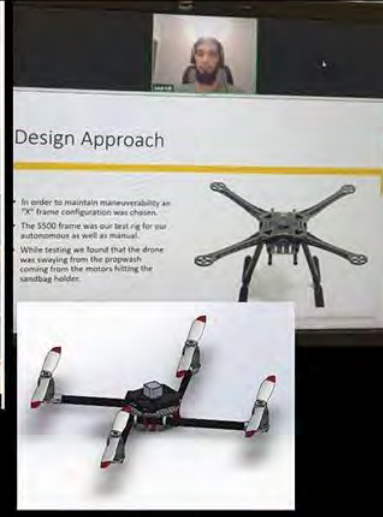
2020 Society of Hispanic Professional Engineers (SHPE) Virtual Conference, Oct 26-31, 2020

Nine Vaughn's chapter of Society of Hispanic Professional Engineers participated in 2020 Virtual SHPE annual conference. Vaughn College students were selected as **finalists for the virtual design competition** of this annual conference.



2020 SWE and SHPE Virtual Conferences

April 16, 2021 **VFS virtual Design-Build-Vertical Flight competition**
Vertical Flight Society



Awards: The team won "**Honorable mention with the Most Manufacturable Award**" of the virtual Design-Build-Vertical Flight competition of 2021 Vertical Flight Society.

2021 VFS Virtual Design-Build-Vertical Flight Competition

Robotics, UAV, SWE, NSBE, and SHPE Clubs' presentation
11:00 am to 12:00 pm

Each technical club and student chapter of a professional society provided 7 minutes presentation of their annual activities that includes their involvement in technical competitions, organizing and hosting STEM workshops, community outreach activities, assisting Vaughn College in hosting regional High Schools and College Robotics competitions, hosting Robotics and Drone workshops during Vaughn's Annual Manufacturing Day and Annual STEM Day, hosting STEM workshops during SWE and SHPE annual conferences, participating in extreme engineering and Nissan design challenges of SHPE annual conference as well as other activities that helped them with internship and career opportunities. Also, they talked about their involvement in scholarly activities including participation, presentations, and publications in technical conferences. The videos of their presentation provide more details of these activities.



Annual Activities Presentation by Robotics and UAV Clubs

Eboard Members for 2020-2021

President	Vice President	Secretary	Treasurer	Fundraising Chair
Alina Santander Mechatronic Engineering	Maharshi Patel Mechanical Engineering	Tatiana James Mechatronic Engineering	Mariah Vilalon Electrical Engineering	Manolo Duenas Mechatronic Engineering

National and Regional Conferences

NSBE primarily has two conferences:

- Fall Regional Conference: Respective regions hold these conferences
- Spring National Conference: All regions in the country come together for this.

In both conferences, a number of professional development workshops are held and Career fairs as well. Members in good standing are funded by the college to attend these conferences.

SOCIETY OF HISPANIC PROFESSIONAL ENGINEERS

SHPE Vaughn College of Aeronautics and Technology
Leading Hispanics in STEM

THE FIVE SHPE PILLARS

- Academic Development
- Professional Development
- Leadership Development
- Community Outreach
- Chapter Development

**A Presentation by Vaughn’s Student Chapter of Professional Societies
SWE, NSBE, and SHPE Annual Activities Presentation**

Student Technical Paper Presentation, 12:00 pm to 1:00 pm

A total of six capstone degree projects as listed below were selected for publication in 2021 VCJET Journal, and among those a total of three design degree projects were selected by our industry advisory members as finalists for the **Best Paper and Presentation Award** of 2021 Vaughn College Annual Technology Day Virtual Conference. In addition one work-in-progress project was selected as finalist for the **Best Work-In-Progress Project Award** and presentation during this annual gathering.

Capstone Degree Projects

1. Autonomous Strategy Panning with Constraints of Tether Robot System

Finalist for the Best Paper and Presentation Award

Authors: Timothy Tullio
Program: Mechatronic Engineering
Advisor: Dr. Shouling He

2. Handle Shield: Door Handle Limited Contamination Device Mechanism

Authors: Joan Cruz, Olaitan Hammed, Luis Pintado
Program: Mechanical Engineering
Advisor: Dr. Amir Elzawawy

3. Assistive Partial Limb Exoskeleton (APLE)

Finalist for the Best Paper and Presentation Award

Author: Aaron Arana
Program: Mechatronic Engineering
Advisors: Drs. Shouling He and Mohammed Benalla

4. Automatic Shopping Cart

Finalist for the Best Paper and Presentation Award

Authors: Samia Oishi, Deno Jordan and Kastronepaul Thevasahayam
Program: Mechatronic and Electrical Engineering
Advisor: Dr. Shouling He

5. Optimized Water Purification of a Solar Still

Authors: Darius Palmer and Joseph Blejec
Program: Mechanical Engineering Technology
Advisor: Dr. Yougashwar Budhoo

6. The Use of Thermo-Electric Generators to Recycle Thermal Energy produced by Electronic Components for Convection Cooling

Authors: Steven McAdam, Tommy Saenz, and Cae Chow
Program: Mechanical Engineering
Advisor: Dr. Amir Elzawawy

Work-in-progress Design Project

1. Wireless Heating Pad

Best Work-In-Progress Design Project Presentation Award

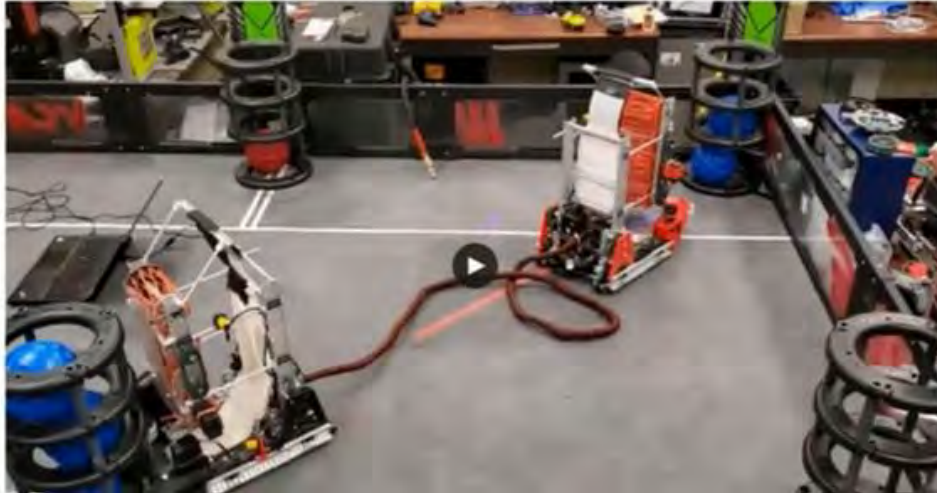
Authors: Rafacely Brito, August Rodriguez, Suraiya Nawaz, Tatiana Jaimes,
and Isa AL-Maktoum
Programs: Mechanical and Mechatronic Engineering
Advisor: Dr. Ghania Benbelkacem

Autonomous Strategy Planning with Constraints of Tether Robot System

By: Timothy Tullio
Senior in Mechatronics Engineering Program
Vaughn College of Aeronautics and Technology
Prepared for: Dr. Shouling He



Path#1 for both Subsystems



APLE Robotic Orthosis (Assistive Partial-Limb Exoskeleton)

Presented By: Aaron G. Arana



Engineering Requirements and Design Constraints

- **Safety and Comfort:**
 - Operated comfortably without harm through overextension
- **Portability:**
 - Compact, well fit, and easy to transport
- **Precision and Accuracy:**
 - Efficient and precise assistive movement
- **User-friendly:**
 - No extensive training required to operate or calibrate the device
- **Affordable, Adaptable, and Available:**
 - Inexpensive, mass producible, customizable and adjustable



Prototype

• EduExo Kit



Students' Capstone Design Papers Presentation

5. Design Analysis - *Electr* Wireless Heating Pad

Four subcircuits:

- 1) PWM Transistor
- 2) Rotary Encoder
- 3) Thermocouple
- 4) Wireless Module



2. Impacts

Economic

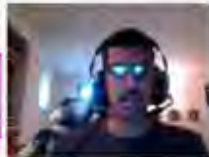
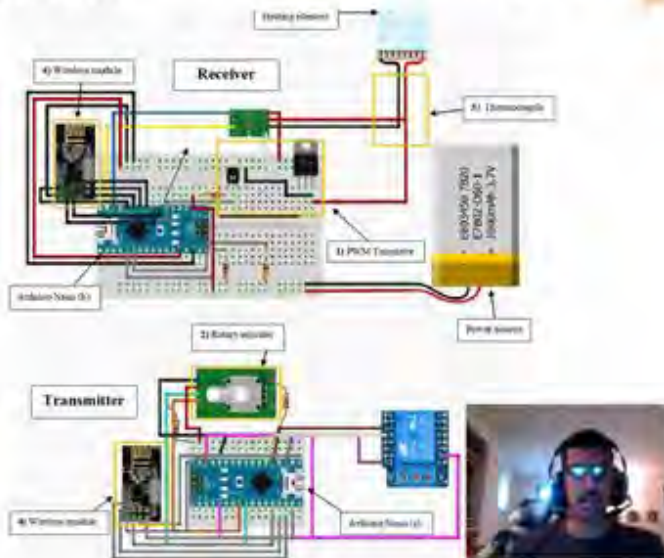
- Global market of \$779.8 Million in the year 2020
- Projected increase to US \$1.2 Billion by 2027
- Highest marketing is found in China

Environmental

- Decrease wattage usage
- Utilize sustainable components
- Carbon fiber heating saves energy resources
- Decrease electrical, water, and heat waste

Social

- Secure the safety of users - senior citizens and hospital patients
- Allow portability to adapt to users' needs
- Aid those with health conditions



Students' Work-In-Progress Design Project Presentation

Best Paper and Presentation Award Recipients

The top two research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper and presentation awards of this session. The winning papers included: **First place Design Paper and Presentation winner**, "Assistive Partial Limb Exoskeleton (APLE)" by Aaron Arana; and **Second Place Design Paper and Presentation winner**, "Autonomous Strategy Panning with Constraints of Tether Robot System" by Timothy Tullio; and the **Best Work-In-Progress Design Project presentation winner**, "Wireless Heating Pad" by Rafacely Brito, August Rodriguez, Suraiya Nawaz, Tatiana Jaimes, and Isa AL-Maktoum.





Best Student Papers and Presentation Awards



Best Work-In-Progress Presentation Award

In conclusion, Dr. Rahemi, congratulated all capstone paper and technical club presenters, and he commented how impressed he and the Vaughn community are with the quality of their work.

He extended his gratitude to the federal department of education HSI-STEM funding support for all STEM activities and students’ engagements in hands-on technical clubs, competitions, and scholarly activities. He thanked the industry advisory board and alumni for their feedback and continuous support in every aspect of the department and student success. Finally, he expressed his sincere gratitude to those advisory members who served as judges to evaluate student’s capstone projects as well as those who served as reviewers for Vaughn’s new computer engineering program.

Supplemental Instruction

Supplemental Instruction (SI) is a student academic assistance program which increases academic performance and retention through the use of collaborative learning strategies. The SI program at Vaughn targets challenging mathematics, engineering, and physics courses and provides regularly scheduled, out-of-class, peer-facilitated sessions giving students further opportunity to process the information learned in class. Supplemental instruction is a proactive approach to student learning and engagement which increases student persistence and retention. In an effort to increase learning effectiveness, during the spring of 2009 a formal supplemental learning program was introduced. In addition, during the spring of 2012, as part of the Hispanic-Serving Institution (HSI) STEM grant, the SI program has been further enhanced to assist and improve student understanding in fundamental engineering and engineering technology courses. In these courses, such as statics, dynamics, strength of materials, AC/DC circuits, Robotics, automation, and Computer Aided Design, highly talented students who have already completed those courses are selected to sit-in on the classes for a second time, with the instructor, and to serve as a designated Supplemental Instructor (SI) for these courses and laboratory exercises. The student SI is assigned the task of reviewing class lectures, conducting problem solving sessions and communicating with the faculty member about the areas where students need reinforcement for successful course completion. This SI program was initiated in conjunction with the Teaching and Learning Center (TLC). The current HSI-STEM title III grant provides additional funding (\$60,000/year, 2016-2021) to further enhance the SI program through more fundamental courses that can improve the attainment of student learning outcomes in all STEM related programs.

The student SI is scheduled for ten hours per week to assist students in the fundamental engineering and engineering technology courses. This includes three hours per week that the SI attends the class with the instructor for the second time, and another seven hours per week to assist students with problem solving sessions. For fall 2021 the student supplemental instructors and their schedule are presented in the following table.

Table 4-1: Fall 2021 SIs for the Corresponding Courses and Course Schedule

Course	Faculty	Supplemental Instructor	Class Schedule	Out-of-Class Zoom SI Work
MEE210 Thermodynamics	Ghania Benbelkacem	Ariel Ferrera	Monday: 2:00-3:30pm Wednesday: 2:00-3:30pm	Monday - 6-8pm Tuesday: 6-8pm Wednesday: 6-8pm Thursday: 6-7pm
MEE370 Finite Element Analysis	Hossein Rahemi	Sam Vitez	Tuesday: 4:00-5:50pm Thursday: 4:00-5:50pm	Monday: 1pm-3pm Tuesday: 3pm-5pm Wednesday: 2pm-5pm
ELE326 Microprocessors	Shouling He	Sam Vitez	Tuesday: 3:00-4:50pm	Monday: 9am-11am Tuesday: 11am-2pm Thursday: 3pm-5pm
MEE215 Dynamics	Douglas Jhanke	Jack Sze	Monday: 2:00pm-3:30 pm Wednesday: 2:00 pm - 3:30 pm	Monday: 12:30-2:00pm Thursday: 12:00-2:30pm Friday: 1:00pm - 4:00 pm

MEE115 Engineering Mechanics I	Douglas Jhanke	Alanke Perrera	Monday: 12:00-1:50pm Wednesday: 12:00- 1:50pm	Tuesday: 6:00pm-9:00pm Wednesday: 6:00-9:00pm Thursday: 9:00-11:00am Saturday: 9:00-11:00am
MEE345 Fluid of Mechanics	Ghania Benbelkacem	Almaz Abdrasulov	Tuesday: 9:00-10:30am Thursday: 9:00-10:30am	Monday: 3:00 - 5:00 pm Tuesday: 3:00 - 5:00 pm Wednesday: 3:00-5:00 pm Thursday: 3:00 - 5:00 pm Friday: 11:00am- 1:00 pm
MCE410/410L Mechatronics	Shouling He	Deanna Gubitto	Monday 9:00am-12:00pm Wednesday: 9:00am – 11:00am	Tuesday: 12:00 - 3:00 pm Thursday: 12:00- 2:00 pm
MEE220 Mechanics of Materials	Douglas Jhanke	Misael Marquez	Tuesday: 3:00-4:50pm Thursday: 3:00-4:50pm	Monday 12pm - 3pm Tuesday 11 am - 3 pm Thursday 12 pm - 3 pm
MCE101 Introduction to Robotics	Tang, Ryan	August Rodriguez	Monday: 9:00am-1:50am 5:00pm-7:50pm 2:00pm-4:50 pm	Monday: 9:00am-1:50am 5:00pm-7:50pm 2:00pm-4:50 pm
Lab Assistant	Mohammed Benalla	Tika Tamang		Tuesday: 12pm-4pm Wednesday: 12pm-2pm Thursday: 8am-9am & 1pm-5pm
ELE230/ELE230L	Shouling He	Daniel Doscher	Tuesday: 12:00-1:50pm Tuesday: 2:00-3:50pm Thursday: 12:00-1:50pm	Tuesday: 23pm-3pm & 6:00pm-8:30pm Wednesday: 1:00pm- 3:30pm

2021 Department's Activities and Highlights

1. STEM related student engagement (Technical Competitions, STEM workshops and Conferences):

- ❖ **2021 West Virginia Regional VEX U Robotics Tournament:** On Saturday, February 20th 2021, Vaughn College's Robotics team participated at the Fairmount State University VEX U Robotics Remote Skills-Only Tournament. A total of twelve colleges and universities participated in the event. Vaughn's team with a total of 205 skills points finished **second place** behind the University of Waterloo with a total of 251 skills points. In this regional tournament, Vaughn's team won the **“Excellence Award”** for their tremendous attention to the engineering design process.
- ❖ **2021 VFS Design-Build-Vertical Flight Competition:** On Friday April 16, 2021, Vaughn's UAV team project was selected as one of the finalists along with Penn State, Ohio State, Oregon State, University of Michigan, and University of Maryland for the Virtual Design-Build-Vertical Flight Competition. Vaughn's UAV Team developed a drone to compete in both the manual and autonomous categories. The drone was designed to perform vertical takeoff & landing (VTOL) with onboard flight-stabilization and camera. Among all participating teams, Vaughn's UAV team was recognized by Boeing for having a compact design and being able to have a great lift capacity with the given design. Judges awarded Vaughn's UAV team with an **“Honorable mention with the *Most Manufacturable Award*”**. This is the fourth year in a row that Vaughn's UAV team has won the top award of the VFS competition.

- ❖ **2021 VEX U Robotics World Championship:** From June 26-27, department chair and six members of Vaughn’s Robotics club traveled to Greenville, Texas to participate in 2021 VEX U Robotics World Championship. Forty one (41) national and international universities and colleges were invited to the 2021 World Robotics Championship. Invitation to the VEX U Robotics World championship was only granted to a team that is a tournament champion or excellence award recipient of a regional competition. The VEX U Robotics Championship was an intense two days competition where our team was continuously modifying their robots and autonomous programming to be competitive with other top teams in this tournament. Vaughn’s team finished 6th place of overall ranking and 3rd place of Robot Skills ranking, and they retained their standing as one of the top ranked competitors in the 2021 VEX U In-Person Robotics championship
- ❖ **2021 LACCEI International Conference:** From July 19-23, Vaughn’s engineering and technology students, along with Dr. Hossein Rahemi, department chair and PD of HSI-STEM, attended the LACCEI 2021 Virtual Conference. Two Vaughn student team research papers were accepted for presentation and publication in the LACCEI 2020 international conference. Both Vaughn student papers, as listed below, were selected to compete among ten finalists for the student paper session as well as student poster session of LACCEI 2021.
 - ✓ **“Intelligent Robot Design for VEX U Skills Challenge”** by Misael Marquez
 - ✓ **“BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy”** by Tatiana Jaimés, Alina Santander Vinokurova, August Rodriguez.

From 11 am to 1 pm on Wednesday July 21, two of our student team papers, as listed above, were presented to the international conference audience during the student paper session of LACCEI 2021. Vaughn’s student paper **“Intelligent Robot Design for VEX U Skills Challenge “** and the presentation by Misael Marquez that covered the design, manufacturing, and development process of a robot as well as autonomous programming for VEX U skills challenge won the **third place award of 2021 LACCEI student paper session competition** Also, from 2:30 pm to 4:30 pm on Tuesday July 20, both of Vaughn’s student team projects were selected as finalists for the LACCEI 2021 Virtual poster session competition.
- ❖ **2021 Federal Department of Education Virtual Project Directors’ Conference:** From Aug 3-5, department chair and project director of Title III HSI-STEM, 3D/CNC curriculum designer, Prof. Manny Jesus, and project director of Title V SOAR grant, Dr. Margaret Ducharme attended virtual project directors’ conference. For this conference, Vaughn’s grant team developed and submitted a proposal and prerecorded presentation about **Vaughn’s Title III and Title V grant project activities during COVID**. These activities covered, virtual STEM workshops, virtual outreach, students’ involvement in virtual extracurricular activities, establishment of Vaughn’s manufacturing centers, and common reading program.
- ❖ **2021 SWE Annual Conference:** From October 21 to 23, 2021, with the support of title III HSI-STEM funding, the Vaughn College chapter of the Society of Women Engineers (SWE) attended the 2021 Women Engineers Conference in Indianapolis, Indiana from October 21st through October 23rd, 2021. During the conference, nine members of the chapter had the opportunity to attend leadership seminars and technology talks. In addition to attending those, SWE students attended the in-person

and virtual career fairs, where some interviewed with industry-leading companies such as Honeywell, Carrier, Raytheon Technologies, Accenture, and EBI. The conference was successful as 7 internship positions were offered on-site; interview opportunities were also given both on-site and during the remote career fair.

- ❖ **2021 Society of Hispanic Professional Engineers (SHPE) National Conference:** From Nov 10 – 14, 2021, with the funding support of Title III HSI-STEM grant, a group of thirteen engineering students from Vaughn College attended the 2021 Society of Hispanic Professional Engineers (SHPE) in-person Conference at Orlando, Florida. Vaughn’s students participated in innovation, Nissan Design, and Extreme Engineering challenges as well as various professional development workshops that aimed to promote leadership, unity, and expose them to the diverse career opportunities in the STEM fields. Also, Vaughn participated in the career fair session of SHPE national conference and Vaughn’s SHPE chapter received a total of 11 interviews for both internship and full-time position with companies such as DuPont, Lockheed Martin, Rockwell Automation, Cummins, Tesla, Honeywell, Amazon, and Raytheon, seven of which resulted in pending Internships and two internship offers. Also, Several of the Vaughn HSI-STEM grant-supported students had the opportunity to participate in Innovation Challenge, Cybersecurity Challenge, and the Nissan Design Challenge. Vaughn’s student, **Kevin Kenta Osada, won second place in the Nissan Design Challenge** and **Kirill Sokolov won third place in the Innovation Challenge** of the SHPE national Conference (**Attachment 1 - 2021 SHPE National Conference**).
- ❖ **2021 Southern Biomedical Engineering Conference:** From December 2-5, four Vaughn engineering students, Alina Santander, Tatiana Jaimes, Aaron Arana, and Mariah Villalon, along with Dr. Hossein Rahemi, engineering department chair, and engineering faculty, Drs. Mohammed Benalla, Shouling He, and Prof. Khalid Mouaouya participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA. Three Vaughn’s student team research papers were accepted for publication and presentation in this annual gathering. Vaughn’s student papers as listed below were presented in the 37th Southern Biomedical Engineering conference on Saturday December 4th from 2:15 AM to 2:45 AM
- ❖ **2021 Vaughn’s Technology Day Virtual Conference:** On Friday, May 28, 2021, Vaughn graduating engineering students gave presentations about their capstone research projects during afternoon paper sessions of the 2021 Virtual Technology Day Conference. Six capstone papers were presented during afternoon session of this Virtual event. The top two research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper and presentation awards of this session. The winning papers included: **First place Design Paper and Presentation winner**, “Assistive Partial Limb Exoskeleton (APLE)” by Aaron Arana; and **Second Place Design Paper and Presentation winner**, “Autonomous Strategy Panning with Constraints of Tether Robot System” by Timothy Tullio; and the **Best Work-In-Progress Design Project presentation winner**, “Wireless Heating Pad” by Rafacely Brito, August Rodriguez, Suraiya Nawaz, Tatiana Jaimes, and Isa AL-Maktoum.

2. Lab Equipment, Laboratory Enhancement and Development:

- ❖ **HASS Desktop Mill Trainer:** On Nov 4, 2021, with the support of supplemental HSI-STEM title III grant funding and with recommendation of 3D/CNC curriculum developer and CNC lab tech, PD placed a purchase order (**\$12,694.75**) to acquire a HAAS Desktop Mill Trainer. The HAAS CNC Desktop Mill is an educational version of the popular HAAS VF2 SS CNC and MCU control system. It allows instructors to teach the HAAS CNC MCU (Microcomputer / Machine Control Unit) interface to students in a lecture / lab classroom environment before moving on to the full-size industrial HASS VF2 SS milling machine.
- ❖ **3D Scanner for manufacturing lab:** On November 17, 2021, with recommendation of 3D/CNC curriculum developer and CNC lab tech, PD placed a purchase order (**\$18,849**) for a metrology grade 3D scanner. This state-of-the-art metrology grade 3D scanner will be used for precision measuring alongside our CMM station to inspect production CNC parts and 3D scan parts for reverse engineering. (Attachment # 3 – PO for the 3D Scanner).
- ❖ **Magics Additive Manufacturing Software Licenses:** On October 13, 2021 with recommendation of 3D/CNC curriculum developer and CNC lab tech, PD placed a purchase order (**\$3,154**) for the Magic Additive Manufacturing Software licenses. This Software is used in CDE375 and the 3D Printing Lab for manufacturing related courses and activities.
- ❖ **PLC Lab Equipment:** On August 16, 2021, as part of Vaughn's 2020 approved supplemental award, the grant team placed a purchase order for 20 units of SIMATIC S7-1200 PLC with all accessories (**\$10,175**). This PLC equipment will provide students with more relevant hands-on knowledge to operate new PLC automation systems and programming developed to facilitate engineering processes.
- ❖ **Non-destructive Lab Equipment:** On Feb 11-19, 2021, as part of title III HSI-STEM project, the grant team placed a purchase order for the Olympus Imaging Flaw Detector, Digital Ultrasonic Flaw Detector, and other Non-destructive equipment with all accessories (**\$29,997.24**). This equipment will provide students with more relevant hands-on knowledge in mechanical testing and evaluation. .
- ❖ **METAL X 3D Printer:** On Feb 2nd, as part of title III HSI-STEM project, the grant team placed a purchase order for a METAL X 3D Printer with all accessories (**\$205,000**). This equipment will provide students with hands-on knowledge in additive and subtractive manufacturing,
- ❖ **Vericut CNC Software:** In January 2022, as part of Title III HIS-STEM project, the grant team, with the recommendation of CNC/3D curriculum designer, placed a purchase order for the Vericut CNC software (**\$2000**). Vericut software is used in high end aerospace manufacturing as a safe method to debug and troubleshoot CNC programs. Our industry advisory board partners specifically requested we add Vericut CNC software to our course curriculum. They have positions ready for students well versed in the Vericut workflow. Most importantly, Verticut is an important tool for safety first mantra of modern machine shops where program verification is used to prevent tool breakage, machine damage, or injury to machine operator. Our configuration will feature three complete replicas of our HAAS Mill, StepCraft Mill, and Okuma Lathe for rapid verification simulations before the time, expense, and potential danger of running unproven CAM programs.

3. **Hosting STEM related Conferences, Workshops, Seminars, STEM Outreach and other Department's related Activities:**

- ❖ **2021 Vaughn College 7th VEX U Robotics Regional Tournament (Virtual):** On Saturday, Jan 16, 2021, the department chair, along with the Vaughn College Robotics team, hosted the Virtual VEX U College Regional Skills Robotics competition, and During the skills challenge matches, **Vaughn's team finished First in Robot Skills** with a total score of 204 points
- ❖ **2021 Vaughn College 7th High School Robotics Competition (Virtual):** On Sunday Jan 17, 2021, the department chair along with the Vaughn College Robotics team hosted the Virtual High School VEX skills Robotics Tournament. A total of 9 regional high schools from Queens, Brooklyn, Bronx, Nassau, and Suffolk and other NY counties attended the February VEX state qualifier at Vaughn College.
- ❖ **2021 Vaughn's STEM Day Workshop:** On Friday, April 9, 2021, the department chair along with faculty, lab techs, and STEM pathway Liaison hosted its **3rd annual STEM Day workshop** for community colleges and high schools students. The participants of Vaughn's STEM Day virtual workshop event were students and faculty from Passaic CC, Queensborough CC, Bergen CC, Aviation High, and Humanities & Arts high school. For this virtual event, Vaughn's STEM Liaison and 3D/CNC curriculum developer, Prof. Manuel Jesus, introduced participants to Vaughn College's program offerings in engineering and engineering technology disciplines as well as to student involvement in various STEM related clubs and professional activities. Prof. Jesus, provided participants with a video tour of Vaughn's 3D Makerspace and CNC manufacturing centers. Finally, the department hosted couple of virtual STEM workshops related to 3D Scanning, CAM and CNC, and Virtual Reality
- ❖ **7th Annual Manufacturing Day Virtual Conference:** The Engineering and Technology department chair and Title III HSI-STEM project director together with 3D/CNC curriculum designer hosted the 7th annual manufacturing day conference on Friday, October 29, 2021 (10 am to 1 pm) to celebrate the national manufacturing day. The guest speakers addressed the Vaughn community, faculty, and invited guests about manufacturing innovation in the area of manufacturing of surgical masks, OT Cyber Security & Artificial Intelligence, Autonomous Mobile Robots, AM in Electronics, 3D Scanning and Precision measurement tools, and Virtual Reality in aerospace and manufacturing industries.
- ❖ **7th Annual Manufacturing Day STEM Workshops:** On Friday, October 29, 2021, in a parallel session, from 10 am to 1:00 pm, Vaughn's Robotics and UAV clubs organized and hosted virtual STEM workshops for the high school students. These workshops covered the following items:
 - ✓ Robotics Workshop - Robotics design & autonomous programming for the 2021 VEX U Robotics Competitions
 - ✓ An informational session about the basics of drones and the design considerations
 - ✓ Drone Autonomous Programming using Mission Planner softwareThese workshop sessions were conducted in both in-person and in virtual zoom meetings.
- ❖ **13th Annual Technology Day Virtual Conference:** On Friday, May 28, 2021, the Engineering and Technology department chair together with the 3D/CNC curriculum designer hosted its Thirteenth Annual Industry Advisory Meeting and Technology Day Conference. In this virtual conference, Dr. Rahemi updated Advisory Council members

on recent developments in the Engineering and Technology Department such as the fall 2020 EAC-ABET virtual visit for the purpose of initial EAC accreditation of ME and EE programs, HSI-STEM grant activities including development process of stackable manufacturing certificate programs in CNC machining, Composite, and 3D additive and subtractive manufacturing and UAS design, application and operation as well as establishment of manufacturing centers (CNC machining, composite, additive manufacturing, PLC & automation, and UAS) to support courses within these certificate programs. The PD updated advisory members on grant supported STEM activities, on student engagement and on outreach activities. Each technical club (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE, SHPE, and NSBE) provided their annual activities and accomplishments to the audiences of 2021 Virtual Tech-Day Conference, and capstone degree presenters talked about their innovative research project. The top 3 research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper awards of this session. In conclusion, Dr. Rahemi congratulated all capstone paper and technical club presenters.

❖ **Industry Connection and Engineering Seminar Series:**

- **An introduction to NASA, NASA Goddard Space Flight Center, NASA Goddard Institute for Space Studies and NASA Internship Opportunities:** on Thursday, Feb 11, 2021, Mr. Matthew Pearce, National Aeronautics and Space Administration (NASA) education programs specialist and Ms. Rosalba Giarratano, Pathways Intern at the Goddard Institute for Space Studies, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this Microsoft Teams Virtual event, both Ms. Rosalba Giarratano and Mr. Pearce's presentation covered topics related to an overview of NASA, NASA Goddard Institute for Space Studies, NASA STEM Workforce Challenges, and they talked about all available STEM Internships, Fellowships, and other career opportunities with NASA and NASA's internship application and interview process.
- **Power System Integration for Aerospace Industry:** On Friday February 19, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this virtual event seminar, Mr. Asaro talked about topics related to high horse power motor, PLC, high power cables conductors, electronics conduit design and manufacturing processes within the aerospace industry (Attachment#2-Power System Integration for Aerospace Industry).
- **Celebrating Black History and Women's History months with Engineer and Astronaut Stephanie Wilson, March 9, 2021:** On Tuesday, March 9th from 10 to 11 am, Vaughn's students, faculty, and Staff, in observance of Black History and Women's History months, participated in a virtual fireside chat with engineer and NASA astronaut Stephanie Wilson to celebrate accomplishments of distinguished African American Engineers and Astronauts. This special virtual meeting was held by NASA to promote STEM in education. Stephanie Wilson graciously shared her career path as an African American Woman involved in a STEM career. Specifically, she shared insight regarding her role as an astronaut with NASA during the Shuttle Program and construction of the International

Space Station. First and foremost, Ms. Wilson made a point to share that she was an aerospace engineer who worked hard to lay the foundations that eventually brought her to a successful career as a leading astronaut.

- **Electrical Safety and Consideration:** On Tuesday, March 23, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky and an adjunct faculty member at Vaughn College, addressed the Vaughn community on the topic of Electrical Safety Considerations, as part of the College's Virtual Industry Connection Seminar series. The overall topic of the presentation was safety first. The serious nature of this topic was addressed through discussion of tragic workplace accidents related to servicing motors accidentally left in a powered-on state. Personal electrical safety equipment such as probes, high voltage resistant gloves, and foot pads were shown as effective measures against fatal injuries.
- **Update on new FAA drone Rules that go into effect April 2021:** On Thursday, April 15 from 11 am to 12 pm, as part of the College's industry connection seminar series, Ms. Loretta Alkalay, an aviation attorney specializing in issues related to compliance with federal aviation regulations including drone rules, who is also an adjunct professor at Vaughn College, updated the Vaughn community on new FAA drone rules that go into effect April 2021, including the operations over people rule and the remote ID rule.
- **Drone Awareness Week:** On Thursday September 16, the engineering department in collaboration with the Management department hosted a seminar to celebrate National Drone Awareness Week. This seminar featured a presentation regarding Drone and UAV Safety Standards. Federal Aviation Administration experts Michael O'Shea, the UAS Program Manager led the discussion regarding drone safety mandates. Mr. O'Shea's presentation showcased the FAA's ongoing mission to provide the safest, most efficient aerospace system around the world. Vaughn's UAV club secretary Yusuf Rafi started the event with a presentation that highlighted current club activities and past achievements such as their 1st place award for Autonomous at the 2018 VFS Student Challenge Competition. UAV club students shared their findings on the topic of UAV safety through their own experiences in drone operation, the Part 107 License, and best practices for UAV flight within the FAA restrictions.
- **Summer internship programs with NASA and InstaHub:** On Tuesday December 7, 2021 as part of department's Engineering Seminar Series, Tatiana Jaimes and Alina Santander, Senior Students in Mechatronic Engineering who participated in summer internship programs with NASA and InstaHub, addressed the Vaughn community about their summer internship programs and life-long learning experiences that they both gained through their projects.. Tatiana Jaimes spoke of her summer internship at NASA where she worked on the Osam 1: Satellite Servicing Mission. This project centered on developing technology to service satellites in orbit, a crucial task to perform since the retirement of the manned space shuttle fleet and its unique ability to rendezvous with and service satellite hardware. Alina Santander had the opportunity to spend the summer with InstaHub a northeast US developer of building automation hardware solutions.
- **History and overview of the 737 program:** Mr. Ed Clark, a vice president and general manager of Boeing's 737 Program, addressed the Vaughn community on

December 9, 2021 as part of the College's Industry Speaker series that has been organized by Vaughn's Career Service Department. The event was held both in-person and virtually. His presentation began with the history and overview of the 737 program. The 737 program commenced in the 1960's with the need to supplement Boeing's existing 727 program. Since the maiden flight of the 737 in 1967, there have been four generations of 737 planes. Clark mentioned that Boeing produces three airplanes per month out of the Renton, WA assembly building and 50 airplanes per month out of the Seattle delivery center.

- ❖ **Career Advisement Day – Career Conversations with Students:** On Thursday, October 7, 2021, the engineering and technology department hosted its 3rd Annual Curriculum and Career Advisement day with students in engineering and engineering technology programs. Dr. Rahemi, along STEM Liaison and engineering faculty, organized a virtual event to provide curriculum and career advisement to all engineering and engineering technology students. This virtual event covered topics related to curriculum as well as to activities in which students should participate in order to enhance their career opportunities while studying at Vaughn
- ❖ **STEM Outreach:**
 - ✓ **VCAT Robotics at Thomas A. Edison High School:** Seven Vaughn College engineering students with their faculty mentor traveled to Thomas A. Edison High School on December 10th, 2021 and presented various topics related to college experiences, competition experiences, robot experience, and finally to a robot competition demo where the students were allowed to operate the robots under the team's supervision.
 - ✓ **Freeport High School Regional State Qualifier Robotics Competition:** On Saturday, February 5th, 2022, Freeport High School hosted its regional state qualifier robotics completion, and more than twenty-four regional high schools and middle schools participated in this competition. Six members of Vaughn's robotics team, along with two faculty members, participated in assisting Freeport High School with this regional robotics tournament.
 - ✓ **Vaughn College VEX High School Robotics Qualifier Tournament:** Vaughn College of Aeronautics and Technology hosted its eighth annual high school robotics competition on Saturday February 12th, 2022. A total of 25 regional high schools from Queens, Bronx, Nassau, and Suffolk and other NY counties attended the 2022 VEX state qualifier at Vaughn College. Nine members of Vaughn's robotics team, along with three faculty members, served as referees, event planner, announcers, and judges for this regional High Scholl tournament.
 - ✓ **Drone Awareness and Tiny Whoop Race:** On Saturday, February 27th 2022, Vaughn's UAV team organized and hosted its third annual "Community Outreach Drone Awareness and Tiny Whoop Race" event at the Cradle of Aviation Museum. The event was free and open to the community. Many drone hobbyists and FPV pilots, as well as the locals from the area, attended this event.
 - ✓ **Drone Day Workshop at Elementary School – PS10:** On Friday March 4th, Vaughn UAV team, along with engineering faculty member Dr. Ghania Benbelkacem, traveled and hosted a Drone Day workshop for students at PS10 elementary school students in Brooklyn, NY.
- ❖ **The initial EAC-ABET accreditation of Mechanical and Electrical Engineering Programs:** From Sunday, November 15 to Tuesday, November 17, 2020, the

Engineering Accreditation Commission (EAC) of ABET made a virtual visit to Vaughn College for the purpose of initial EAC ABET accreditation of mechanical and electrical engineering programs. Both Mechanical and Electrical Engineering programs have been developed, with the support of HIS-STEM grant funding, and received NYSED approval in academic year 2015-2016. EAC ABET team conducted a zoom virtual visit with Vaughn's faculty, students, alumni, senior administration, and industry advisory members, and during Tuesday's exit briefing they informed us that both programs are in compliance with all ABET criteria requirements. In September 2021, we received ABET's final accreditation statement and both programs received perfect review with a maximum possible six-year EAC accreditation. This accreditation will be retroactive for students who graduated from these programs since October 2018

- ❖ On October 2021, the engineering and technology department chair provided the academic VP with an executive summary to update the board of trustees on department annual activities, including an EAC-ABET final accreditation statement for the mechanical and electrical engineering programs, submission of BS computer engineering application to NYSED, advanced manufacturing laboratory enhancement, faculty and student professional development (VEX U World Robotics competition, 2021 LACCEI conference, and grant team participation and presentation in Project Director conference), the industry connection seminar series, and other department related issues.
- ❖ In September 2021, the department chair and project director of Title III HSI-STEM, with the assistance of the Grants Manager, completed and submitted a No-Cost-Extension for the carryover balance to the project officer. The grant management team provided recommendations for the carryover balance, NCE budget narrative, and project activities during NCE period (2021-2022 academic year).
- ❖ On February 2022, the engineering and technology department chair provided the academic VP with an executive summary to update the board of trustees on department annual activities, including the new title III HIS-STEM grant award for developing a BS in computer science program, 7th annual manufacturing day conference, NYSED approval for BS computer engineering program, student professional engagement (participation, publication, and presentation in 2021 SWE conference, and 2021 SHPE national conference, and 37th Southern Biomedical Engineering Conference), the industry connection seminar series, and the manufacturing laboratory's upgrade and enhancement.

Laboratory Development, Upgrade and Enhancement

For the past several years, as a result of the Title III grant funding support, the engineering technology department has been able to establish several state-of-the-art-laboratories such as the Thermo-Fluid lab, the Robotics and Control System lab, the automation lab, the Energy Conversion and Smart Grid Power Systems lab, and the 3D innovation Center. These new facilities and upgraded existing facilities contribute to student success in both scholarly activities and technical competitions.

The current title III grant "Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students," will further

enable the engineering department to develop stackable certificate programs leading to a BS in the advanced manufacturing program as well as to laboratories associated with this program. This new grant supports the engineering department towards the development and enhancement of state-of-the-art CNC machining, 3D Makerspace, composite manufacturing, and UAS laboratories. Vaughn's faculty and staff are confident that through the effective and efficient use of grant funding, the college will successfully accomplish its vision for the future.

In the 2021-2022 academic year, the department completed purchase of the following laboratory equipment:

1. **HASS Desktop Mill Trainer:** A HAAS Desktop Mill Trainer. The HAAS CNC Desktop Mill is an educational version of the popular HAAS VF2 SS CNC and MCU control system. It allows instructors to teach the HAAS CNC MCU (Microcomputer / Machine Control Unit) interface to students in a lecture / lab classroom environment before moving on to the full-size industrial HASS VF2 SS milling machine (**\$12,694.75**).
2. **3D Scanner for manufacturing lab:** This state-of-the-art metrology grade 3D scanner will be used for precision measuring alongside our CMM station to inspect production CNC parts and 3D scan parts for reverse engineering (**\$18,849**).
3. **Magics Additive Manufacturing Software Licenses:** the Magic Additive Manufacturing Software license is used in CDE375 and the 3D Printing Lab for manufacturing related courses and activities (**\$3,154**).
4. **PLC Lab Equipment:** These 20 units of SIMATIC S7-1200 PLC equipment will provide students with more relevant hands-on knowledge with new PLC automation systems and programming developed to facilitate engineering processes (**\$10,175**).
5. **Non-destructive Lab Equipment:** The Olympus Imaging Flaw Detector, Digital Ultrasonic Flaw Detector, and other Non-destructive equipment will provide students with more relevant hands-on knowledge in mechanical testing and evaluation (**\$29,997.24**).
6. **METAL X 3D Printer:** A METAL X 3D Printer will provide students with hands-on knowledge in additive and subtractive manufacturing (**\$205,000**).
7. **Vericut CNC Software:** Vericut CNC software is used in high end aerospace manufacturing as a safe method to debug and troubleshoot CNC programs. Most importantly, Vericut is an important tool for the safety-first mantra of modern machine shops where program verification is used to prevent tool breakage, machine damage, or injury to machine operator (**\$2000**).

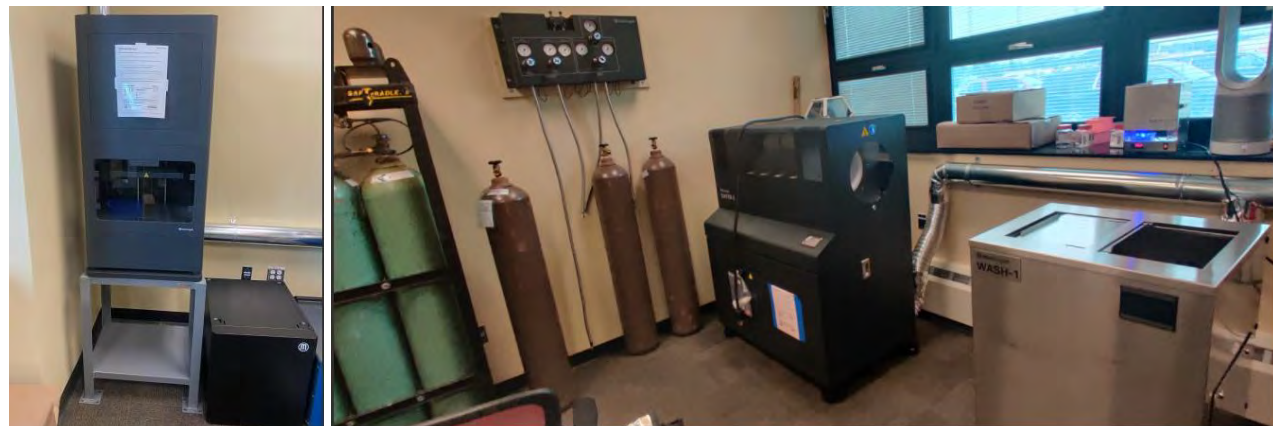
This laboratory equipment allows Vaughn to provide students with practical STEM hands-on training in CNC, Composite, UAS, and 3D additive and subtractive manufacturing that is current with today's manufacturing industry standards.



CNC Equipment with Hass Control Simulators



Automation Lab with SIMATIC S7-1200 PLC equipment



Additive and Subtractive Manufacturing Center with Metal X 3D Printer

Manufacturing Certificate Programs

For the past four years, with the support of HSI-STEM grant funding, the project director and grant management team completed establishment of four manufacturing centers with state-of-the-art laboratory equipment. Those are, the 3D innovation center completed in fall 2018, the CNC Manufacturing Center completed in spring 2019, the PLC and Automation completed in fall 2019, and the composite manufacturing lab completed in spring 2019. These centers will be used to teach and conduct hands-on courses within our newly developed NYSED approved manufacturing certificate programs in 1) Computer Aided Design for Additive and Subtractive Manufacturing Certificate, 2) Composite Design and Manufacturing certificate, 3) CNC Subtractive Manufacturing Certificate, 4) UAS Design, Application, Operation, and Regulation certificate. Courses within these stackable certificate programs will provide students with practical hands-on knowledge and skills that are current in today's manufacturing industry.

Courses from all stackable certificate programs will lead to a BS degree in Advance manufacturing, and students will be able to use these courses as tech electives towards BS mechanical engineering technology and mechanical engineering programs within the engineering and technology department.

1. Computer Aided Design for Additive and Subtractive Manufacturing Certificate Program

The support of the new Title III grant will assist the department in the complete establishment of Vaughn's state-of-the-art 3D prototyping innovation center by adding a Form Labs Fusion (SLA Powder based SLS printer capable of printing fully assembled products with minimal cleanup), 3D Systems HD3600 3D printer, Fusion laser engraver, and a Forged Desktop Injection Molding Machine. In the academic year 2018, the department added the Digilab 3D Printer (model D45-01), and one ProJet MJP 2500 3D Printer. In fall 2020, the department added SV2 printable circuit board (PCB) printer to this lab to support implementation of stackable manufacturing certificates and BS in advanced manufacturing program.

This certificate program will cover manufacturing systems utilized in the additive and subtractive manufacturing fields. Students will gain hands-on experience developing CAM programs for Haas CNC machines. Rapid prototyping will be covered via 3D Printing systems such as Form 2, Stratasys Fortus 250 MC, 3D Systems ProJet 3600, and Magics 3D printing software. Reverse engineering through the use of 3D scanning will be explored to develop parts using Artec Eva Scanners, Catia, Geomagic, and SolidWorks. At the end of the program, students will have a strong foundation in real world computer-aided design, problem-solving skills, and fabrication techniques.

1) CDE 117: Computer Aided Design with Solidworks

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Prerequisites: None

Course Description: The goal of this course is to provide an introduction to engineering graphics and computer-aided design engineering standards using Solid Works CAD software. This is accomplished by examining the role of the computer in the present design process. Topics include computer graphics, computer aided-design and drafting, (CAD) geometric construction, orthographic projection, dimensioning, section and auxiliary views, detail drawings, 3D modeling, and introduction to assembly drawings. Students will also gain skills in developing part assemblies for 3D printing.

2) CDE 385: Catia Fundamentals

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Co-requisites: CDE 117

Course Description: This course introduces students to Catia, one of the leading parametric modeling packages in the aerospace and automotive manufacturing industries. Practical solid modeling techniques will be covered in a project based approach. Real world examples will take students through the various Catia Workbenches such as Part Design, Assembly Design, Drafting, Wireframe Surface Design, and Generative Sheet Metal Design. Students will gain the knowledge required to design parts suitable for 3D printing and manufacturing through hands on lab projects.

3) CDE 375: Computer Graphics for Additive Manufacturing

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Prerequisites: CDE 117, CDE 385

Course Description: Students will work on computer graphics techniques related to additive manufacturing through the use of 3D printing and 3D scanning equipment. Image acquisition in 2D and 3D will be covered in Adobe Photoshop and Artec Scan Studio, where students will learn about graphic image formats, and 3d scan data processing. Autodesk 3ds Max and Maya will be used as a tool for fast 3D surface development STL file repair. Reverse engineering will be covered through the use of Artec 3D scanners in conjunction with Solid Works and Catia surface modeling techniques. Students will learn to operate and maintain production quality 3D printers, such as the Fortus 250MC FDM printer, Form2 SLA printer, and Makerbot range of 3D printers.

4) CDE 487: Catia for Prismatic Machining and Subtractive Manufacturing

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Prerequisites: CDE 117, CDE 385

Course Description: This course will present the basics of CAM (Computer Aided Machining) and subtractive manufacturing with the Catia CNC Prismatic Machining Workbench. Computer controlled three axis milling and drilling will be covered extensively through the use of real time simulation and program verification. Fundamental milling operations consisting of facing, profile contouring, pockets, drilling, curve following, point to point, and surface machining will be covered in detail. The CATIA prismatic machining module will be used to virtually design and machine a series of parts suitable for output on the Nomad desktop CNC and HAAS CNC machines. Finally, design verification techniques will be explored with the Vericut CNC simulator. Upon completion of the course, students will feel a sense of accomplishment in part design, development, and manufacturing.



Vaughn's Additive and Subtractive Manufacturing Center

2. Composite Certificate Program

This certificate program provides a “well-rounded” education to prospective engineers and technicians who are interested in composite materials. Students will be introduced to the analysis of composite materials, along with hands-on experience in composite manufacturing. Students will also be introduced to mold fabrication and adhesive bonding of composite and metals, which is an integral part of composite manufacturing. Finally, students will be exposed to the most common and latest Non-Destructive Inspection (NDI) equipment and methods and techniques used in the field of composite inspection.

1) Introduction to Engineering Materials

Credits and Contact Hours (lecture/laboratory): 3 credits, 3 lecture hours

Prerequisites: None

Course Description: The purpose of this course is to present to students the basic principles necessary to understand structure-property relations in engineering materials. The student will be introduced to concepts of structure from bonding to microstructure. They will then study the relationships between structure and property of a material. Properties ranging in nature from mechanical, thermal, electrical, optical, magnetic, to chemical will be considered. This course will also introduce the concepts of stress, deformation, and strain in solid materials. Basic relationships between loads, stresses, and deformation of structural and machine elements such as rods, shafts, and beams will be developed. The load-carrying capacity of these elements under tension, compression, torsion, bending and shear forces is considered.

2) Introduction to Composite Materials

Credits and Contact Hours (lecture/laboratory): 3 credits, 3 lecture hours

Prerequisites: None

Course Description: This course introduces basic terminologies used in composite design and manufacturing. An introduction to the various composite manufacturing processes is also introduced. The foundations for the mechanics of composite materials are presented with special emphasis on the long-fibre and woven lamina. On both a micro-mechanics and macro-mechanics level we study the elastic behavior and strength of a composite lamina, i.e. a single layer of unidirectional fibers within a matrix. On the macro-mechanics level, we also study composite laminates (two or laminae stacked together) with respect to elastic behavior, hydrothermal effects, stress, and failure analysis.

3) Introduction to Composite Manufacturing

Credits and Contact Hours (lecture/laboratory): 2 credits, 3 lab hours, 1 lecture hour

Prerequisites: Introduction to Composite Materials

Course Description: Students will work with prepreg carbon fiber unidirectional tape to explore the effects of orientation, balance and symmetry in a laminate. Students will also work with dry glass fabric and liquid epoxy resin to understand the fundamental vacuum bagging, bleeder & breather concepts. Work with prepreg glass and aramid fiber harness-satin fabrics, along with honeycomb and polyurethane foam core materials and the construction of sandwich panel structures and the utilization of laminate “nesting” techniques will be presented in detail. Finally, basic repair methods and techniques will be presented along with the performance of a “wet layup” repair in the lab. The final repaired part will be cut in half for evaluation of the manufactured and repaired panel.

4) Mold Fabrication and Adhesive Bonding of Composite and Metals

Credits and Contact Hours (lecture/laboratory): 2 credits, 3 lab hours, 1 lecture hour

Co-requisites: Introduction to Composite Manufacturing

Course Description: This course is designed to teach students about designing and building molds and fixtures using advanced composite materials. In this course, students will learn about tool design techniques that contribute to both dimensional stability and tool longevity. Students will also gain skills in adhesive bonding technology, while acquiring a deeper understanding of the surface preparation and the fundamental adhesion principles necessary to achieve a good bond to both (polymeric) composite and metallic surfaces.

5) Non-Destructive Testing Techniques for Composite Materials

Credits and Contact Hours (lecture/laboratory): 2 credits, 3 lab hours, 1 lecture hour

Co-requisites: Introduction to Composite Manufacturing

Course Description: This course is designed for students interested in identifying and quantifying defects in new or damaged composite panels using the latest equipment, methods, and techniques. The course is very “hands-on” in nature. Four of the most commonly used NDI techniques will be discussed and practiced in class. These techniques include Visual Inspection, Tap Testing (both manual and instrumented tap testing), Resonance Bond Testing, Acoustic Emission testing, Radiographic testing, and Ultrasonic Inspection.

3. CNC Subtractive Manufacturing Certificate Program

The renovation of the new CNC machine shop at Vaughn's Aviation Training Institute (ATI) building was completed in spring 2019 and this lab with CNC equipment such as HASS VF-2SS CNC milling and cutting machine, Okuma Genos lathe machine, and Coordinate Measuring Machine -CMM for manufacturing part inspection allows the department to offer courses in the CNC manufacturing certificate program. This certificate program will cover CNC manufacturing equipment and systems used in the subtractive manufacturing field. Students will gain hands-on experience developing CAM programs with G-Code, Mastercam, and Catia for the Hass mill and Okuma Lathe CNC machines. Best industry practices for safety, machine shop management, and organization will be demonstrated to students in preparation for entry into the manufacturing field. Part inspection will be conducted using traditional gauges and a granite inspection table along with precision measuring using a Complex Measuring Machine (CMM) from Aims Metrology and Renishaw. Upon completion of this program students will have a strong foundation in real world CNC and CAM problem solving skills for manufacturing.

1) CNC100: Precision Measurement for CNC

Credits and Contact Hours (lecture/laboratory): 3 credits: 2 lecture hours, 3 lab hours

Prerequisites: None

Course Description: This course will introduce students to the world of precision part inspection. After completion of the course, students will understand the multi-view orthographic drawing and its importance in all stages, from development to design and inspection. Students will be able to identify all print abbreviations and use common systems of measurement in their designs. Geometric dimensioning and tolerance concepts will be explored as used in manufacturing. All major instrumentation used in measuring geometric tolerances will be covered, including gauges, micrometers, go and no-go gages, calipers and Coordinate Measuring Machines (CMM). Measurements of surface finish and thread gauges will be covered, in addition to the use of an indicator to perform open setup inspections. At the completion of this course, students will have hands-on experience in the major aspects of part inspection.

2) CNC201 CNC (Computer Numerical Control) Manufacturing I

Credits and Contact Hours (lecture/laboratory): 3 credits: 2 lecture hours, 3 lab hours

Co-requisites: CNC100

Course Description: Students will learn about CNC machine operation through the use of the Haas VF2SS mill and Okuma lathe. Basic CNC terms such as MCU, MDI keys, and the grid coordinate system movements will be explored. Machine tool operations, speeds, feeds, and their use in part development will be covered, in addition to coolant use and chip removal. As the course progresses, students will practice manual machine controls and program execution. Machine shop best practices, organization, and safety will also be covered through hands-on exercises. At the end of the course, students will be able to run a job and prepare all work holding, as they safely operate the machine.

3) CNC202 CNC G code Programming Fundamentals

Credits and Contact Hours (lecture/laboratory): 3 credits: 2 lecture hours, 3 lab hours

Prerequisites: CNC100 and CNC201

Course Description: This course will cover G-Code from both the programmer perspective and the machine operator standpoint. Students will learn to code parts and troubleshoot common problems

in CNC programming. Program blocks, G, L, M, and T codes are explored in relation to programs and subprograms. As the course progresses, conversational, absolute, and incremental programming is covered in addition to subprograms. Program inspection, execution, and testing through the use of a dry run will be covered, along with program edits and coordinate adjustments. Students will leave the course with a strong understanding of the G code programming process in the context of CNC manufacturing.

4) CNC203 CNC (Computer Numerical Control) Manufacturing II

Credits and Contact Hours (lecture/laboratory): 3 credits: 2 lecture hours, 3 lab hours

Prerequisites: CNC100 and CNC201

Course Description: An introduction to 3 and 4 axis CNC machines as a system to run part programs, ranging from small parts to production runs on the HAAS CNC mill and Okuma lathe. Setting tool length and work offsets using manual and probed methods will be explored using the Hass MCU and Renishaw Probe. Tooling geometry, live tooling, and tool selection will be taught for mill and lathe operations. Towards the end of the course, G-Code Program edits using the MCU will be shown in depth to optimize production runs. To insure quality parts in CNC, the importance of part inspection during the machining process will be presented.

5) CNC204 CNC (Computer Numerical Control) CAM Programming

Credits and Contact Hours (lecture/laboratory): 3 credits: 2 lecture hours, 3 lab hours

Prerequisites: CNC100 and CNC201

Course Description: The computer will be explored as both a design tool and a CAM programming tool. Mastercam and Catia software will be used to produce parts and tool paths for CNC manufacturing throughout the course. Students will learn how to develop part designs for machining on the Haas and Okuma range of CNC machines. All the industry standard tooling paths, work holding, and machining operation tasks will be covered in the context of CAM using 2.5, 3 and 4 axis systems. At the end of the course, students will be able to design a part in CAD and deliver post processed G-CODE for manufacturing on the Haas Mill and Okuma Lathe.



Vaughn's CNC Manufacturing Centers

4. UAS Design, Application, Operation, Certificate Program

This certificate program will cover design, construction, application, operation, and system integration for Unmanned Aerial Vehicles (UAV). In this certificate program, through courses such as introduction to UAV, drones rapid prototyping, and application for land surveying, students will gain hands-on experience in designing, constructing, and operating a UAV for a specific application with consideration of payloads types, communication and control systems. Also, through the drone law and remote pilot course, students will learn about FAA's new part 107 regulation, and the course prepares them, with the required aeronautical knowledge test, to acquire the remote pilot certificate for operating UAS. At the end of the program, students will have a strong foundation in UAS design, construction, application and operation.

This certificate program provides a "well-rounded" education to prospective engineers and technicians who are interested in UAS design, construction, application, and operation. Students will gain hands-on experience in designing, constructing, and operating a UAV for a specific application with consideration of payloads types, communication and control systems. Also, through the drone law and remote pilot course, students will learn about FAA's new part 107 regulation, and the course prepares them, with the required aeronautical knowledge test, to acquire the remote pilot certificate for operating UAS.

1) UAS 200: Introduction to Unmanned Aerial Vehicles

Credits and Contact Hours (lecture/laboratory): 3 credits, 3 lecture hours

Prerequisites: None

Course Description: This course provides an introduction to Unmanned Aircraft Systems. The course will cover the design, operations, and system architecture for Unmanned Aircraft Systems as a whole. The course specifically covers UAV airframe configurations, payload types, communications, and ground and vehicle based command & control systems. In addition, instruction covering operations, human factors, risk and accidents will be included. At the conclusion of this course, the student will have an understanding of the entire lifecycle of a UAS product from preliminary design to development and operations, and the multitude of uses of UAVs.

2) UAS 220 - Drone Laws and Remote Pilot Certification

Credits and Contact Hours (lecture/laboratory): 3 credits, 3 lecture hour

Prerequisites: None

Course Description: This course examines the laws that apply to the operation of civilian Unmanned Aircraft Systems – or drones - with a focus on small UAS, those weighing less than 55 pounds. Particular focus will be on the FAA's new Part 107 regulations and preparing students for the aeronautical knowledge test to acquire the Remote Pilot Certificate with small UAS rating. This FAA airman's certificate will allow students to legally fly drones for compensation or hire. The course will also cover rules applicable to flying model aircraft for hobby or recreation and the legal issues raised by drones, such as privacy, law enforcement use, first amendment and freedom of the press, insurance, product liability and property rights in air space. The course will touch on issues of pre-emption and the legality of numerous recently-promulgated state and local laws. It will also survey the approach to drone regulation internationally, including ICAO and EASA's approach, Canada, Mexico and other countries.

The course enables the students to gain the knowledge necessary to gain a valuable FAA certification as a drone pilot and allows students to explore the complexities of these emerging legal issues and the difficulties faced by the drone industry, regulatory agencies and the manned aviation community.

3) UAS 231 - Introduction to Drones Aeronautics

Credits and Contact Hours (lecture/laboratory): 3 credits, 2 lecture hour, 3 lab hours

Prerequisites: None

Course Description: This course covers classical and modern aerodynamics design concepts for both fixed wing and Multi-rotor UAVs. In this course, students are introduced aerodynamics design fundamentals such as lift, drag, thrust and basic flight control elements. The course will cover classical dynamic analysis of Unmanned Aerial Vehicles using structure and fluid mechanics principles. This is in addition to providing an introduction to modern aerodynamics design tools using CAE (Computer Aided Engineering) software.

4) UAS 241 - Drone Applications Series- Land Surveying Using Drones

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Prerequisites: None

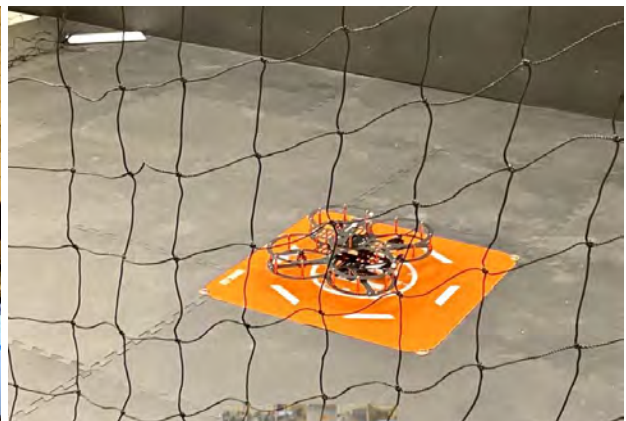
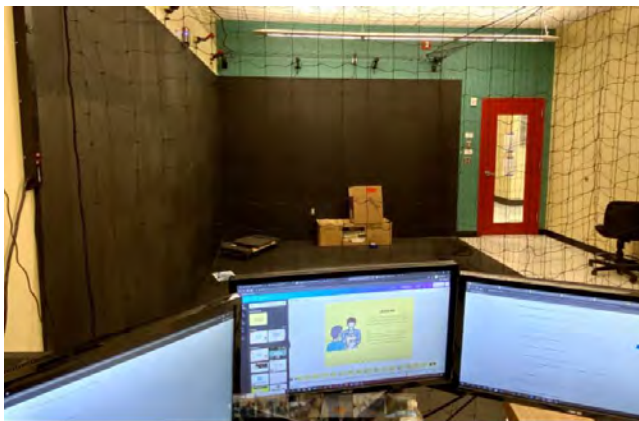
Course Description: Land surveying is currently one of the most important applications of drones. In this course student will learn the basic knowledge of photogrammetry, image capturing using unmanned aerial vehicles (UAV), and GPS based mission planning. In addition, students will gain knowledge in post processing and reconstruction techniques.

5) UAS 251 - Drones Rapid Prototyping and System Integration

Credits and Contact Hours (lecture/laboratory): 2 credits, 1 lecture hour, 3 lab hours

Prerequisites: None

Course Description: In this hands-on course, students will have the chance to design, build, and fly UAV models to serve specific civilian and commercial applications. In this process, students will be able to build and construct UAV using CAD software (SolidWorks) and 3D printing technology in addition to CNC technology. In the second phase, students will be assisted in equipping the UAV with basic control units such as IMU and in finally testing and flying the UAVs.



Vaughn's UAS Centers

Industry Advisory Council

The department of engineering and technology at Vaughn College has always recognized the value of external review of our curriculum to ensure that we are satisfying the needs of our constituents. The Industrial Advisory Committee (IAC) convenes every year, usually in the spring semester, and has met every year for the past 25 years. Since fall 2017, in addition to the annual technology meeting, we hold a fall meeting with our advisory members to discuss issues related to curriculum, laboratory development and program assessment. Also, through email communication, we continuously inform our advisory members and alumni about department activities, new program development, student professional engagement, and any issue related to accreditation and program assessment.

The IAC is comprised of representatives of industry, government agencies, academia and other segments of the profession who are able to advise the program on current industry trends and the latest state-of-art technologies that we can incorporate into our program. Their mission is to act as an advisory group to the program on specific academic issues and to act as a link between the program and its industry partners, providing an input to current and future industry needs for the program. Members of the IAC are comprised of a select group of representatives from Lockheed Martin, Pratt & Whitney GE, CYIENT, Dassault Systemes, Con Edison, Bakery Innovative Technology, Easy Aerial, FAA, CPI-Aerospace, Corning, COX and Company, SciMax Technologies, Micro Merchant Systems, Defense Contract Management Agency, Pavon Manufacturing Group, US Didactic, and Siemens. The close partnerships with these industrial companies allow our students to explore careers or internship opportunities with top engineering enterprises.

Some of the IAC members are past graduates and are deeply involved in the professional needs of the department. The Table below summarizes the membership of IAC, and after every annual meeting, minutes are produced along with an oral debriefing to the engineering department.

INDUSTRIAL ADVISORY COUNCIL COMMITTEE

Name	Company	Title	Member Since
Marvin Blackman	CARBON RKAYD Control & Systems Integration	Lead Onsite Service Specialist	2013
Robert Anderson	Bakery Innovative Technology	Control Engineer	2016
Oliver Scheel	U.S. Didactic	Director of Educational & Training Systems	2000
Michael A. Joseph, II	Corning, Incorporated	Sr. Project Engineer	2001
Michael Wroblewski	Stark Products	Manufacturing Engineer	2016
Raul Telles	Pratt & Whitney	Sr. Design Engineer	2012
Al Bunshaft	3DS, Dassault Systemes	SVP Global Affairs, Americas President, DS US Foundation	2017
Matthew Pearce	NASA	NASA Education Program Specialist	2015
Dr. Aparicio Carranza	CUNY-NYC College of Technology	Professor of Computer Engineering Technology	2011
John Pavon	Pavon Manufacturing Group	President	2007
Waseem Hussain	Union Crate	Co-Founder & VP	2017
Arya Ranasingh	Micro Merchant Systems	Computer Systems Analyst/ Sr. Team Lead	2009
Carlo Asaro	Lockheed Martin/Sikorsky Corp	Aircraft Electrical and Avionics	2015

		Engineer	
Nick Visciotti	Cyient Inc.	Technical Leader	2013
Jonathan Zubarrain	Cox & Company, Inc	Test Equipment Engineer	2018
Felipe I. Munoz	Lockheed Martin/Sikorsky Corp	Technical Lead- Platform Systems Integration (PSI)	2016
Manny Santana	Defense Contract Management Agency	Quality Assurance	2013
Rajdeep Singh	Lockheed Martin/Sikorsky Corp.	Deputy Chief Engineer	2010
Terry Jack	Lockheed Martin/Sikorsky Corp.	UAEW – Chief Engineer	2015
Hitesh Shah	Cyient Inc.	Business Unit Manager	2015
Beant Singh	Siemens	Project Engineer	2014
Diogenes Ramos	FAA	Executive Team Lead	2008
Omar Eldeebo	Lockheed Martin/Sikorsky Corp.	Harness Design Engineer Lean Six Sigma Green Belt	2016
Shiva Lall	FAA	Aerospace Engineer	2010
Robert Isoldi	CPI Aero	Manager of Manufacturing Operations	2016
Rich Brown	Lockheed Martin/Sikorsky Corp.	CH-53K/E Aftermarket Chief Engineer	2017

Internship Programs

Vaughn’s internship program is a key part of an engineering curriculum to prepare students for the workplace. For the past several years, our students were involved with both summer and school year internship programs with top engineering companies such as Daimler, John Deere, NASA, Sikorsky, Northrop Grumman Corporation, Lockheed Martin, RCM-Tech, Rockwell Collins, Federal Aviation Administration (FAA), Alken Industries, Cummins Engine, MTA, GE, Pall Corp., Pavon Manufacturing Group, Raytheon, Safe Flight Instruments, Toyota, Robotics Education and Competition Foundation (RECF), and Naval Research Enterprise Internship Program (NREIP). These internships provide students with a greater appreciation for engineering education and expand their hands-on and career-building experiences. As a result of these internships, many of our graduates are currently working with these companies as new advisory members for our programs and assisting our current students in pursuing internships with these companies.

Faculty Professional Engagements and Workshop Participation

To improve the quality and effectiveness of instructional delivery and student learning, the engineering and technology department encourages faculty members to participate in conferences and workshops designed to enhance faculty understanding of new technological discoveries and innovations to maintain teaching quality. For the past few years our faculty members have been active participants in many educational and technical conferences and workshops such as the American Society for Engineering Education (ASEE), Latin American and Caribbean Consortium of Engineering Institutions (LACCEI), Aircrafts Electronics Association (AEA), Institute of Electrical and Electronics Engineers (IEEE), American Institute of Aeronautics and Astronautics (AIAA), Society for Experimental Mechanics (SEM), and American Society of Mechanical Engineers (ASME). Also, faculty were involved with the development and implementation process of two new mechanical and electrical engineering programs, laboratory development/enhancement, and learning communities for NSF scholarship recipients.

During the calendar year 2021–2022, faculty in the engineering and technology department participated in the following professional engagements and workshops:

Hossein Rahemi

1. Department chair with the input from Aero Manufacturing curriculum Designer developed a UAS certificate program and in fall 2020 this certificate has been submitted to the New York State Education Department (NYSED) and in **January 22, 2021** we received NYSED approval for the “*UAS Design, Application, and Operation*” to be offered at Vaughn College of Aeronautics and Technology. The following courses are part of this certificate program.
 - UAS200 – Introduction to Unman Aerial Vehicles (Design, Operation, and system architecture for UAS), 3 Credits
 - UAS220 - Drone Laws and Remote Pilot Certification, 3 Credits
 - UAS231 - Introduction to Drone Aerodynamics, 3 credits (2 credits lecture & 1 credit Lab)
 - UAS241 - Drone Application – Lan Surveying , 2 Credits (1 credit Lecture & 1 credit lab)
 - UAS251 - Drones Rapid Prototyping and System Integration, 2 Credits (1 credit lecture & 1 credit lab)
2. On Saturday, Jan 16, 2021, the department chair, along with the Vaughn College Robotics team, hosted the Virtual VEX U College Regional Skills Robotics competition, and During the skills challenge matches, **Vaughn’s team finished First in Robot Skills** with a total score of 204 points
3. On Sunday Jan 17, 2021, the department chair along with Vaughn College Robotics team hosted the Virtual High School VEX skills Robotics Tournament. A total of 9 regional high schools from Queens, Brooklyn, Bronx, Nassau, and Suffolk and other NY counties attended the February VEX state qualifier at Vaughn College.
4. In spring 2021, as part of title III HSI-STEM grant-supported fund, the department chair assigned an hour virtual problem-solving session in fundamental STEM courses (Statics, Thermodynamics, strength of materials, computational method, fluid mechanics, dynamics, mechanics of materials, and others). The main objective is to enhance attainment of student

- outcomes in solving complex engineering problems and consequently improve and increase both student persistence and retention in STEM fields.
5. On Saturday, February 20th 2021, with the support of engineering department, Vaughn College's Robotics team participated at the Fairmount State University VEX U Robotics Remote Skills-Only Tournament. A total of twelve colleges and universities participated in the event. Vaughn's team with a total of 205 skills points Vaughn's team finished **second place** behind the University of Waterloo with a total of 251 skills points. In this regional tournament, Vaughn's team was awarded the most prestigious award presented at a Vex Robotic Competition: the "**Excellence Award**" for their tremendous attention to the engineering design process and what that design process produced.
 6. In spring 2021, the Project Director submitted an annual progress report for the Title III STEM grant "Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students" that includes information/updates on facilities, faculty and staff, and the development process of stackable manufacturing certificate programs.
 7. On Thursday, March 4, 2021, the department chair along with STEM pathway Liaison hosted its **2nd annual STEM Day** by engineering clubs. The department chair opened the session and thanked all the participants and especially the club leaders for their contribution to this virtual event. Vaughn's technical clubs and student chapters of professional societies (Robotics, NSBE, Rover, SHPE, SWE, and UAV) addressed the Vaughn community with a presentation about their annual professional activities. Each club provided a detailed discussion of their activities during COVID.
 8. On Friday, April 9, 2021, the department chair along with faculty, lab techs, and STEM pathway Liaison hosted its **3rd annual STEM Day workshop** for community colleges and high school students. The participants of Vaughn's STEM Day virtual workshop event were students and faculty from Passaic CC, Queensborough CC, Bergen CC, Aviation High, and Humanities & Arts high school. For this virtual event, Vaughn's STEM Liaison and 3D/CNC curriculum developer, Prof. Manuel Jesus, introduced participants to Vaughn College's program offerings in engineering and engineering technology disciplines as well as to student involvement in various STEM related clubs and professional activities. Prof. Jesus, provided participants with a video tour of Vaughn's 3D Makerspace and CNC manufacturing centers. Finally, the department hosted a couple of virtual STEM workshops related to 3D Scanning, CAM and CNC, and Virtual Reality
 9. The department chair published the **Thirteenth Annual Vaughn College Journal of Engineering and Technology (VCJET)**. This journal includes annual department's activities, laboratories upgrade and development, faculty and student professional engagements, graduate success stories, industry tours, engineering seminar series, industry connection seminar series and student capstone design papers (May 2021).
 10. On Friday, May 28, 2021, the Engineering and Technology department chair together with 3D/CNC curriculum designer hosted its **Thirteenth Annual Industry Advisory Meeting and Technology Day Conference**. In this virtual conference, Dr. Rahemi updated Advisory Council members in recent developments in the Engineering and Technology Department such as: fall 2020 EAC-ABET virtual visit for the purpose of initial EAC accreditation of ME and EE programs, HSI-STEM grant activities including development process of stackable manufacturing certificate programs in CNC machining, Composite, and 3D additive and subtractive manufacturing and UAS design, application and operation

as well as establishment of manufacturing centers (CNC machining, composite, additive manufacturing, PLC & automation, and UAS) to support courses within these certificate programs. The PD updated advisory members on grant supported STEM activities, student engagement and outreach activities. Each technical club (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE, SHPE, and NSBE) provided their annual activities and accomplishments to the audiences of the 2021 Virtual Tech-Day Conference. Finally, capstone degree presenters talked about their innovative research project. The top 3 research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper awards of this session. In conclusion, Dr. Rahemi congratulated all capstone paper and technical club presenters.

11. From June 26-27, the department chair and six members of Vaughn's Robotics club traveled to Greenville, Texas to participate in 2021 VEX U Robotics Championship. Forty one (41) national and international universities and colleges were invited to the 2021 World Robotics Championship. Invitation to the VEX U Robotics World championship was only granted to a team that is a tournament champion or excellence award recipient of a regional competition. The VEX U Robotics Championship was an intense two days competition where our team was continuously modifying their robots and autonomous programming to be competitive with other top teams in this tournament. During the qualifying matches, Vaughn's team (VCAT) competed against 6 teams, and they won 5 out of the 6 matches and received **6th place overall ranking** and advanced to the Saturday afternoon playoff round. During the single elimination playoff round, the top sixteen teams competed, and Vaughn's team defeated a team from Mexico thus advancing to the quarterfinal playoff round against GATR1 (a team from University of Florida). In an intense close scoring match, the VCAT team, with a total score of 10 points, lost to GATR1 team with a total score of 11 points. The VEX U Robotics championship is a tough and challenging competition in which only the top US regional and international champions qualify to participate. Vaughn's team finished 6th place in overall ranking and 3rd place in Robot Skills ranking, and they retained their standing as one of the top ranked competitors in the 2021 VEX U In-Person Robotics championship
12. From July 19-23, Vaughn's engineering and technology students, along with Dr. Hossein Rahemi, department chair and PD of HSI-STEM, attended the LACCEI 2021 Virtual Conference. Two Vaughn student team research papers were accepted for presentation and publication in the LACCEI 2020 international conference; both Vaughn student papers, as listed below, were selected to compete among ten finalists for the student paper session as well as student poster session of LACCEI 2021.
 - ✓ **"Intelligent Robot Design for VEX U Skills Challenge"** by Misael Marquez
 - ✓ **"BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy"** by Tatiana Jaimes, Alina Santander Vinokurova, August Rodriguez.From 11 am to 1 pm on Wednesday July 21, two of our student team papers, as listed above, were presented to the international conference audience during the student paper session of LACCEI 2021. Vaughn's student paper **"Intelligent Robot Design for VEX U Skills Challenge"** and the presentation by Misael Marquez that covered the design, manufacturing, and development process of a robot as well as autonomous programming for VEX U skills challenge won the **third place award of the 2021 LACCEI student paper session competition.** Also, from 2:30 pm to 4:30 pm on Tuesday, July 20, both of

Vaughn's student team projects were selected as finalists for the LACCEI 2021 Virtual poster session competition.

13. From spring to fall 2021, the PD submitted a monthly progress report for the Title III STEM grant "Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students" that includes information/updates on student engagement, facilities, faculty and staff, and the development process of the stackable manufacturing certificate programs, as well as the process for developing the advanced manufacturing program.
14. On Tuesday, October 12th, the engineering and technology department chair submitted an executive summary to the Academic VP to update the board of trustees on department annual activities, assessment & EAC ABET accreditation of ME and EE programs, 2021 in-person VEX U Robotics World Championship, submission of BS computer engineering application to the NYSED, purchase of PLC and laser cutter manufacturing laboratory equipment, faculty and student professional engagement (UAV, Robotics competitions, conference, and scholarly activities), industry connection seminar series, and other department related issues
15. From Aug 3-5, department chair and project director of Title III HSI-STEM, 3D/CNC curriculum designer, Prof. Manny Jesus, and project director of Title V SOAR grant, Dr. Margaret Ducharme attended the virtual project directors' conference. For this conference, Vaughn's grant team developed and submitted a proposal and prerecorded presentation about **Vaughn's Title III and Title V grant project activities during COVID**. These activities covered, virtual STEM workshops, virtual outreach, students' involvement in virtual extracurricular activities, establishment of Vaughn's manufacturing centers, and the Common Reading program.
16. In late August, department chair and project director of Title III HSI-STEM completed and submitted a No-Cost-Extension for the carryover balance to the project officer. The grant management team provided recommendations for the carryover balance, NCE budget narrative, and project activities during NCE period (2021-2022 academic year).
17. In late September, Vaughn College was awarded with a new Title III HIS-STEM grant with a \$4,999,748 funding for five years. This grant project, supports appointment of three staff (Career Advisor & Internship Coordinator, STEM Pathway & Transfer Liaison, and Project Assistant) and three full-time faculty (Computer Science, Applied Math, and Data Science). On Wednesday September 29, both Dr. LaVergne and Dr. Rahemi had an introductory meeting with the Fed Project Officer, Ms. Kissy Chapman and she congratulated us and expressed her satisfaction with our existing HSI-STEM project, and she will continue and be available to work with the PD in successful implementation of this new title III HSI-STEM grant project as well.
18. On June 28, the engineering department completed and submitted Computer Engineering application with all supporting materials (evaluation report by NYSED-approved external reviewer, CV of program evaluator, Faculty Vitae, and syllabuses for computer engineering courses) for registration of a new program with NYSED. The establishment of Vaughn's computer engineering program is supported by the Title V HSI department of education grant. This program is currently under review by NYSED. In late October, the department received NYSED engineering board's feedback related to CE program's enrollment, laboratory courses, budget, and faculty. On Nov 5, 2021, the department

chair responded to all related questions with additional supporting documentation.

19. From November 15 through November 17, 2020, the ABET team had a virtual visit with Vaughn College for the purpose of the initial EAC accreditation of ME and EE programs. The ABET team reviewed self-study reports and all supporting assessment reports, had zoom meetings with Vaughn's faculty, students, alumni, senior administration, and industry advisory members, and during Tuesday's Nov 17 exit briefing they informed us that both programs are in full compliance with all ABET requirements. **In late August 2021 we received ABET's final accreditation statement, and both programs received a perfect review with the maximum possible six-year EAC accreditation. This accreditation will be retroactive for students who graduated from these programs since October 2018**
20. On August 23, the department chair, along with the 3D/CNC curriculum designer and Aero Manufacturing Curriculum developer, attended a **virtual orientation meeting** with Vaughn's new engineering and engineering technology students. In this meeting, Dr. Rahemi welcomed all new students and encouraged them to get involved with scholarly and hands-on STEM related activities that can enhance their career opportunities. Also, they provided advisement to students regarding curriculum and involvement in after class technical clubs and chapters of professional societies, and in STEM outreach activities and conferences.
21. On Thursday, October 7, 2021, the engineering and technology department hosted its 3rd Annual Curriculum and Career Advisement Day with students in engineering and engineering technology programs. Dr. Rahemi, along with the STEM Liaison, and engineering faculty organized a virtual event to provide curriculum and career advisement to all engineering and engineering technology students. This virtual event covered topics related to curriculum as well as to activities in which students should participate in order to enhance their career opportunities while studying at Vaughn.
22. The Engineering and Technology department chair and Title III HSI-STEM project director together with the 3D/CNC curriculum designer hosted the **7th annual manufacturing day conference on Friday, October 29, 2021** (10 am to 1 pm) to celebrate the national manufacturing day. Six guest speakers addressed Vaughn community, faculty, and invited guests about manufacturing innovation in the area of manufacturing of surgical masks, OT Cyber Security & Artificial Intelligence, Autonomous Mobile Robots, AM in Electronics, 3D Scanning and Precision measurement tools, and Virtual Reality in aerospace and manufacturing industries. In a parallel session, from 10 am to 1:00 pm, Vaughn's Robotics, UAV, SWE, and SHPE clubs organized and hosted virtual STEM workshops for the high school students. These workshops covered the following items:
 - ✓ Robotics Workshop - Robotics design & autonomous programming for the 2021 VEX U Robotics Competitions
 - ✓ An informational session about the basics of drones and the design considerations
 - ✓ Drone Autonomous Programming using Mission Planner softwareThese workshop sessions were conducted in both in-person and in virtual zoom meetings.
23. From October 21 to 23, 2021, with the support of title III HSI-STEM funding, the Vaughn College chapter of the Society of Women Engineers (SWE) attended the 2021 Women Engineers Conference in Indianapolis, Indiana from October 21st through October 23rd, 2021. During the conference, nine members of the chapter had the opportunity to attend leadership seminars and technology talks. In addition to attending those, SWE students

- attended the in-person and virtual career fairs, where some interviewed with industry-leading companies such as Honeywell, Carrier, Raytheon Technologies, Accenture, and EBI. The conference was successful as 7 internship positions were offered on-site; interview opportunities were given both on-site and during the remote career fair
24. From Nov 10 – 14, 2021, with the funding support of Title III HSI-STEM grant, a group of thirteen engineering students from Vaughn College attended the 2021 Society of Hispanic Professional Engineers (SHPE) in-person Conference at Orlando, Florida. Vaughn's students participated in innovation, Nissan Design, and Extreme Engineering challenges as well as various professional development workshops that aimed to promote leadership, unity, and expose them to the diverse career opportunities in the STEM fields. Also, Vaughn participated in the career fair session of SHPE national conference and Vaughn's SHPE chapter received a total of 11 interviews for both internship and full-time position with companies such as DuPont, Lockheed Martin, Rockwell Automation, Cummins, Tesla, Honeywell, Amazon, and Raytheon, seven of which resulted in pending Internships and two internship offers. Also, several of the Vaughn HSI-STEM grant-supported students had the opportunity to participate in Innovation Challenge, Cybersecurity Challenge, and the Nissan Design Challenge. Vaughn student, **Kevin Kenta Osada, won second place in the Nissan Design Challenge** and **Kirill Sokolov won third place in the Innovation Challenge** of the SHPE national Conference (**Attachment 1 - 2021 SHPE National Conference**).
 25. From December 2-5, four Vaughn's engineering students, Alina Santander, Tatiana Jaimes, Aaron Arana, and Mariah Villalon, along with Dr. Hossein Rahemi, engineering department chair, and engineering faculty, Drs. Mohammed Benalla, Shouling He, and Prof. Khalid Mouaouya participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA. Three Vaughn student team research papers were accepted for publication and presentation at this annual gathering. Vaughn's student papers, as listed below, were presented at the 37th Southern Biomedical Engineering conference on Saturday, December 4th from 2:15 AM to 2:45 AM
 26. On Tuesday, December 7, 2021, as part of the department's Engineering Seminar Series, Tatiana Jaimes and Alina Santander, Senior Students in Mechatronic Engineering who participated in summer internship programs with NASA and InstaHub, addressed the Vaughn community about their summer internship programs and life-long learning experiences that they both gained through their projects.. Tatiana Jaimes spoke of her summer internship at NASA where she worked on the Osam 1: Satellite Servicing Mission. This project centered on developing technology to service satellites in orbit, a crucial task to perform since the retirement of the manned space shuttle fleet and its unique ability to rendezvous with and service satellite hardware. Alina Santander had the opportunity to spend the summer with InstaHub a northeast US developer of building automation hardware solutions.
 27. On Friday, January 7, 2022, the department chair, along with the 3D/CNC curriculum designer and faculty from engineering department, attended a **virtual orientation meeting** with Vaughn's new engineering and engineering technology students. In this meeting, Dr. Rahemi welcomed all new students and encouraged them to get involved with scholarly and hands-on STEM related activities that can enhance their learning outcomes and career opportunities. Also, they provided advisement to students regarding curriculum and

involvement in after class technical clubs, chapters of professional societies, and STEM outreach activities and conferences.

28. **Industry Connection and Engineering Seminar Series:** The department chair organized and invited several industry leaders as guest speakers for the fall and spring Industry Connection Seminar Series. The names, dates, and topics of presentation for those who accepted our invitation are as follows:

- **An introduction to NASA, NASA Goddard Space Flight Center, NASA Goddard Institute for Space Studies and NASA Internship Opportunities:** on Thursday, Feb 11, 2021, Mr. Matthew Pearce, National Aeronautics and Space Administration (NASA) education programs specialist and Ms. Rosalba Giarratano, Pathways Intern at the Goddard Institute for Space Studies, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this Microsoft Teams Virtual event, both Ms. Rosalba Giarratano and Mr. Pearce's presentation covered topics related to an overview of NASA, NASA Goddard Institute for Space Studies, NASA STEM Workforce Challenges, and they talked about all available STEM Internships, Fellowships, and other career opportunities with NASA and NASA's internship application and interview process.
- **Power System Integration for Aerospace Industry:** On Friday, February 19, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this virtual event seminar, Mr. Asaro talked about topics related to high horse power motor, PLC, high power cables conductors, electronics conduit design and manufacturing processes within the aerospace industry (Attachment#2-Power System Integration for Aerospace Industry)..
- **Celebrating Black History and Women's History months with Engineer and Astronaut Stephanie Wilson, March 9, 2021:** On Tuesday, March 9th from 10 to 11 am, Vaughn's students, faculty, and Staff, in observance of Black History and Women's History months, participated in a virtual fireside chat with engineer and NASA astronaut Stephanie Wilson to celebrate accomplishments of distinguished African American Engineers and Astronauts. This special virtual meeting was held by NASA to promote STEM in education. Stephanie Wilson graciously shared her career path as an African American Woman involved in a STEM career. Specifically, she shared insight regarding her role as an astronaut with NASA during the Shuttle Program and construction of the International Space Station. First and foremost, Ms. Wilson made a point to share that she was an aerospace engineer who worked hard to lay the foundations that eventually brought her to a successful career as a leading astronaut.
- **Electrical Safety and Consideration:** On Tuesday, March 23, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky and an adjunct faculty member at Vaughn College, addressed the Vaughn community on the topic of Electrical Safety Considerations, as part of the College's Virtual Industry Connection Seminar series. The overall topic of the presentation was safety first. The serious nature of this topic was addressed through discussion of tragic workplace accidents related to servicing motors accidentally left in a powered-on state. Personal electrical safety equipment such as probes, high voltage resistant

gloves, and foot pads were shown as effective measures against fatal injuries.

- **Update on new FAA drone Rules that go into effect April 2021:** On Thursday, April 15 from 11 am to 12 pm, as part of the College's industry connection seminar series, Ms. Loretta Alkalay, an aviation attorney specializing in issues related to compliance with federal aviation regulations including drone rules, who is also an adjunct professor at Vaughn College, updated the Vaughn community on new FAA drone rules that go into effect April 2021, including the operations over people rule and the remote ID rule.
- **Drone Awareness Week:** On Thursday September 16, the engineering department in collaboration with the Management department, hosted a seminar to celebrate the National Drone Awareness Week. This seminar featured a presentation regarding Drone and UAV Safety Standards. Federal Aviation Administration expert Michael O'Shea, the UAS Program Manager led the discussion regarding drone safety mandates. Mr. O'Shea's presentation showcased the FAA's ongoing mission to provide the safest, most efficient aerospace system around the world. Vaughn's UAV club secretary Yusuf Rafi started the event with a presentation that highlighted current club activities and past achievements such as their 1st place award for Autonomous at the 2018 VFS Student Challenge Competition. UAV club students shared their findings on the topic of UAV safety through their own experiences in drone operation, the Part 107 License, and best practices for UAV flight within the FAA restrictions.
- **Summer internship programs with NASA and InstaHub:** On Tuesday, December 7, 2021, as part of department's Engineering Seminar Series, Tatiana Jaimes and Alina Santander, Senior Students in Mechatronic Engineering who participated in summer internship programs with NASA and InstaHub, addressed the Vaughn community about their summer internship programs and life-long learning experiences that they both gained through their projects.. Tatiana Jaimes spoke of her summer internship at NASA where she worked on the Osam 1: Satellite Servicing Mission. This project centered on developing technology to service satellites in orbit, a crucial task to perform since the retirement of the manned space shuttle fleet and its unique ability to rendezvous with and service satellite hardware. Alina Santander had the opportunity to spend the summer with InstaHub a northeast US developer of building automation hardware solutions.
- **History and overview of the 737 program:** Mr. Ed Clark, a vice president and general manager of Boeing's 737 Program, addressed the Vaughn community on December 9, 2021 as part of the College's Industry Speaker series that has been organized by Vaughn's Career Service Department. The event was held both in-person and virtually. His presentation began with the history and overview of the 737 program. The 737 program commenced in the 1960's with the need to supplement Boeing's existing 727 program. Since the maiden flight of the 737 in 1967, there have been four generations of 737 planes. Clark mentioned that Boeing produces three airplanes per month out of the Renton, WA assembly building and 50 airplanes per month out of the Seattle delivery center.
- **Electronics Breadboard Hands-on Learning:** Mr. Carlo Asaro, an Aircraft Avionics Systems Engineer, addressed the Vaughn community on Thursday, February 17, 2022, as part of the College's Industry Connection Seminar series. Mr.

Asaro, has more than 30 years of experience in the industry in research and development, testing and evaluation of rotor-wing electronics with primary focus on power electronics and weapon systems. In this virtual seminar, Mr. Asaro talked about topics related to electronics breadboard design and hands-on learning.

- **Internship Program with L3Harris:** On Thursday, February 24th, 2022, Eben Rockwell, a senior student in the Electronics Engineering Technology program, shared his experience as an intern at Level3 Harris Technologies. As part of this internship program, he was assigned to the F-18 super hornet counter measures system IDECM AN/ALQ-214 which utilizes the electromagnetic spectrum to protect these aircraft from enemy threats. The IDECM's powerful suite of electronics offers safeguard from air to air and surface to air missiles. Despite strict security restrictions, Eben was still able to offer an engaging overview of the project.

Amir Elzawawy

1. ME Program Coordinator:
 - Supervised Fall and Spring semester scheduling
 - Completed course evaluations for transfer students
 - Completed ME curriculum modifications
 - Conducted the ME program continuous improvement process which involves program assessment and evaluation
 - Advised ME students professionally and academically
2. CSTEP Project Director: Involves more than 75 students,
Major activities in 2021:
 - 2021 Summer Research Program: 15 students selected to work on various research topics under the supervision of Vaughn's faculty members
 - Organized Extended Workshop Series and Mini-Courses to improve students in the following topics: Engineering Mechanics, Fundamentals of Electrical Engineering, Preparation for CATIA Certification, Calculus and Differential Equations Review, and Introduction to Cybersecurity
 - Provided tutoring and exam review sessions to CSTEP students.
 - CSTEP Seminar Series
 - Introduced INROADS internship program
 - Career preparation workshops
 - Conferences and professional networking events (SHPE, NSBE, SWE, etc.)
 - Monthly meeting with CSTEP program participants
 - All program activities planning, staff hiring and budgeting.
3. Advisor for AIAA Student Chapter and UAV Club.
4. Senior Member of American Institute of Aeronautics and Astronautics (AIAA)
5. Attended 7th Annual Manufacturing Day Conference, Vaughn College, Flushing, NY, October 29th, 2021
6. Developed the outline of the courses for the Unmanned Aerial Systems (UAS) Certificate program (Approved by NYSED January 2021).
7. Attended IEEE and AIAA- Electric Aircraft Technologies Virtual Symposium (EATS) (August 11 – 13)
8. Attended open houses and Commencement Ceremony for fall and spring of the academic

year 2020/2021

9. Advised students to present at the 13th annual technology day and publish in the Vaughn College Journal of Engineering and Technology (VC-JET)
10. Attended Society of Hispanic Professional Engineers (SHPE) Annual Conference, November 10-14, 2021, Orlando, FL.
11. Served in the faculty senate for the academic year 2020/2021
12. Served in several hiring search committees.

Ghania Benbelkacem

1. Participated, with Vaughn's team including EWB and Robotic club members, in 2022 IEEE Region 1 Micromouse Competition. Connecting Students with Industry Professionals and IEEE Leaders. April 9th, Union College, Schenectady, NY.
2. Attended Vaughn's 4th Annual STEM Day, for networking with industrial leaders in engineering, aviation, and manufacturing April 8th, 2022.
3. Attended WIE International Leadership Conference sponsored by Women in Engineering at IEEE to celebrate international Women's Day. March 8th, 2022.
4. Organized and hosted with UAV club, SWE club, HSI-STEM, and CSTEP students outreach activities at elementary schools. Under a form of workshops, 4th and 5th graders benefitted from a fun and immersive learning experience. Spring 2022.
5. Developed and hosted Fundamentals of Engineering Mechanics Workshops as part of the CSTEP – College Science Technology Program, to support Vaughn student's success, Spring 22.
6. Participated at Vaughn's 7th Annual Manufacturing Day, a one-day event for networking with industrial leaders in engineering, aviation, and manufacturing. October 29th, 2021
7. Served as a member of Ad Hoc subcommittee to work on industry Broadening in order to open new opportunities for Vaughn graduates, November 2020-October 2021.
8. Served in the faculty senate for the academic year 2021/2022.
9. Advised research project for CSTEP students, Summer 2021.
10. Attended all of Vaughn's Spring and Fall 2021 Industry Connection Seminar Series, and Engineering Seminar Series.
11. CSTEP Advisory Committee member since Spring 2020.
12. Working on building an automated grading system for Engineering drawing courses in collaboration with NYU - Tandon school of Engineering and NYU – Teaching and Learning Services. The aim is to develop an Automatic Grading Platform that benefits both students and instructors. 2021/2022.
13. Attended Research and Teaching Webinars offered by NYU – Tandon School of Engineering and its partners, 2021/2022.
14. Supervisor for Vaughn college clubs: Society of Women Engineers (SWE), Engineers Without Borders (EWB).
15. Member of American Society of Rheology. ASME, IEEE, WIE, and ASAA Member. Reviewer for Journal of Rheology.

Shouling He

1. Served as a Mechatronic Engineering (MCE) Program Coordinator in 2021 completed the following tasks
 - ✓ Improved the Mechatronic capstone degree project courses (MCE401 and MCE409) with

the design consideration of social, economic, etc. factors in response to the ABET Board requirements.

- ✓ Continually improved the critical Mechatronic Engineering courses MCE410/MCE410L Industrial Manufacturing Automation and Lab, MCE420/MCE420L Autonomous Mobile Robots and Lab by developing class and lab handouts, and developing new approaches to teach timers, path planning and localization.
 - ✓ Organized continual improvement assessment documents by collecting the faculty members' FCAR reports and course samples and developed FCARs and course samples for ELE230 and ELE230L (for MCE program), ELE450 and ELE450L (for both MCE and ELE programs) and MCE409 (for MCE program).
 - ✓ Evaluated transfer students' transcripts and advised Mechatronic Engineering students in their career goals, as well as course and elective course selections.
2. Served as a director to apply for FAA Aviation Workforce Development Aircraft Pilots Grant by preparing the grant application and providing relevant documents. The grant got approved by FAA on January 18, 2022, with \$498000 and will last 18 months.
 3. Worked as a fellow of NSF Mentor-Connect (Nov.2020-Oct.2021), a highly regarded mentoring program for faculty preparation of competitive proposals to the National Science Foundation Advanced Technological Education (NSF/ATE) Program, and a Principal Investigator for the NSF proposal of Developing PLC and Robotic Automation Technician Training For Service Industries, including the development of logic model, narrative, new course syllabi, Business and Industry Leadership Team (BILT), budget, time schedule and program assessment with the external evaluator.
 4. Worked as the advisor for six groups (Spring, Summer and Fall semesters) of student capstone degree projects and the student research project presentations at the 2021 VCAT Tech Day Conference and helped students to develop the research paper for publication in the 2021 VCJET.
 5. Participated the 3rd Annual STEM Day Workshop with the presentation (1) Makerspace and CNC Lab Video tours; (2) Virtual Reality; (3) Motion Capture, April 9, 2021.
 6. Attended the 11th IEEE Integrated STEM Education Conference, "iSTEM: Lead, Engaged, Succeed!", Princeton University, March 13, 2021.
 7. Completed the Workshop of 2021 Fourth Smart Manufacturing for America's Revolutionizing Technological Transformation (SMARTT) supported by NSF Award No. 1801120, with eight modules and drone programming, July 15 – July 22, 2021.
 8. Participated in the Seventh Manufacturing Day Conference held on October 29, 2021 and discussed the presentations (1) Manufacturing of Surgical Masks; (2) Cyber Security and AI; (3) Autonomous Mobile Robots from Design to Production; (4) AM in Electronics; (5) 3D Scanning & Precision Measurement Tools used in Manufacturing.
 9. Attended the 2021 Southern Bio-Medical Engineering Conference (SBEC) and advised a student to present the paper "Assistive Partial Limb Exoskeleton (APLE)", December 3-5, 2021.
 10. Successfully completed the Winter Education Workshop "Internet of The Things" with the grade of A (+97.83/100) for six sections, taught by STCC team at Massachusetts and supported by NSF ATE GRANT, December 2021 – January 2022.
 11. Completed the Future of Mechatronics & Robotics Engineering Education (FoMRE) – Unified Curriculum and Course Design for Mechatronics and Robotics Engineering Workshop with the Certificate from Robotics Engineering, WPI, and supported by NSF,

EEC GRANT, January 5-7, 2022.

12. Applied for and completed the workshop of MANUEVER – Manufacturing Education Using Virtual Environment Resources supported by NFS GRANT, January 10-14, 2022.
13. Worked as a technical judge for VEX Freeport High School Robotics Competition held on February 5, 2022, and February 11, 2022, at Vaughn College and evaluated the performance of middle and high school students from more than 24 teams and 25 schools, respectively.

Youngashwar Boohoo

1. Member of ASME – The American Society of Mechanical Engineers, New York, NY, 2010 – present
2. Developed course assessment reports for the courses within ME and MET programs during fall 2021.
3. Purchased equipment for the development of the non-destructive testing lab which will be part of the composite certificate program.
4. Attended Open House during fall 2021 to assist faculty in providing information to potential future incoming students.
5. Attended Vaughn’s Engineering and Technology department 7th Annual Manufacturing day Conference on October 29th, 2021.
6. Attended “Power System Integration for Aerospace Industry” Industry Connection Seminar Series, Vaughn College, Flushing, NY, February 19, 2021
7. Attended “The Electrical Safety and Consideration” Industry Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021
8. Attended “Update on New FAA Drone Rules that go into effect April 2021” Industry Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021
9. Attended 3rd Annual STEM Day Workshops, Vaughn College, Flushing, NY, April 9, 2021
10. Served in the faculty senate for the academic year 2020/2021
11. Attended the Thirteenth Vaughn College Annual Technology Day Conference, May 28, 2021.

Douglas Jahnke

1. Co-PI for NSF ATE Grant application “Developing PLC and Robotic Automation Technician Training for Service Industries” to develop a one-year 24-credit PRA Technician certificate program at Vaughn College, 2021
2. Member of Cohort 9 of the NSF-ATE Mentor Connect Program, NSF Advanced Technological Education (ATE) program, 2021
3. Attended “Logic Models,” EvaluATE – NSF Advanced Technological Education (ATE) program, Webinar, August 24, 2021
4. Attended “Next-Level Logic Models for Your ATE Proposal and Beyond,” EvaluATE – NSF Advanced Technological Education (ATE) program, Webinar, September 1, 2021
5. Attended “An Overview of the NASA, STEM Workforce Challenges, and NASA Internship Opportunities” Industry Connection Seminar Series, Vaughn College, Flushing, NY, February 11, 2021
6. Attended “Power System Integration for Aerospace Industry” Industry Connection Seminar Series, Vaughn College, Flushing, NY, February 19, 2021
7. Attended “The Electrical Safety and Consideration” Industry Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021
8. Attended “Update on New FAA Drone Rules that go into effect April 2021” Industry

- Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021
9. Attended Vaughn College Fall Open House, Vaughn College, Flushing, NY, February 12, 2021
 10. Attended 3rd Annual STEM Day Workshops, Vaughn College, Flushing, NY, April 9, 2021
 11. Developed materials for the Vaughn College CSTEP Tutoring Program, Vaughn College, Flushing, NY, 2021
 12. Managed undergraduate research group participating in the Vaughn College CSTEP Summer Research Program, Vaughn College, Flushing, NY, 2021
 13. Participated in CSTEP Faculty Open House, Vaughn College, Flushing, NY, October 8, 2021
 14. Attended Office of Grants Faculty/Staff Open House, Vaughn College, Flushing, NY, October 22, 2021
 15. Attended “Trauma-Informed Teaching with Dr. Stacey Dutil” faculty training seminar, Vaughn College, Flushing, NY, March 23, 2021
 16. Attended 7th Annual Manufacturing Day Conference, Vaughn College, Flushing, NY, October 29, 2021
 17. Participated in Vaughn College Annual Assessment Day, Vaughn College, Flushing, NY, December 3, 2021
 18. Attended “An Overview of Summer Internship Programs with NASA and InstaHub,” Engineering Seminar Series, Vaughn College, Flushing, NY, December 7, 2021
 19. Completed “Ditching the Traditional College Lecture in Remote Instruction,” IEEE Effective Remote Instruction: Reimagining the Engineering Student Experience webinar, July 27, 2020
 20. Completed “Making Labs Effective with Remote Learning,” IEEE Effective Remote Instruction: Reimagining the Engineering Student Experience webinar, July 28, 2020
 21. Completed “Managing Remote Student Teams,” IEEE Effective Remote Instruction: Reimagining the Engineering Student Experience webinar, July 29, 2020
 22. Completed “Student Assessments for Remote Delivery,” IEEE Effective Remote Instruction: Reimagining the Engineering Student Experience webinar, July 30, 2020
 23. Completed “Student and Data Privacy when Offering Remote Instruction,” IEEE Effective Remote Instruction: Reimagining the Engineering Student Experience webinar, July 31, 2020
 24. Advisor for the Society of Automotive Engineers (SAE) chapter at Vaughn College. 2018 – present
 25. Member of ASME – The American Society of Mechanical Engineers, New York, NY, 2010 – present
 26. Served on Student Retention Committee to develop ideas to improve student retention at Vaughn College. 2018 – present
 27. Served as co-chair of Marketing and Enrollment working group for Vaughn College’s strategic planning initiative. 2018 – present

Harrison Carranza

1. Presented paper presented at Proceedings of the 8th International Conference on Control Systems, and Robotics (CDSR’21), May 23-25, 2021, Niagara Falls, Canada, via Zoom titled “Plane Detection Based Object Recognition for Augmented Reality”, alongside co-authors Aparicio Carranza, Juan Estrella, Syed R. Zaidi. **Won Best Paper Award**

2. Attended 13th Technology Day Virtual Conference, Vaughn College, a one-day event and presentation of annual activities from departments and technical clubs, accomplishments and presentations of students' capstone degree projects and networking with industrial leaders, May 28, 2021.
3. Attended 7th Manufacturing Day Virtual Conference, Vaughn College, a one-day event for networking with industrial leaders in engineering, aviation, and manufacturing, October 29, 2021.
4. Improved course material for EET210-Electronic Laboratory Practices to be taught through hybrid mode because of COVID19 crisis. The task was to create material that could be equally balanced with online lectures and on-campus laboratory experiments that could supplement those lectures to fulfill course requirements. Students were also given a tour of the campus hangar as requirement for course and to become familiarized with aeronautic technology.
5. Improved course material for AVT235-Aircraft Navigation Systems to be taught through hybrid mode because of COVID19 crisis. Used labs that were taught online and implemented them on campus through the use of electronic lab experiments using op-amps. Multisim was a resourceful tool to help fulfill course requirements. Students were also given a tour of the campus hangar as requirement for course and to become familiarized with aeronautic technology.
6. Improved course material for AVT346-Power and Distribution Systems to be taught through hybrid mode because of COVID19 crisis. Used electronic lab manuals as well as online resources to create labs for the students. Lab experiments were done using Multisim to fulfill course requirements due to COVID19. On campus experimentation helped supplement theoretical learning and lab simulations. Students were also given a tour of the campus hangar as requirement for course and to become familiarized with aeronautic technology.
7. Improved course material for AVT453-Traffic Collision Avoidance Systems to be taught through hybrid mode because of COVID19 crisis. This includes demonstrating simulations and real-world scenarios on videos. To supplement learning, students were given a tour of hangar to get the experience of working on an aircraft.
8. During Summer 2021 Session 1, worked one-on-one with a student, Darius Booker to help develop the course AVT352-Integrated Avionics Systems to develop material such as Power Point lessons and exams with their answer keys for future use. At the end, we wrote a small abstract to summarize our work for the course. We met for an extra week to accomplish the tasks mentioned.
9. Developed material for EET350-Control Systems since Fall 2021 was the first time offered since Spring 2019. Worked with Andy Paulino on projects using the Arduino microcontroller and the program code to create physical projects that included sensors, LEDs, buzzer, and other electrical components. Despite certain difficulties, together, the student and I developed 6 well laid out lab experiments that helped grow the understanding of control systems.
10. Actively mentoring students and tutoring them through Zoom or other forms of communication on and off my office hours to provide them assistance on courses that I teach as well as any additional work.

Mohammed Benalla

1. Reviewer and Chair of Biomechanics session, 37th Southern Biomedical Engineering Conference 2021, New Orleans LA, December 3-5, 2021
2. Developed ELE Assessment Reports, for the fall 2021, in progress.
 - EGR380, Engineering Project Management
 - ELE117, DC/AC Circuits
 - ELE118, ELECTRIC CIRCUITS II
 - ELE220, Electronic Circuits Lecture / Lab
3. Prepared EGR Assessment report for MCE, MEE, and MET, in progress.
4. Attending the spring open house for the academic year 2021 – 2022, April 9th
5. Attended the fall open house for the academic year 2021 – 2022, November the 30th
6. Developed new course “Data Acquisition and Applied Control System Design - ELE450 & ELE45L”
7. Oral presentation and conference journal publication 2021: “*Electromechanical Device for Inceptive Braille Learning*”, Alina Santander, Tatiana Jaimes, August Rodriguez and Mohammed Benalla, 37th Southern Biomedical Engineering Conference, New Orleans, LA, December 2 - 5, 2021.
8. Oral presentation and conference journal publication 2021: “Non-invasive Glucose Monitoring System with Server Link”, Mariah Villalon, Isa Al-Maktoum, and Rebeca Snyder and Mohammed Benalla, 37th Southern Biomedical Engineering Conference, New Orleans, LA, December 2 - 5, 2021.
9. Oral presentation and conference journal publication 2021: “Assistive Partial Limb Exoskeleton (APLE)”, Aaron Arana, Shouling He, Hossein Rahemi, and Mohammed Benalla, 37th Southern Biomedical Engineering Conference, New Orleans, LA, December 2 - 5, 2021.
10. Journal publication: “*Electromechanical Device for Inceptive Braille Learning*”, Alina Santander, Tatiana Jaimes and Mohammed Benalla, *Biomedical sciences Journal*, January 2021, Volume 57(4)
11. Journal publication: “*Assistive Partial Limb Exoskeleton (APLE)*”, Aaron Arana, Shouling He, Hossein Rahemi and Mohammed Benalla,, *Biomedical sciences Journal*, January 2020, Volume 57(4).
12. Participated as a member of search committees to hire new faculties for the Computer Science, and Computer Engineering programs. The interviewed candidates are
 - Dr. Amar Khoukhi, phone and campus interview
 - Dr. Hago Kiflet, phone and campus interview
 - Dr. Oluwaseyi Ajayi, phone and campus interview
 - Dr. Weiru Chen, phone and campus interview
 - Dr. Jizhou Tong, phone interview
 - Dr. bdul Razaque, phone interview
 - Samuel Kofi Erskine, phone interview
 - Dr. Alex Mathew, phone interview
 - Abdul Waji Khan, phone interview

Miguel A. Bustamante

1. On January 26, 2021, I attended a workshop by US Department of Education on: “Technical assistance workshop on the Title III & Title V Annual Performance Report. This workshop provided a guided tour of all five sections of the Annual Performance Report (APR), including: the Executive Summary; GPRA Indicators; Grant Activities, Objectives and Performance Measures; Budget; LAAs; and Institutionalization.
2. Seminar introduction to MATLAB February 23, 2021, in this session, I learned how MATLAB can be used to visualize and analyze data, perform numerical computations, and develop algorithms. Through live demonstrations and examples, we saw how MATLAB can help faculty and students to become more effective in mathematical models. This session was targeted for those who were new to MATLAB. However, experienced MATLAB users also benefit from the session, as they covered some tips and tricks from the newer releases of MATLAB. The Highlights of the seminar included:
 - Accessing data from many sources (files, other software, hardware, etc.)
 - Using interactive tools for iterative exploration, design, and problem solving
 - Automating and capturing your work in easy-to-write interactive scripts and programs
 - Sharing your results with others by automatically creating reports
 - Building and deploying interactive applications
 - Performing these workflows from anywhere, with MATLAB Online
3. March 29, 2021, Attended “Online Delivery of a Control Theory Course During the Pandemic”. A major challenge in the online delivery of engineering courses was the implementation of the lab component. With most campuses being closed due to COVID-19, many of the engineering courses’ labs were either cancelled or converted to simple simulations. This webinar detailed on how the labs for a third-year control theory course were converted to suit online delivery. Most of the labs utilized MATLAB/Simulink and the Quanser Virtual QUBE-Servo 2 digital twin. By using a 3D gaming engine to animate a virtual motor, engaging and immersive control experiments were performed by students from home. Theory Course During the Pandemic. The guest presenter, Dr. Mostafa Soliman, professor at McMaster University, discussed this topic in detail.
4. On March 31, 2021, I attended a webinar hosted by Red Hat Academy for all RHA faculty and instructors to learn about the importance of certifications from consultants and a former hiring manager. The topic of discussion was “Hear why Red Hat Certifications are important from a former hiring manager and current Red Hat Consultants” We learned how important are certification for students in the cybersecurity and computer engineering field.
5. April 7, 2021, MATLAB seminar: “Systems Engineering and Controls with Simulink and Simscape”. Simulink has been used for over 30 years to help design the world’s most complex engineering systems. We learned on how to build a model from scratch and simulate it to find design flaws in minutes, and then use that same model for both component- and system-level tests. They did demonstrate how Simulink and Simscape can improve your modeling and simulation workflow. Also, how can we incorporate SIMULINK in engineering classes.
6. December 3, 2020, I attended an educational webcast presented by Control Engineering and Fortined on: “Cybersecurity: What do you need to know”. What do you need to know about cybersecurity related to controls, automation, and instrumentation, especially with more remote connections resulting from the COVID-19 pandemic? Capabilities inherent in

existing cybersecurity design methodologies and technologies were explored along with what should be covered in cybersecurity training. One important question was asked, when was your last cybersecurity risk assessment? It was also explained how important to identify architectures for cybersecurity designs for controls, automation, and instrumentation. Establish, conduct, and update cybersecurity training. Seek out cybersecurity best practices. Do cybersecurity risk assessments? I did obtain a certificate of course completion.

7. On November 16, 2020, I did attend IEEE educational cast on: Engineering Education 2.0: Models, Methods and Techniques for Innovation. This educational training evaluated the new methodology on how faculty members should approach teaching engineering courses. I did obtain a certificate of completion and a certificate of professional development.
8. October 1, 2020, Vaughn college received a Title V grant “Closing the Equity Gap for Hispanic and Low-Income Students by Developing New Degree Pathways in High Need STEM Disciplines.” Dr. Bustamante is the Project Director for this grant. The goals of the grant is to increase the number of Hispanic and low-income students who have access to and complete articulated STEM (especially in computer engineering) degrees and career opportunities in a service area that is one of the most diverse areas in the nation, where poverty is high, and educational attainment is low.
9. Advised and mentored multiple teams of students to develop research journal papers for VCJET 2020. The projects will webcast student session of 12th Annual Vaughn College Technology Day Conference, April 2020.
10. Mentor-Connect Cohort 8 conference, a team compose of Dr. Miguel Bustamante, Professor Rodney Dash and Grant manager Natasha Waldron, participated on the Technical Assistance and Grant writing workshop hosted in New Orleans January 28 to the 31, 2020. The objectives for this workshop were to engage participants in the ATE community and prepare college teams and their accompanying grant writers and/or administrators to initiate a fundable NSF ATE grant proposal. This Mentor-Connect was entered as a competition and our team from Vaughn College was selected to participate on this journey.

Oluwasevi Ajayi

1. Develop course syllabi for Bachelor of Science, Computer Science Program, and its associated cybersecurity courses January 2022
2. Testing the Computer Engineering courses and modifying as them as appropriate. January 2022
3. Served as committee member that oversees the cybersecurity lab setup and running. November 2021
4. In preparation for the ABET visit for computer Engineering program,
 - Assisted in designing an outcome assessment report for the program. January 2022
 - Attended meeting with an ABET consultant to commence an early preparation for ABET visit. January 2022
5. On Wednesday Feb 16 and 23, 2022, Attended a virtual hands-on training workshop on **P4 programming switches** organized by University of South Carolina, Energy Sciences Network(ESnet), The Engagement and Performance Operations center (EPOC) and Great Plains Network sponsored by National Science Foundations (NSF).

6. Attended the *2021 IEEE 4th 5G World Forum (5GWF'21)* and presented a paper titled **“Transpacific testbed for Real-Time Experimentation”** October 2021, Montreal, Canada
7. Attended *the 2021 International Symposium on Networks, Computers and Communications: Trust, Security, and Privacy (ISNCC-TSP)* and presented a paper titled **“Detecting Insider attacks in Blockchain Networks”** November 2021, Dubai, UAE
8. Co-authored a journal paper titled: **“Evaluation of Concurrent Variation in Rain Specific Attenuation and Tropospheric Amplitude Scintillation Over Akure, Southwest Nigeria”** published June 2021 at *Earth Systems and Environment Journal*
9. Co-authored a conference paper title: **“Forecasting tropospheric wet delay using LSTM neural network.”** presented in the *13th International Conference on Soft Computing and Pattern recognition (SoCPaR 2021)* December 2021, Nigeria
10. Organized hands-on training for five students (comprising both master’s and Undergraduates students) on setting up private blockchain networks for specific purposes
11. Co-authored a conference paper title: **“Blockchain Framework for Secured On-Demand Patient Health Records Sharing”** presented at *the 2021 IEEE 12th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference (UEMCON 2021)*, December 2021, New York
12. Completed an online course “Splunk 7.X fundamentals” in October 2021
13. Commenced an **Ethernaut hacking challenging** for blockchain smart contract Solidity and Web3 using online OpenZeppelin December 2021
14. Review all the course syllabi for Bachelor of Science, Computer Engineering Program as well as Cybersecurity program October 2021
15. Developed course syllabi for Computer Engineering and Cybersecurity Summer program for High School and Associate Degree programs November 2021

Manuel Jesus

1. As STEM Activity Liaison, I assisted engineering department chair to organize and host the following Industry Connection seminar and Engineering Seminar series during academic year 2021-2022.
 - **An introduction to NASA, NASA Goddard Space Flight Center, NASA Goddard Institute for Space Studies and NASA Internship Opportunities:** on Thursday, Feb 11, 2021, Mr. Matthew Pearce, National Aeronautics and Space Administration (NASA) education programs specialist and Ms. Rosalba Giarratano, Pathways Intern at the Goddard Institute for Space Studies, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this Microsoft Teams Virtual event, both Ms. Rosalba Giarratano and Mr. Pearce’s presentation covered topics related to an overview of NASA, NASA Goddard Institute for Space Studies, NASA STEM Workforce Challenges, and they talked about all available STEM Internships, Fellowships, and other career opportunities with NASA and NASA’s internship application and interview process.
 - **Power System Integration for Aerospace Industry:** On Friday February 19, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky, addressed the Vaughn community as part of the College's Industry Connection Seminar series. For this virtual event seminar, Mr. Asaro talked about topics related to high horse power motor, PLC, high power cables conductors, electronics conduit

design and manufacturing processes within the aerospace industry (Attachment#2-Power System Integration for Aerospace Industry).

- **Celebrating Black History and Women’s History months with Engineer and Astronaut Stephanie Wilson, March 9, 2021:** On Tuesday, March 9th from 10 to 11 am, Vaughn’s students, faculty, and Staff in observance of Black History and Women’s History months, participated in a virtual fireside chat with engineer and NASA astronaut Stephanie Wilson to celebrate accomplishments of distinguished African American Engineers and Astronauts. This special virtual meeting was held by NASA to promote STEM in education. Stephanie Wilson graciously shared her career path as an African American Woman involved in a STEM career. Specifically, she shared insight regarding her role as an astronaut with NASA during the Shuttle Program and construction of the International Space Station. First and foremost, Ms. Wilson made a point to share that she was an aerospace engineer who worked hard to lay the foundations that eventually brought her to a successful career as a leading astronaut.
- **Electrical Safety and Consideration:** On Tuesday, March 23, 2021, Mr. Carlo Asaro, a senior Aircraft Avionics Systems Engineer for Sikorsky and an adjunct faculty member at Vaughn College, addressed the Vaughn community on the topic of Electrical Safety Considerations, as part of the College's Virtual Industry Connection Seminar series. The overall topic of the presentation was safety first. The serious nature of this topic was addressed through discussion of tragic workplace accidents related to servicing motors accidentally left in a powered-on state. Personal electrical safety equipment such as probes, high voltage resistant gloves, and foot pads were shown as effective measures against fatal injuries.
- **Update on new FAA drone Rules that go into effect April 2021:** On Thursday, April 15 from 11 am to 12 pm, as part of the College’s industry connection seminar series, Ms. Loretta Alkalay, an aviation attorney specializing in issues related to compliance with federal aviation regulations including drone rules, who is also an adjunct professor at Vaughn College, updated the Vaughn community on new FAA drone rules that go into effect April 2021, including the operations over people rule and the remote ID rule.
- **Drone Awareness Week:** On Thursday September 16, the engineering department, in collaboration with the Management department, hosted a seminar to celebrate the National Drone Awareness Week. This seminar featured a presentation regarding Drone and UAV Safety Standards. Federal Aviation Administration expert Michael O’Shea, the UAS Program Manager led the discussion regarding drone safety mandates. Mr. O’Shea’s presentation showcased the FAA’s ongoing mission to provide the safest, most efficient aerospace system around the world. Vaughn’s UAV club secretary Yusuf Rafi started the event with a presentation that highlighted current club activities and past achievements such as their 1st place award for Autonomous at the 2018 VFS Student Challenge Competition. UAV club students shared their findings on the topic of UAV safety through their own experiences in drone operation, the Part 107 License, and best practices for UAV flight within the FAA restrictions.
- **Summer internship programs with NASA and InstaHub:** On Tuesday December 7, 2021 as part of department’s Engineering Seminar Series, Tatiana

Jaimés and Alina Santander, Senior Students in Mechatronic Engineering who participated in summer internship programs with NASA and InstaHub, addressed the Vaughn community about their summer internship programs and life-long learning experiences that they both gained through their projects.. Tatiana Jaimés spoke of her summer internship at NASA where she worked on the Osam 1: Satellite Servicing Mission. This project centered on developing technology to service satellites in orbit, a crucial task to perform since the retirement of the manned space shuttle fleet and its unique ability to rendezvous with and service satellite hardware. Alina Santander had the opportunity to spend the summer with InstaHub a northeast US developer of building automation hardware solutions.

- **History and overview of the 737 program:** Mr. Ed Clark, a vice president and general manager of Boeing's 737 Program, addressed the Vaughn community on December 9, 2021 as part of the College's Industry Speaker series that has been organized by Vaughn's Career Service Department. The event was held both in-person and virtually. His presentation began with the history and overview of the 737 program. The 737 program commenced in the 1960's with the need to supplement Boeing's existing 727 program. Since the maiden flight of the 737 in 1967, there have been four generations of 737 planes. Clark mentioned that Boeing produces three airplanes per month out of the Renton, WA assembly building and 50 airplanes per month out of the Seattle delivery center.
 - **Electronics Breadboard Hands-on Learning:** Mr. Carlo Asaro, an Aircraft Avionics Systems Engineer, addressed the Vaughn community on Thursday, February 17, 2022, as part of the College's Industry Connection Seminar series. Mr. Asaro has more than 30 years of experience in the industry in research and development, and in testing and evaluation of rotor-wing electronics with primary focus on power electronics and weapon systems. In this virtual seminar, Mr. Asaro talked about topics related to electronics breadboard design and hands-on learning.
2. Advised students on degree project tasks related to additive manufacturing, 3D Scanning, and CAD related tasks. (Ongoing)
 3. Participated and co-hosted Vaughn's 13th Annual Technology Day Conference, a one-day event and presentation of department annual activities, presentation of technical clubs, annual activities, accomplishments, and presentation of students' capstone degree projects as well as networking with industrial leaders. May 28th, 2021.
 4. On Thursday October 7, 2021, attended the **3rd Annual Curriculum and Career Advisement day** with students in engineering and engineering technology programs. This virtual meeting discussion covered activities in which students should participate in order to enhance their career opportunities while studying at Vaughn.
 5. Participated and developed virtual online content for the Spring 2021 and Fall 2021 Virtual Open House Sessions.(Spring and Fall 2021)
 6. Co-hosted Virtual Manufacturing Day Leadership Session Conference. Presentations were given by industry experts and successful alumni for the purpose of sharing inspirational success stories, technical expertise and mastery in their field, student engagement, and networking. The conference centered around supply chain restructuring and manufacturing to meet the global challenges of COVID-19 pandemic and cyber security. As part of my involvement, I sought out presenters from industry partners such as Artec 3D Scanners, and EMS 3D Scanning solutions. November, 2021.

7. Participated in Long Island Manufacturing Day and presented information regarding Additive Manufacturing and CNC lab development and course offerings to Long Island and Queens area high school students, October, 2021.
8. CSTEP Program
 - ✓ Conducted a CSTEP CATIA V5 Workshop to prepare students for certification exams. Summer 2021
 - ✓ Worked with students to explore the VR content creation landscape for STEM education environments. Summer 2021
9. Contributed activity reports related to ongoing Virtual student engagement events for use in the Vaughn College Journal of Engineering Technology.(Ongoing)
10. Contributed further time and effort into development of CNC, Additive Manufacturing, and Computer Graphics for VR in STEM lab spaces and course offerings. (Ongoing)
11. From Aug 3-5, as 3D/CNC curriculum designer along with department chair and project director of Title III HSI-STEM, Dr. Hossein Rahemi, and project director of Title V SOAR grant, Dr. Margaret Ducharme attended virtual project directors' conference. For this conference, Vaughn's grant team developed and submitted a proposal and prerecorded presentation about **Vaughn's Title III and Title V grant project activities during COVID**. These activities covered, virtual STEM workshops, virtual outreach, students' involvement in virtual extracurricular activities, establishment of Vaughn's manufacturing centers, and common reading program.
12. On Friday, April 9, 2021, as the STEM pathway Liaison along with the department chair and additive manufacturing lab techs hosted Vaughn's **3rd annual STEM Day workshop** for community colleges and high schools students. The participants of Vaughn's STEM Day virtual workshop event were students and faculty from Passaic CC, Queensborough CC, Bergen CC, Aviation High, and Humanities & Arts high school. For this virtual events, Vaughn's STEM Liaison and 3D/CNC curriculum developer, Prof. Manuel Jesus, introduced participants to Vaughn College's program offerings in engineering and engineering technology disciplines as well as student involvement in various STEM related clubs and professional activities. Prof. Jesus, provided participants with a video tour of Vaughn's 3D Makerspace and CNC manufacturing centers. Finally, department hosted couple of virtual STEM workshops related to 3D Scanning, CAM and CNC, and Virtual Reality

Khalid Mouaouya

1. Attended 13th Vaughn's Annual Technology Day Virtual Conference, a one-day event and presentation of annual activities from departments and technical clubs, accomplishments and presentations of students' capstone degree projects and networking with industrial leaders, May 28, 2021.
2. Attended Vaughn's 7th Annual Manufacturing Day Virtual Conference, a one-day event for networking with industrial leaders in engineering, aviation, and manufacturing, October 29, 2021.
3. Attended Open House during fall 2021 to assist faculty in providing information to potential future incoming students.
4. Attended "Power System Integration for Aerospace Industry" Industry Connection Seminar Series, Vaughn College, Flushing, NY, February 19, 2021
5. Attended "The Electrical Safety and Consideration" Industry Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021

6. Attended “Update on New FAA Drone Rules that go into effect April 2021” Industry Connection Seminar Series, Vaughn College, Flushing, NY, March 23, 2021
7. Attended 3rd Annual STEM Day Workshops, Vaughn College, Flushing, NY, April 9, 2021
8. Attended “Summer internship programs with NASA and InstaHub” Engineering Seminar Series, Vaughn College, Flushing, NY, December 7, 2021
9. Attended “Electronics Breadboard Hands-on Learning” Industry Connection Seminar Series, Vaughn College, Flushing, NY, February 17, 2022
10. Attended “Internship Experience: F-18 super hornet counter measures system IDECM AN/ALQ-214” Engineering Seminar Series, Vaughn College, Flushing, NY, February 24, 2022

Jonathan Sypeck

1. Advised and mentored several Associates Degree students in their final Degree Project, relating to the fields of Conceptual Aircraft Design and Flow Simulation using SolidWorks.
2. Attended 13th Technology Day Virtual Conference, Vaughn College, a one-day event and presentation of annual activities from departments and technical clubs, accomplishments and presentations of students’ capstone degree projects and networking with industrial leaders, May 28, 2021.
3. Helped conduct Virtual Open Houses for undergraduate students at Vaughn College during spring and fall 2021 and presented engineering and engineering technology program offerings.
4. Attended IEEE “Effective Remote Instruction: Reimagining the Engineering Student Experience” Webinars over the course of five days in Summer 2020 to gain extensive knowledge on how to pivot traditional Engineering lecture and lab teaching techniques to meet the virtual-environment requirements of today’s COVID-19 world.
5. Attended ASEE “Thinking Outside the Box: Alternative Assessment Methods” Webinar in Fall 2020 to gain valuable information regarding how to assess students through virtual learning.
6. Attended ASEE “How Boise State University Provides Engineering Students with Remote Access to Applications & Desktops” Webinar in Fall 2020 to gain important information regarding how to migrate traditional Engineering software from on-campus offerings to virtual desktops and web-apps.
7. On Thursday October 7, 2021, attended the **3rd Annual Curriculum and Career Advisement day** with students in engineering and engineering technology programs. This virtual meeting discussion covered activities in which students should participate in order to enhance their career opportunities while studying at Vaughn. In this virtual gathering, we discussed several career strategies for obtaining a successful career in STEM fields.
8. Attended Vaughn’s 7th Annual Manufacturing Day Virtual Conference, a one-day event for networking with industrial leaders in engineering, aviation, and manufacturing, October 29, 2021.
9. Participated in all Vaughn's spring and fall 2021-2022 Industry Connection Seminar Series, and Engineering Seminar Series.

Ryan Tang Dan

1. Advised students of the Vaughn College Robotics team competing in the VEX Robotics Competition.
2. Advised students of the Vaughn College UAV team competing in the AUVSI SUAS and VFS Design-Build-Vertical (DBV) Competitions.
3. Head coach of the 16099/16699 Overclock Robotics VEX Robotics Competition team at KG Computech Inc.
 - a. Worked closely with middle and high school students in preparing for the VEX Robotics Competition seasons.
 - b. Developed a summer training program introducing new students to VEX Robotics Competition and engineering core course topics in Robotics and Mechatronic Engineering.
4. STEM Director and Instructor at KG Computech Inc.
 - a. Developed STEM courseware utilized in introducing elementary, middle, and high school to engineering STEM topics.
 - b. Head instructor of multiple STEM programs teaching topics in Computer Aided Design (CAD), robotics, drones, programming, and electronics.
 - c. Oversaw STEM program and student recruitment programs for STEM courses.
5. Certification as an VEX Robotics Competition Event Partner, VRC Head Referee, VIQC Head Referee, and Judge Advisor for all 2020, 2021, and 2022 competition seasons.
6. Worked as an event partner for VEX Robotics Competition hosting middle and high school events.
 - a. Hosted multiple Live Remote Skills Competitions via Zoom.
 - b. Head Event Partner for the 2022 Southern New York State Championships for the following:
 - i. High School Tipping Point State Championship.
 - ii. Middle School tipping Point State Championship.
 - iii. VEX IQ Elementary and Middle School Blended State Championship.
7. Served as a volunteer judge advisor and emcee at VEX Robotics Competitions.
8. A Drone Education Consultant and Instructor at the Cradle of Aviation Museum.
 - a. Overseeing the development of a high school drone summer camp curriculum.
 - b. Development of drone education course materials.
 - c. Instructor for the drone summer program at the museum.
9. An adjunct professor for MCE101, Introduction to Robotics.
10. Vaughn's FAA AWD UAS Certification Grant Project Coordinator.
 - a. Assisting in the management of day-to-day operations of an FAA funded Aviation Workforce Development initiative.
 - b. Assisting in the development of marketing materials and recruiting high school students on the UAS program course schedule.
 - c. Supervising and evaluating program staff and authoring of program reports to the funder.
 - d. Traveling to local schools to disseminate information, recruit cohort participants and for other purposes.

Alaric Hyland – Mechatronics and 3D Printing Lab Specialist

1. Advised several Mechatronic Engineering degree project teams in the design and manufacture of their additively manufactured/CNC Laser Cut projects (currently ongoing for Spring 2022 as well)
2. Liasoned with multiple Vaughn student body clubs (such as UAV, Robotics, and SWE) for additive manufacturing/CNC Laser Cut goals (currently ongoing)
3. Enrolled in two courses at Pennsylvania State University with the intent to acquire a Masters in Additive Manufacturing degree (four courses remain after May 2022)
4. Ongoing communication with the company Markforged to install the Metal X 3D printing suite
5. Assisted in conducting Vaughn’s Fall 2021 Open House for incoming undergraduate students, demonstrating lab equipment and course offerings
6. Manufactured awards for Vaughn-sponsored VEX Robotics competitions, ongoing throughout Spring 2022
7. Developed new hardware platform for Mechatronics lab from scratch, utilizing Siemens PLCs to replace old outdated hardware (design completed, implementation ongoing)
8. Improved layout and functionality of Vaughn College MakerSpace; new machines added replacing old/nonfunctioning machines, CNC laser cutter added; tables replaced; metal 3d printing implementation ongoing (see entry 4)
9. Attended Vaughn’s 7th Annual Manufacturing Day Virtual Conference, a one-day event for networking with industrial leaders in engineering, aviation, and manufacturing, October 29, 2021.
10. Attended 13th Vaughn’s Annual Technology Day Virtual Conference, a one-day event and presentation of annual activities from departments and technical clubs, accomplishments and presentations of students’ capstone degree projects and networking with industrial leaders, May 28, 2021.

Graduate Success Stories

In order to prepare students for the growing demands of today's technology and to aid them in their future careers, the Engineering and Technology Department at Vaughn College adopted a set of in-class and out-of-class academic activities reflective of ongoing technological change. These activities are designed to instill in students an awareness of the importance of lifelong learning in meeting the challenges in their future professions.

Whatever path our engineering and engineering technology students choose, their Vaughn education provides them with an edge for success.

Atif Saeed, Class of 2020
Life Cycle Engineer, SpaceX
BS in Mechatronic Engineering, 2020
AOS Airframe and Powerplant Technology, 2017



In 2010, I visited Pakistan for the first time since I left for the United States when I was three. As I disembarked the plane, I turned around and looked at the aircraft and stood there in exhilaration as I witnessed a magnificent engineering creation. I exited the terminal and saw a vague impression of my family whom I hadn't seen in nine years. They stood in shock as they observed how much I had grown since the last time they had seen me.

My month-long trip became a realization of education and career aspiration. With the ambient noise of children playing in the streets, I noticed that the children were not in school, I asked my uncle why they were not at school. He replied, they have a desire to learn, but due to the high tuition rates their parents are unable to pay. These children usually end up getting a job at an early age and are forced to provide for their families. When I returned to the United States, I was more motivated in school because I had seen that people in foreign countries were unable to have an education, but they wanted to. Before my trip, it was the exact opposite for me, education was mandatory, but the ambition of wanting an education was not present.

I want to follow my childhood dream of working with magnificently engineered aircrafts that I saw as a little kid. Engineering allows you to use your inventiveness every day. With what I saw in Pakistan during my trip, it motivated me to try my hardest in school and to attain an extraordinary level of education for the people in Pakistan who cannot and follow my love of aerospace and become the first engineer in my family.

The first step I took towards attaining my engineering degree was by setting and achieving goals. I have flourished both socially and academically by doing so. Although I have accomplished a lot, I feel I have laid the foundation for my future career by establishing other, more long-term goals. Prior to beginning my path to gaining my engineering degree, I studied for two years at Vaughn College to gain my Airframe and Powerplant Licenses. Having these licenses allowed me to really understand more about aircraft and I feel that I have a better understanding of how mechanisms work during my more theoretical classes during my undergraduate degree in Mechatronic Engineering at Vaughn College.

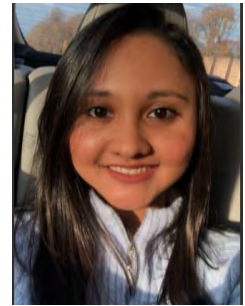
In my junior year, my internship as a Research Engineer at Lockheed Martin consisted of an engineering focus, backed with project management and sustainment. During this internship I designed and implement a robust Neural Network architecture for expanded mechanical fault detection and classification for the F-35 Lighting II Gen V and C-130 programs, along with future execution on GPS III satellite program. Furthermore, throughout my internship I developed a modular mounting and electrical system for multi-sensor interfacing with an existing inspection drone to implement the newly created Neural Network system. All these projects that I worked on had to be backed with both use-case and cost analysis data from both Lockheed Martin Space and Lockheed Martin Aeronautics. My work as an intern was presented to the Director of Digital Transformation at Lockheed Martin. The internship was concluded with an offer from Lockheed Martin Aeronautics for a full-time position, which I accepted.

In addition, my extracurricular activities included being the Vice President of Vaughn College Robotics, for which I developed a specific-tasked robot, including the design, build, and programming phases. I was also an active member of the Vaughn College UAV Club in which I was a part of the design and build phases of the UAVs that competed in competitions across the nation. Also, I was a member of the Society of Women Engineers Vaughn Chapter where I participated in K-12 STEM workshops and attended the Women in Engineering National Conference. Lastly, I was part of the Vaughn College Leadership Academy, in which I attended weekly meetings with job professionals to learn key characteristics of becoming a better leader.

Together with my education and extracurricular activities, I have written and published four papers for LACCEI (Latin American and Caribbean Consortium of Engineering Institutions), ASEE (the American Society of Engineering Education), and the SBEC (Southern Biomedical Engineering Conference). In June 2019, at ASEE, I published a paper on, the Braille Block, the precursor to the Braille Block Learning System. Then in July 2019, my paper, on which I was lead author, was published, and I presented this paper on The Braille Block Learning System that will help young blind children learn braille affordably. I won second place at the student competition.

After graduating from Vaughn College, my career started as a Mechanical Engineer at Lockheed Martin Space, working within Core Electronics Packing in Sunnyvale, CA. My day to day consisted of utilizing the full spectrum of the design, analysis, test, and manufacturing tools to create efficient electromechanical packaging structures and components for flight sensitive electronics (CCA/PWB). After working for Lockheed Martin Space for a year, I left my position and took on a new role as a Life Cycle Engineer at SpaceX in Los Angeles, CA. At SpaceX, my role consists of being a Responsible Engineer (RE) for multiple products on Falcon and Dragon vehicles. As a RE, my main goal is to disposition flight hardware that has failed during production and on vehicle using analysis, testing, and heritage documentation rational. My current position stresses what I learned at Vaughn College more than ever, including but not limited to finite element analysis, stress analysis, material science, complex statics, and dynamics. Not only am I utilizing everything had I learned at Vaughn College daily, it has created the foundation I need to be successful in my career at SpaceX.

Sagufta Kapadia, Class of 2020
Associate Software Engineer, Lockheed Martin
BS in Mechatronics Engineering, 2020



When I used to see airplanes soar through the sky as a child, I would tell my mom, “One day I am going to be a Pilot!” As I grew up, I began to wonder what makes an airplane fly. How does such a large vehicle hold so many people and items and glide in the air so effortlessly? So, I began exploring the world of engineering, and Math and Physics became my favorite subject. When my high school physics teacher saw enthusiasm in class, she urged me to join the school’s robotics club, which I inevitably did. Being in the robotics club, I realized how vast the world of engineering is. Thus, when it came to choosing a college and a major as junior year of high school came around, I had decided I would major in engineering, but the question was which area of engineering? During my college research, I came across Vaughn College of Aeronautics and Technology and decided to sign up for an open house to learn more about what it has to offer. During the open house, we were given a tour of all the lab equipment the students have access to, and I remember seeing the 3D printing lab and thinking to myself maybe I do want to attend this college. However, when I learned about how the college offered a major in Mechatronic Engineering, a major where the students would be able to explore three areas of engineering, electrical, mechanical and computer science, I was sure this is the college I wanted to attend.

As college began, I was excited to explore the extracurricular activities the college had to offer. From the open house I remembered the college had an accomplished robotics club and an emerging Unmanned Aerial Vehicle (UAV) club. Hence, during club fair made sure to sign up for those two clubs first, but as I walked around the fair, a club named Society of Women Engineers (SWE) caught my eye and I decided to sign up for that as well. I quickly realized that I was lot more intrigued by the UAV club than the robotics club and being active in both clubs would not be possible. Hence, I became an active member of the UAV club and the SWE chapter of Vaughn College. The UAV club allowed for my technical skills grow as we designed, built and programmed drones to accomplish the competition challenges and SWE allowed for my professional growth as we hosted workshops for kids that gave them a glimpse of the world of engineering as well as resume building and mock interview workshops for college students. The Vaughn SWE chapter also gave me the opportunity to attend the annual SWE Conference, where I landed an internship at Lockheed Martin. I was able to attend the SWE conference without a worry about the cost of travel or hotels or the admission fee as the Vaughn College Engineering depart completely funded this trip of the SWE chapter to the conference. At the conference, the recruiters were impressed by how I not only had classroom knowledge but was also able to apply this knowledge through work I did in the UAV club. Through these extra-curricular activities, I also learned about leadership and how to work in a team, which led me to perform very well in my internship. By my senior year in college, I was the president of SWE Chapter, Vice president of UAV club and had a job offer from Lockheed Martin. Being at Vaughn College taught me that you cannot wait for an opportunity to strike at your door, you must do everything in your power to after what you want. After all, **"Don't sit down and wait for the opportunities to come. Get up and make them."** - Madam C.J Walker

Bruce N. Tenesaca Class of 2020
Capabilities Development Specialist
National Security Agency, MD
Bachelor's Degree in Mechatronic Engineering

Life is unpredictable. Things happen for a reason, even if it doesn't seem like it. I was supposed to go to Rensselaer Polytechnic Institute, but I ended up changing my mind last second and I had nowhere to go, since it was already too late to apply for the fall semester of 2016. Luckily, one of my good friends, Juan Castaño told me about Vaughn College of Aeronautics and Technology. I was able to enroll and here I am now, expressing my gratitude to everyone. The most important thing I was able to engrave in my mind from the Mechatronic curriculum was the term "Lifelong Learning".

Being born in the year of 1998, I was exposed to a renaissance of emerging technology. Geniuses were improving what was already convenient. I always wondered just how people were able to do such wonders for society through technology. My philosophy is just to go with what life throws at you, but plan appropriately. I liked both Science and Mathematics, so naturally, I gravitated towards Engineering without realizing. The only problem was I was not sure which aspect of Engineering I wanted to dedicate years into studying.

When going over what the Mechatronic Engineering curriculum with faculty back in the summer of 2016, I was amazed how I would be exposed to a multitude engineering disciplines. It automatically was way better than RPI's dual major curriculum that would take 5 years and would have placed me in debt for a long time. I was able to see what Engineering fields I loved and which ones were not a fit for me. Vaughn was also close to where I lived, which shows how things happen for a reason. I got to meet such talented people, from students, to faculty. I was bombarded with information and challenged in multiple classes, but I pushed on through to succeed in them. I want to give my sincerest thanks to Dr. Rahemi, Dr. He, Dr. Lavergne, Dr. Bustamante, Professor Sypeck, Dr. Addabbo, Dr. Budhoo, and especially Dr. Elzawawy and of course everyone else, including friends that I will have until the day I die. Dr. Elzawawy gave me support when I was going through the long, arduous process of being hired into the National Security Agency after graduating. Thank you.

I now can proudly say that I work at the NSA, more specifically, NSA Washington. I was cleared for TS/SI, and I even had to go through a polygraph. I am a Capabilities Development Specialist, and I conduct comprehensive technology research to evaluate vulnerabilities in cyberspace systems. I use what I learned back at Vaughn to do my part in helping this blessed country. This is the best thing that has happened in my life. Although I recently started my lifelong career here at the Agency, I'm already being bombarded with information just like at Vaughn, which is perfect. I can even take courses and go to events at the Agency to improve my wellbeing and my skillset. I was speechless meeting such talented and kind people here. The thought of "how people are able to do such wonders for society through technology" came back to me. The Agency pushes me just like my professors have pushed me to succeed. I am going to still be learning new things, and I'm ready. Looking back, I've never been this happy in my life until this moment. I've been inspired and finally realized it.

Curriculum and Career Advisement Day: Career Conversations with Engineering Students

Thursday, October 7, 2021

11 am – 12 pm

Virtual Zoom Meeting

The engineering and technology department hosted its 3rd Annual Curriculum and Career Advisement day with students in engineering and engineering technology programs. Dr. Rahemi, along with the STEM Liaison and engineering faculty, organized a virtual event to provide curriculum and career advisement to all engineering and engineering technology students. This virtual event covered topics related to curriculum as well as to activities in which students should participate in order to enhance their career opportunities while studying at Vaughn.

Vaughn College
Engineering and Technology Department
Curriculum and Career Advisement with Engineering Faculty

Curriculum	Career
1. Know the curriculum and follow the curriculum requirements	1. Build Hands-on, Teamwork, and Communication Skills
2. Beside your SAC advisor get advised by a program faculty	2. Build analytical and computer skills
3. Avoid taking courses out of sequence	3. Get Involve in Extra-Curricular Activities
4. Meet faculty during office hours for course and curriculum advisement	4. Get Involve in an Internship Program
5. Attend Engineering and Industry Connection Seminar Series	5. Get Involve in student Chapter of professional Societies
6. Attend Annual Vaughn College Tech Day Conference	6. Get Involve in Technical Clubs (Robotics, UAV, SAE, ...)
7. Keep Grades Up	7. Get Involve in STEM Outreach Activities
	8. Get Involve in Scholarly Activities (publication & Presentation)
	9. Make connection with Vaughn's Career Service Department

Date: Thursday, October 7, 2021
Time: 11:00 am—12:00 pm

Department chair, program coordinators, and faculty discussed, in detail, the following curriculum and career strategies with students.

1. Know your curriculum – Review the curriculum sheet, learn about the curriculum offerings and contents (Math and Science, technical, and general education), technical electives, and prerequisite and corequisite requirements.
2. Curriculum Advisement – Meet your curriculum advisor at Student Advisement Center (SAC) and get curriculum and registration advisement.
3. Avoid taking courses out of sequence – Many core courses require prerequisites, taking courses out of curriculum sequence may result in missing prerequisites and consequently may delay graduation.
4. Get advised by a program faculty – Meet program faculty during their office hours and get course and curriculum advisement.

5. Attend Engineering and Industry Connection Seminar Series – These seminars will help all students to learn about current technological advancement and engineering innovation, as well as provide an opportunity for students to interact with industry leaders. The main objective of this seminar series is to provide our students with a greater appreciation for engineering education.
6. Attend Annual Vaughn College Technology Day Conference – This annual conference helps all students interact with Vaughn’s industry advisory members as well as learn about graduating students capstone projects presented in the afternoon session of this annual gathering. Attending and presenting in this annual conference helps students to enhance their career opportunities.
7. Keep Grades Up – Having a GPA of 3 or better increases a student’s chances of both obtaining an interview for an internship and employment with many engineering industries.
8. Build hands-on teamwork and communication skills – These career building skills can be attained through hands-on laboratory projects, capstone courses, and involvement in technical clubs (Robotics, UAV, SAE, et) and student chapters of professional societies (SWE, SHPE, EWB, NSBE, LACCEI).
9. Build Analytical and Computer Skills –Analytical and computer coding knowledge and capabilities are two important skills for pursuing a successful career in STEM Fields.
10. Participate in Extra-Curricular Activities – To further enhance career opportunities and cultivate creative ideas, one should consider involvement in extra-curricular activities such as technical clubs, competitions, and STEM workshops.
11. Participate in an Internship Program – Internship programs not only introduce one to the industry environment but also expose one to real-world engineering projects and career-building skills. The department supports and encourages all students to attend career fair conferences. In the past couple of years, those students who attended in SWE, SHPE, and NSBE Career Fair conferences, received both internship and full-time position offerings.
12. Participate in Student Chapters of Professional Societies - Involvement in student chapters of professional societies introduces one to innovations in the STEM fields and provides professional networking opportunities with engineering industries.
13. Participate in Technical Club Activities – Involvement in technical clubs such as Robotics, UAV, SAE, increase creativity and provide an opportunity to apply classroom knowledge to the actual building of an engineering system. The creative mindset acquired through these experiences provides a lifelong edge in one’s professional career.
14. Participate in STEM outreach activities - Organizing and hosting STEM workshops during Vaughn’s Annual Manufacturing Day, Annual International Drone day, SWE Annual Conference, and Vaughn’s Regional High School and College Robotics competitions further enhances leadership and career opportunities in STEM fields.
15. Participate in Scholarly Activities - Publications and presentations at technical conferences such as ASEE, SEM, LACCEI, ASME, SWE, AHS, COMSOL, IEEE, and VCJET integrate career-building skills and contribute to success in professional careers and in continued education.
16. Connect with Vaughn’s Career Service Department – We encourage everyone to be in touch with Vaughn’s Career Service and to participate in their workshops and events related to resume writing, internships, career fairs, and graduate school fairs.

Vaughn College Fall 2021 Common Reading

Dorothy Roberts' book, *Fatal Invention: How Science, Politics, and Big Business Re-Created Race in the Twenty-First Century* was the fall 2021 Common Reading. Professor Roberts is the fourteenth Penn Integrates Knowledge Professor at the University of Pennsylvania, where she is also the George Weiss University Professor of Law and Sociology, and the Raymond Pace and Sadie Tanner Mossell Alexander Professor of Civil Rights. Roberts is also the author of *Killing the Black Body* and *Shattered Bonds* and the chair of the Black Women's Health Imperative.

Professor Roberts' idea that race is a political category, not an innate classification, and that the concept of race persists only because it is politically useful is an original contribution to the race conversation among our students and faculty. This book was a topic of discussion for students in classes of Writing Composition, History, Government, Psychology, and Literature, and Professor Roberts gave Vaughn students a Zoom presentation during which she discussed her book during our college **Common Hour on Thursday, Sept. 30, 2021**. After this event, which was open to the entire college, all were invited to ask Professor Roberts their individual questions and this vital conversation about the role of culture and race in our society continued beyond the student common hour.

Engineering and Engineering Technology Annual Assessment

In academic year 2021, the Engineering and Technology Department conducted annual assessment for all programs within the department. The department's roadmap for a successful assessment and continuous improvement involved with 1) developing and distributing assessment documentations, 2) collecting and analyzing assessment data, 3) identifying shortcomings in student outcomes, and 4) introducing and implementing action plans for improvement.

Student Outcomes Assessment for Engineering Programs: For engineering programs, department uses an outcomes-based assessment process to determine its success in preparing students for entry into the profession. The student outcomes are those specified by the Engineering Accreditation Commission (EAC) of ABET, Inc. in the *Criteria for Accrediting Engineering Programs*. These outcomes are listed below:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Student Outcomes Assessment for Engineering Technology Programs: For engineering technology programs, department uses an outcomes-based assessment process to determine its success in preparing students for entry into the profession. The student outcomes are those specified by the Engineering Technology Accreditation Commission (ETAC) of ABET, Inc. in the *Criteria for Accrediting Engineering Technology Programs*. These outcomes are listed below:

1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems
2. An ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate of an engineering technology related system
3. An ability to communicate written, oral, and graphical in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature
4. An ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results.

- An ability to function effectively as a member as well as a leader on technical teams

The curriculum supports the attainment of the program outcomes through course offered within those programs (map of curriculum to student outcomes). Course content provides the material or develops the skill or knowledge necessary for the students to attain the program outcomes by the time of graduation. Some courses address multiple outcomes and multiple courses address some outcomes. This is necessary to ensure curricular coverage, consistency from year to year and a form of redundancy.

General Assessment Methodology: The Faculty Course Assessment Report, known as FCAR, is a tool that is used by the course instructor to assess the overall effectiveness of the course and is used primarily as a vehicle to improve the course. Recently, courses that assess specific student outcomes based on performance indicators using individual assignments, test problems, reports, etc., include those assessment results as part of the FCAR. A program wide scoring rubric is used to measure the attainment of each performance indicator using student performance and consequently the attainment of the prescribed student outcomes. The initial goal or threshold for percent of students meeting or exceeding expectations (a rubric score of 2 or better) is 70%. These results will form the basis for which evaluation of the results may motivate program improvements. The Assessment Committee will perform the evaluation of the assessment results and compile them into a report that demonstrates the degree to which students are attaining the Student Outcomes. This occurs in May/June with the report disseminated in July. The results of the assessment, together with other input, such as alumni surveys, exit surveys, internship surveys, employer surveys and suggestions emanating from the Industry Advisory Committee will be used to motivate program improvements.

The program faculty determined appropriate performance indicators and subsequently assessment tools for each outcome. As shown in table below, each outcome was subdivided into performance indicators (PI) to provide additional fidelity into the outcome with which the faculty can subsequently target improvement, should it be warranted. These tools were finalized and approved by the faculty. **Error! Reference source not found.**1 shows the performance indicators for each outcome. Table 2 shows the tools used to assess each outcome. With performance indicators defined, a scoring rubric was also devised for each PI by the program faculty. Course tasks and assignments are used as a direct measure to assess performance indicators of each specific outcome

Table1A: Performance Indicators for each Student Outcome for engineering programs

Student Outcome	Performance Indicator	
1. Ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics	PI-1A	Able to take a complex engineering problem and set up an approach to solve it
	PI-1B	Able to apply principles of engineering, science, math and solving complex engineering problems.
2. Ability to apply engineering design to produce solutions that	PI-2A	Understanding requirements
	PI-2B	Developing design space or conduct trade studies

meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	PI-2C	Applying design constraints, standards and other factors
	PI-2D	Obtaining an effective solution that satisfies the requirements
3. Ability to communicate effectively with a range of audiences	PI-3A	Possess good writing skills and organization
	PI-3B	Possess good oral presentation skills and effective data presentation format
	PI-3C	Informative and succinct content targeted to the intended audience
4. Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	PI-4A	Identifying relevant global, economic, environmental, societal issues when proposing an engineering solution
	PI-4B	Understands consequences of poor work quality or omissions
	PI-4C	Understands the potential consequences of unethical behavior
	PI-4D	Understands what to do if others exhibit unethical behavior
5. Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	PI-5A	Demonstrates ability to set goals and plan tasks
	PI-5B	Completes assigned tasks on time and with quality
	PI-5C	Open to other disciplines' issues and input and constructively participates in team meetings/discussions
	PI-5D	Supports team decision process and supports final decisions to meet objectives
6. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	PI-6A	Demonstrate knowledge of experimental approaches
	PI-6B	Demonstrate knowledge of data collection methods
	PI-6C	Has experience conducting experiments
	PI-6D	Demonstrate ability to analyze and interpret data using modern engineering tools and equipment
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	PI-7A	Demonstrate ability to acquire new knowledge and skills that are important to an engineer
	PI-7B	Can list ways to continue learning and maintaining currency in the field

Table1B: Performance Indicators for each Student Outcome for engineering Tech programs

Student Outcome	Performance Indicator	
Ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly-defined engineering problems	PI-1A	Able to take a broadly-defined engineering problem and set up an approach to solve it
	PI-1B	Able to apply principles of math, science, engineering & technology for solving broadly-defined problems.

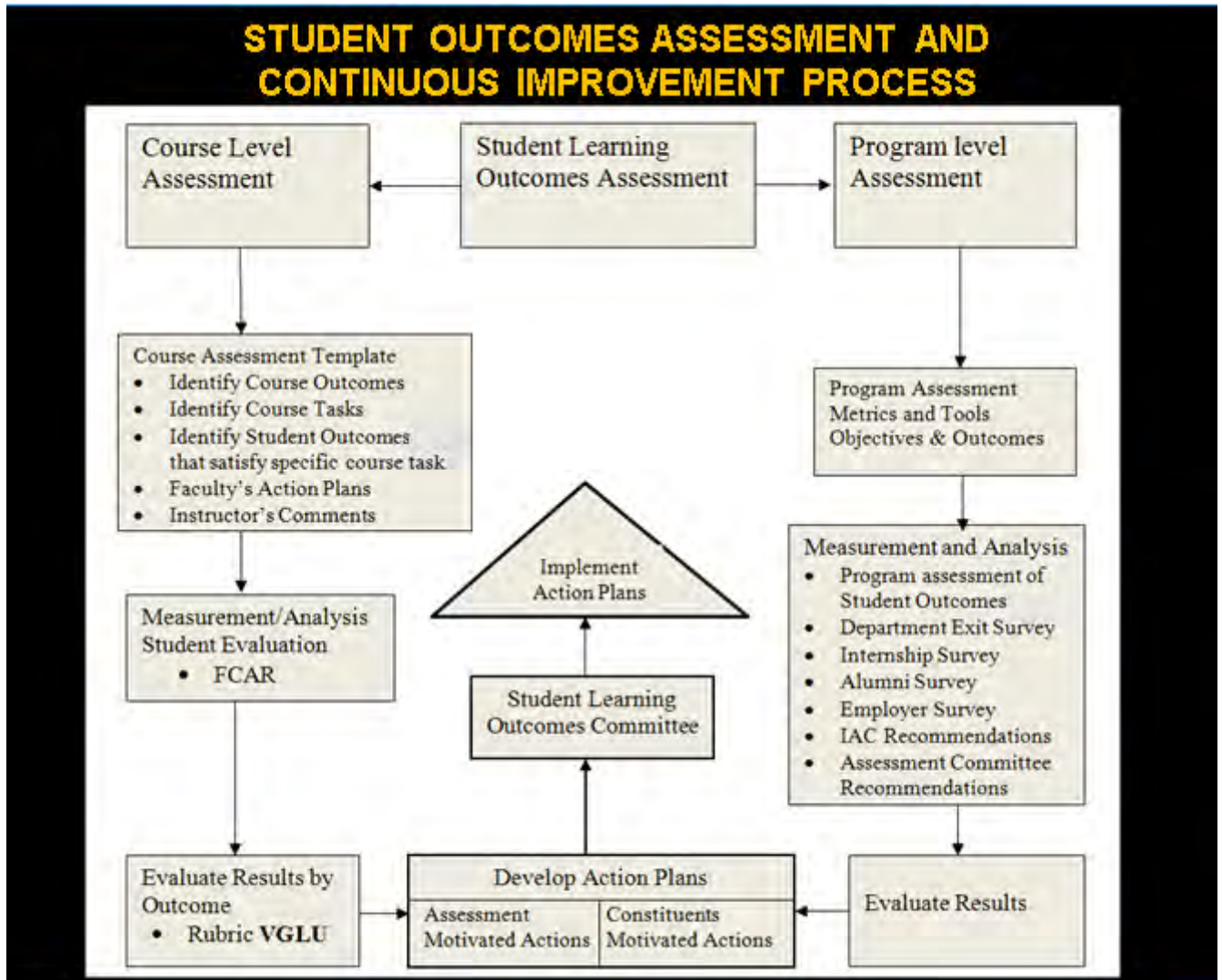
Ability to design systems, components, or processes meeting specified needs for broadly-defined engineering problems appropriate of electronics & avionics engineering technology related systems	PI-2A	Understanding requirements and apply design constraints, standards and other factors
	PI-2B	Obtaining an effective solution that satisfies the requirements and needs for broadly-defined engineering technology problems
Ability to communicate written, oral, and graphical in broadly-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature.	PI-3A	Possess good writing skills and organization
	PI-3B	Possess good oral presentation skills with effective data presentation and graphical illustrations format
	PI-3C	Understand and identify appropriate technical literature resources
Ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results	PI-4A	Demonstrate knowledge of experimental approaches and data collection methods
	PI-4B	Demonstrate ability to conduct experiment, analyze and interpret results
Ability to function effectively as a member as well as a leader on technical teams	PI-5A	Demonstrates ability to set goals, plan tasks, and complete assigned tasks on time and with quality
	PI-5B	Open to other disciplines' issues and input and constructively participates in team meetings/discussions
	PI-5C	Supports team decision process and supports final decisions to meet objectives

Table 2: Assessment Tools

<i>Assessment Tool</i>	<i>Student Outcome</i>						
	1	2	3	4	5	6	7
Student Work (Quiz, Exam, Project, etc)	X	X		X			X
Student Laboratory Reports			X		X	X	
Student Capstone Report and Presentations		X	X	X	X		X
Student Report			X	X	X		
Observation					X		
Simulation						X	

Continuous improvement: Our Continuous improvement process is based on both course and program level assessment. In course level, 3 to 4 higher level core courses are used to assess each student outcome based on assigned course tasks. In program level, questions from constituents' surveys are used to address attainment of each student outcome. The department collects course and program data, evaluates results, and develops assessment-motivated and constituent-motivated actions to address and improve any shortcoming through the program.

Student Outcomes Evaluation by Constituent Surveys: In constituents' table, department used results of questions from constituents' surveys (exit, alumni, internship, employer, and tech day) to measure attainment of each student outcome, and in continuous improvement column we discuss the results and develop necessary action plans, if the result is below our threshold for success.



Virtual STEM Day Presentation by Engineering Clubs

Thursday, March 4, 2021

11 am – 12 pm

Vaughn College
Engineering and Technology Department

Virtual STEM Day — A presentation by Engineering Clubs

Clubs	Presentation Topics
1. Robotics	Background
2. NASA Rover	Annual Professional Activities
3. UAV	A. STEM Workshops
4. NSBE	B. STEM Outreach
5. SHPE	C. Conference Participation, Presentations, Publications
6. SWE	D. Technical Competitions
	E. Career Fairs
	F. Accomplishments

K-12 Outreach
Each club member teaches things and answers questions that they request at schools, churches, or professional meetings.
Visit: To inspire students to Engineering with a primary focus on the science genre.

- Robotics Workshop: September 2018
- Event 1 Build & Workshop: November 2018
- Robot Outreach: December 2018
- Autonomous Car: January 2019
- Capstone Project: March 2019
- World Premier Car: March 2019

Date: Thursday, March 4, 2021
Time: 11:00 am—12:00 pm
Zoom ID: 992 4346 9900

On Thursday, March 4, 2021, the engineering department hosted its 2nd annual Virtual STEM Day. The department chair opened the session and thanked all the participants and especially the club leaders for their contribution to this virtual event. Professor Jesus, 3D/CNC curriculum designer and STEM Liaison, served as the moderator of this event. Professor Jesus started the session with his talk, “Why Join Clubs?”, and his presentation introduced audiences to professional skills, such as, communication, teamwork, safety, networking, and hands-on as well as other career building skills that one may benefit from, by joining a technical club or student chapter of a professional society.

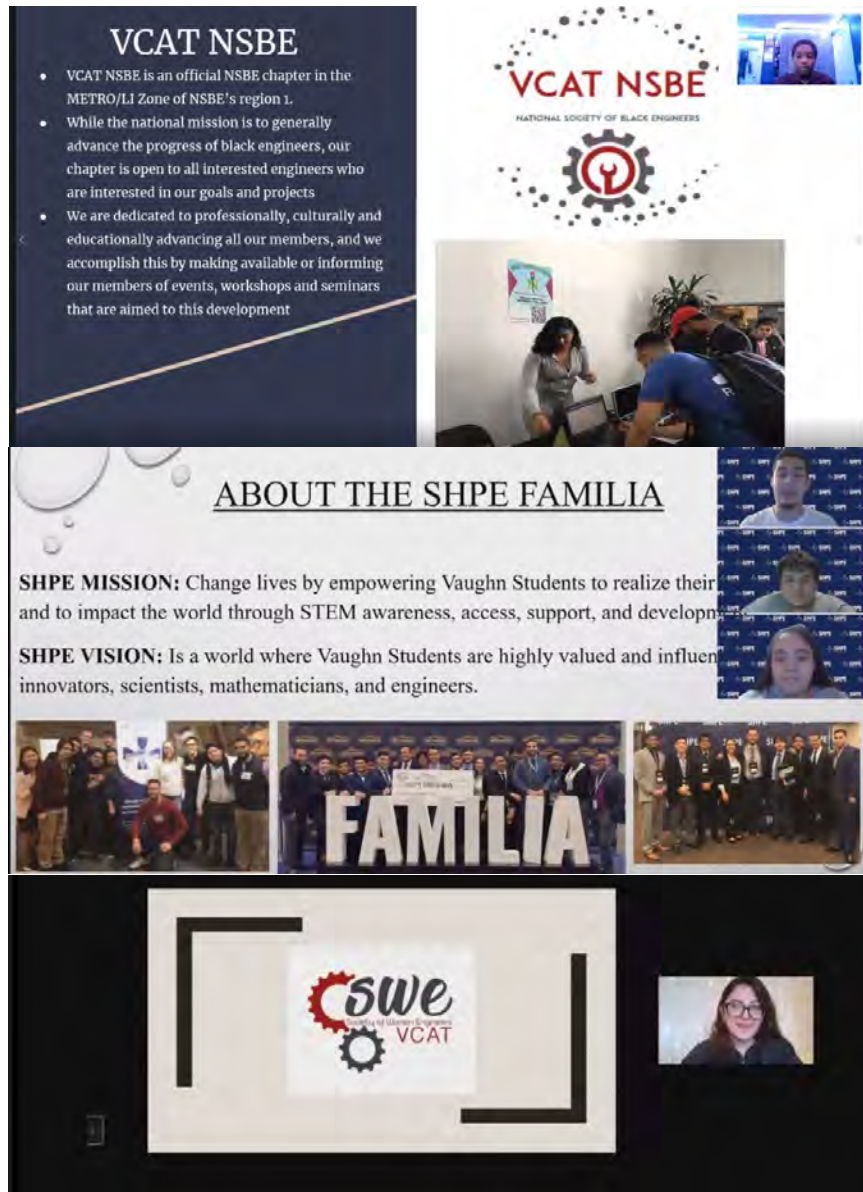
- Vaughn College Club Activities: Why Clubs?
- 1) Develop Soft Skills
- 2) Team Work
- 3) Networking
- 4) Skill Building In Safe Workplace
- 5) Use Skills Attained in Class

Participants visible in the Zoom grid: Hossain Rahemi, Mansel Jesus, Timothy Tullio, Rafacely Brito, Maxine Lubner.

After his introductory talk, Prof. Jesus introduced leaders of Vaughn's technical clubs and student chapters of professional societies (Robotics, NSBE, Rover, SHPE, SWE, and UAV) to address the Vaughn community with a presentation about their annual professional activities. During this virtual event, each club provided a detailed discussion of their activities as listed below

1. STEM Workshop
2. STEM Outreach
3. Involvement in Student Chapters of Professional Societies
4. Conference Participation, Presentations, and Publications
5. Technical Competitions
6. Accomplishments
7. Career Fairs





Virtual STEM Day Presentation by Engineering Clubs, March 4, 2021

In conclusion, Dr. Rahemi thanked all leaders of Vaughn’s technical clubs and student chapters of professional societies for their excellent presentation and encouraged all participating students to join Vaughn’s technical clubs and be involved in extra-curricular club activities. He emphasized how involvement in technical clubs and student chapters of professional societies further enhances hands-on, leadership, teamwork, and other career-building skills as well as leading to the cultivation of creative ideas. Involvement in these clubs introduces one to innovations in the STEM fields and provides professional networking opportunities with engineering industries. Finally, he expressed his sincere gratitude to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn’s students in STEM and professional development activities.



STEM Community Outreach: Annual Long Island Manufacturing Day, Friday, October 1, 2021

Prof. Manuel Jesus, Vaughn College faculty and 3D/CNC curriculum developer and STEM activity liaison, participated as a panelist at the Annual Long Island Virtual Manufacturing Day. This online event featured an innovative show floor interface that allowed students from local high schools to connect with colleges and explore course offerings in engineering related fields. A two-hour virtual trade show style atmosphere was used and when students entered the Vaughn College space they were shown a video showcasing Vaughn's engineering related programs and lab facilities. Later this engagement was followed by interaction with Vaughn staff in a one on one capacity to answer questions.

In the second part of the event a collection of local areas colleges such as NYIT, New York State Community Colleges, and Vaughn College were asked to do a presentation about their schools. The audience of this session was consisted of high schoolers and manufacturing employers. As part of the engagement process Vaughn College was connected with a great list of local manufacturers eager to offer employment to engineering and engineering technology college graduates.



STEM Community Outreach: VCAT Robotics at Thomas A. Edison High School December 10th, 2021



Seven members of Vaughn College engineering students with their faculty mentor traveled to Thomas A. Edison High School on December 10th, 2021 and presented various STEM related topics to middle school students. Vaughn College students Amanda Camacho, Daniel Doscher, Tatiana Jaimes, Christopher Walker, Rebecca Snyder, Cristian Sorto, and Misael Marquez split up into different groups, each with a 40-minute session with a group of students and presented various topics related to college experiences, competition experiences, robot experience, and finally a robot competition demo where the students were allowed to operate the robots under the team's supervision.

Tatiana Jaimes and Daniel Doscher gave an overview of this year's VEX Robotics Competition game, Tipping Point. After explaining the game to the students, basic controls of the robots were shown such that they were able to compete against one another. All students had the opportunity to be a part of the driving and strategizing portions of the matches. Each match was around 2 minutes long.



Christian Sorto and Christopher Walker talked to the students about the general field of robotics and the underlying details. They began the presentation by asking what the students knew about robots or if they had experiences with them. Afterwards, Cristian and Christopher talked about the process of creating competition ready robots, starting with the task or problem, moving to the brainstorming of ideas, comparing the ideas, then testing. From there, the two spoke about the necessity of analyzing a project for possible failures or improvements. They also emphasized the importance of teamwork and how a robot is an amalgamation of ideas. Afterwards, the middle school students discussed their ideas for their own designs and asked for advice as to how to best initialize a robot's programming.

Misael Marquez spoke about what goes on during a competition, primarily the teamwork required to complete tasks quickly. Different roles in the team were discussed such as those on the team's drive team, pit crew, and scouts. Misael then presented a few videos, explaining the different thoughts and possible options of the drive team during a match. In between matches, the pit crew and drive team fix any mechanical or software issues before the next match. Misael then emphasized the importance of strategy. While the team is fixing issues on the robot, scouts are watching the other matches to find a counter strategy for future matches.

Rebecca Snyder and Amanda Camacho were tasked with discussing college in general, college experiences, and how they can begin to learn different subjects through robotics that will benefit the middle school students in the future. They engaged in conversation with the students, asking them why they liked robotics, what they liked about it, and if they saw themselves doing this in the future. They then highlighted that Vaughn has a mechatronics program, but also other engineering programs like Mechanical and electrical. They asked questions about the Vaughn College robotics club, more specifically how the club is managed and degree projects.



STEM Community Outreach: Vaughn’s Robotics Team Assisted Freeport High School to host its Regional State Qualifier Robotics Competition on Saturday, February 5th 2022

On Saturday, February 5th, Freeport High School hosted its regional state qualifier robotics completion, and more than twenty-four regional high schools and middle schools participated in this competition. Six members of Vaughn’s robotics team, along with two faculty members, participated in assisting Freeport High School with this regional competition. The team was assigned the following tasks.



1. Dr. Shouling He served as a judge for the event
2. Maharshi Patel served as a head referee, called rule infractions.
3. Misael Marquez served as a score-keeping referee, recorded match scores
4. Christopher Walker served as a score-keeping referee, recorded match scores
5. Nicholas Bentancur served as skills field manager, ran the skills field
6. Rebecca Snyder served as a skills field manager, ran the skills field
7. John Sutera served as a tournament manager

During this regional completion, VCAT team members learned new skills to improve their robot designs. At the same time, they enjoyed serving the community to promote robotics education. The VCAT team is planning to host its regional VEX Qualifier Robotics Competition for high schools and middle schools on Saturday February 12 and VEX U competition on Sunday February 13, respectively.

The table below provides the list of award recipients for the 2022 regional High School and Middle School VEX Robotics State Qualifier Competition. An alliance of Overclock teams won the tournament championship, while a team from the Hewitt School won the Excellence Award, and Overclock won Design Award and Robot Skills Champions, respectively. “Excellence” Award, “Design” Award and “Robot Skills” Winners qualified to participate in the New York State VEX Championship.

Award	Team #	Team Name	Affiliation	Location
Excellence Award (VRC/VEXU/VAIC)	11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	16099B	Overclock	KG Computech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	16099A	Overclock	KG Computech	Flushing, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
Design Award (VRC/VEXU/VAIC)	16099C	Overclock	KG Computech	Flushing, New York, United States
Robot Skills Champion (VRC/VEXU)	16099B	Overclock	KG Computech	Flushing, New York, United States
Judges Award (VRC/VEXU/VAIC/RADC)	59968D	JFK Robotics D	JOHN F KENNEDY HIGH SCHOOL	Bellmore, New York, United States
Innovate Award (VRC/VEXU/VAIC)	38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
Amaze Award (VRC/VEXU/VAIC)	16699Y	Overclock MS	NY Youth Tech	Flushing, New York, United States

Community Outreach: Drone Awareness and Tiny Whoop Race, February 27, 2022



After Covid-19 had put a halt on everyone's life in 2020-2021, the Vaughn College UAV Team hosted its third annual "Community Outreach Drone Awareness and Tiny Whoop Race" event at the Cradle of Aviation Museum on February

27th. The event was free and opens to the community. Many drone hobbyists and FPV pilots, as well as the locals from the area, attended the event. All visitors had the opportunity to fly at the event. Some flew their own drone during the free fly period, or during the race of flying drones that the UAV club brought for the visitors. The UAV club also held a raffle for a hands-free drone, and many excited attendees took part. There were also prizes given to the winners of the races. The hobbyists, the FPV pilots and the Vaughn College students truly enjoyed having the opportunity to fly in the race at the Cradle of Aviation, while the younger children who attended the event had fun flying during the free fly period. The younger attendees also really enjoyed watching the Tiny Whoops go through the hoops and around the obstacles as the pilots raced each other. After the race, the attendees were able to free fly again, and many younger attendees enjoyed speaking to the pilots who took part in the race. The event was concluded by announcing the raffle winner and the winners of the race. This event provided the pilots with the opportunity to demonstrate their skills, and it allowed the community to learn more about drones by speaking to drone hobbyists and professionals, as well as to the Vaughn UAV team.





Community Outreach: Tiny Whoop Race at the Cradle of Aviation, February 27, 2022

Acknowledgement: We are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn's UAV students in STEM outreach and drone related professional activities.





Drone Day at Elementary School - PS110, Friday, March 4th, 2022

Aim

One of Vaughn College's missions is to prepare new generations for higher education in the field of engineering through outreach STEM activities (Science, Technology, Engineering and Mathematics). Through the presentation of workshops to young students, Vaughn College faculty aim to inform and teach students about STEM fields. Dr. Benbelkacem believes this mission needs to be introduced not only to high school and middle school students but also to younger students, in order to open their minds to engineering. This is how she initiated the project of coordinating with an elementary school (PS110, Brooklyn) for this educational purpose. On March 4th, 2022 "Drone Day" workshop was hosted by Vaughn College - UAV team supported by HSI-STEM and Vaughn College – CSTEP.



Workshop

The objective of Drone Day Workshop was to introduce students to drone basics, such as the types of drones, the rules for flying drones, and monitoring very small drones. The activity aimed to enrich 4th and 5th grader's STEM experience through fun and immersive activities which allow them to understand and experience drones as "systems". The workshop began with an introduction to drones and the rules to be followed when it comes to flying them. Then three activities were offered simultaneously:



- Drone Safety and Display: was an information session where kids learned the rules that apply to drones, and they received the opportunity to see and touch different types of drones and to ask questions.
- Drone Ride Along: was a demonstration session where a trained Vaughn College - UAV member rode a drone and the kids wore goggles to experience the virtual sense of flying.
- Drone Demos: was a hands-on experience session where kids used controllers to actually fly small drones safely. Another option was offered to fly a virtual drone (on a computer) using controllers.



Outcome

After these activities, a question/answer session was held to allow students to interact with UAV members and to ask more questions. 4th and 5th graders showed exceptional interest and attention to this process. They asked relevant and pertinent questions about drones and also about the engineering field in general. The kids exhibited excitement, curiosity, and satisfaction both verbally and in writing, and they handed in many thank you letters with creative drone drawings. Those letters will be displayed in the Vaughn College UAV room as a vestige of a successful STEM Workshop Day at Elementary school - PS110. Dr. Benbelkacem and UAV members were happy to offer the opportunity of a fun and immersive learning experience to possible future engineers.



Acknowledgement

We are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage students in STEM related scholarly and professional activities. In addition, we are thankful to the New York State - Education Department. Collegiate Science and Technology Entry Program grant (CSTEP – Vaughn College) which provided necessary funding support to engage students in STEM related scholarly and professional activities.

STEM Community Outreach: Vaughn College Co-Hosts “The SNY Tipping Point High School State Robotics Championship Event” on Saturday March 12th, 2022

Vaughn College, in partnership with Overclock Robotics and Coast to Coast Robotics, hosted the Southern New York VEX Robotics Competition High School State Championship Event on Saturday March 12th, 2022, at the Cradle of Aviation. This event was the first in-person state championship event since the start of the COVID-19 pandemic. Teams who competed at this event had to first receive an invitation through winning specific awards at regional qualifier events. A total of 57 regional high schools from Queens, Brooklyn, Bronx, Nassau, and other New York counties attended the 2022 State Championship at the Cradle of Aviation. The list of high school participants are as follows:



Team List

57 Teams

Team	Team Name	Organization	Location
1353N	Farmingdale Robotics	FARMINGDALE SENIOR HIGH SCHOOL	Farmingdale, New York, United States
1353V	Farmingdale Robotics	FARMINGDALE SENIOR HIGH SCHOOL	Farmingdale, New York, United States
1353Z	Farmingdale Robotics	FARMINGDALE SENIOR HIGH SCHOOL	Farmingdale, New York, United States
1569A	OMEGA	OMEGA Robotics	Great Neck, New York, United States
1569B	OMEGA	OMEGA Robotics	Great Neck, New York, United States
1808A	Red Devil Robotics	FREEPORT HIGH SCHOOL	Freeport, New York, United States
1808B	Red Devil Robotics	FREEPORT HIGH SCHOOL	Freeport, New York, United States
1808C	Red Devil Robotics	FREEPORT HIGH SCHOOL	Freeport, New York, United States
1808D	Red Devil Robotics	FREEPORT HIGH SCHOOL	Freeport, New York, United States
3362A	LWA Robotics Team 1	Lawrence Woodmere Academy	Woodmere, New York, United States
5059B	Quakers	FRIENDS ACADEMY	Locust Valley, New York, United States
6277A	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277B	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277C	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277D	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277E	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
8880A	Adelphi STEP	Adelphi University STEP Program	Garden City, New York, United States
8880B	Adelphi STEP	Adelphi University STEP Program	Garden City, New York, United States
9717A	St. Catharine Comets	ST CATHARINE ACADEMY	Bronx, New York, United States
9717B	St. Catharine Comets	ST CATHARINE ACADEMY	Bronx, New York, United States
11021G	OMEGA	OMEGA Robotics	Great Neck, New York, United States
11442W	Hewitt Robotics	The Hewitt School	New York, New York, United States
11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States

11442Y	Hewitt Robotics	The Hewitt School	NEW YORK, New York, United States
11442Z	Hewitt Robotics	The Hewitt School	New York, New York, United States
11566A	Calhoun Colts	SANFORD H CALHOUN HIGH SCHOOL	Merrick, New York, United States
11570A	Cyclones Robotics	SOUTH SIDE HIGH SCHOOL	Rockville Centre, New York, United States
11570B	Cyclones Robotics	SOUTH SIDE HIGH SCHOOL	Rockville Centre, New York, United States
16099A	Overclock	KG Computech	Flushing, New York, United States
16099B	Overclock	KG Computech	Flushing, New York, United States
16099C	Overclock	KG Computech	Flushing, New York, United States
19383B	NewRo Bots	NEW ROCHELLE HIGH SCHOOL	New Rochelle, New York, United States
19383C	NewRo Bots	NEW ROCHELLE HIGH SCHOOL	New Rochelle, New York, United States
19396A	Bayside Commodores	Bayside High School	BAYSIDE, New York, United States
21822A	WarriorBots	Our Lady Of Lourdes High School	Poughkeepsie, New York, United States
32563A	Port Jervis High School	PORT JERVIS SENIOR HIGH SCHOOL	Port Jervis, New York, United States
32563B	Port Jervis High School 2	PORT JERVIS SENIOR HIGH SCHOOL	Port Jervis, New York, United States
38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
38211B	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
41579A	El Redmen	East Islip High School	ISLIP TERRACE, New York, United States
55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
59968B	JFK Robotics B	John F Kennedy High School	BELLMORE, New York, United States
61311A	Titan Tech	HOLY TRINITY DIOCESAN HIGH SCHOOL	Hicksville, New York, United States
62880A	Real Steel	Coast 2 Coast Robotics	Bayside, New York, United States
66640A	Wildcats	RYE COUNTRY DAY SCHOOL	Rye, New York, United States
66640B	Wildcats	RYE COUNTRY DAY SCHOOL	Rye, New York, United States
68602B	GC Robots	Garden City High School Robotics Club	Garden City, New York, United States
77628A	Mephram Robotics C	WELLINGTON C MEPHAM HIGH SCHOOL	Bellmore, New York, United States
77628C	Mephram Robotics C	WELLINGTON C MEPHAM HIGH SCHOOL	Bellmore, New York, United States
78792E	Mount Academy Eagles E	The Mount Academy	Esopus, New York, United States
78792T	Mount Academy Eagles T	The Mount Academy	Esopus, New York, United States
97140A	Kennedy Gaels	Kennedy Catholic Preparatory School	Somers, New York, United States
97140B	Kennedy Gaels Too	Kennedy Catholic Preparatory School	Somers, New York, United States
97140C	Kennedy Gaels - La Mata	Kennedy Catholic Preparatory School	Somers, New York, United States
97871R	Roverines Robotics	NEWFIELD HIGH SCHOOL	Selden, New York, United States
99561A	Ambush	FALLSBURG JUNIOR SENIOR HIGH SCHOOL	Fallsburg, New York, United States
99561G	Dinos	FALLSBURG JUNIOR SENIOR HIGH SCHOOL	Fallsburg, New York, United States

Ryan Tang from Vaughn College was the Head Event Partner, Event Planner, and Manager. Members from the VCAT robotics team prepared and ran the event as referees, judges, and event staff. John Sutera was the event electronics manager, Misael Marquez, Sammuell Aremu, Christopher Walker, Kevin Gonzales were scorekeepers. Maharshi Patel was an Event Manager, Tatiana Jaimes, Cristian Sorto, Daniel Doscher, Amanda Camacho, Nicholas Bentancur, Jo Morales, and Rebecca Snyder made up the judging panel. Vaughn College alumni, Jason Becker and John Hernandez, were also part of the judging panel.

The two teams that won the tournament were two teams from Overclock of Flushing. The Tournament finalists consisted of another team from Overclock of Flushing and OMEGA from Great Neck. The excellence and skills awards were given to the two tournament champions. The

design award was given to Real Steel from Bayside. The innovate award was presented to a team from Farmingdale. The Judges award was given to the St. Catherine Comets from the Bronx. The Build Award was awarded to RoboCavs from the Harvey School in Katonah, New York. The Think award was given to Hewitt Robots from Manhattan. The Amaze Award was given to GC Robots from Garden City. The Create Award was given to Kennedy Gaels from Somers and the Inspire Award was given to Adelphi Step from Garden City. The following is a list of the awards given to the winning teams:

VEX Robotics Competition - SNY

Award	Team #	Team Name	Affiliation	Location
Excellence Award (VRC/VEXU/VAIC)	16099A	Overclock	KG Computech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	16099B	Overclock	KG Computech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	16099A	Overclock	KG Computech	Flushing, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	16099C	Overclock	KG Computech	Flushing, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	1569A	OMEGA	OMEGA Robotics	Great Neck, New York, United States
Design Award (VRC/VEXU/VAIC)	62880A	Real Steel	Coast 2 Coast Robotics	Bayside, New York, United States
Robot Skills Champion (VRC/VEXU)	16099B	Overclock	KG Computech	Flushing, New York, United States
Judges Award (VRC/VEXU/VAIC/RADC)	9717B	St. Catharine Comets	ST CATHARINE ACADEMY	Bronx, New York, United States
Innovate Award (VRC/VEXU/VAIC)	1353V	Farmingdale Robotics	FARMINGDALE SENIOR HIGH SCHOOL	Farmingdale, New York, United States
Think Award (VRC/VEXU/VAIC)	11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States
Amaze Award (VRC/VEXU/VAIC)	68602B	GC Robots	Garden City High School Robotics Club	Garden City, New York, United States
Build Award (VRC/VEXU/VAIC)	6277A	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
Create Award (VRC/VEXU/VAIC)	97140A	Kennedy Gaels	Kennedy Catholic Preparatory School	Somers, New York, United States
Inspire Award (VRC/VEXU/VAIC)	8880B	Adelphi STEP	Adelphi University STEP Program	Garden City, New York, United States

Below is the list of awards and whether they qualify for the World Championship. 10 Awards qualify for the World Championship, thus giving 10 Spots to teams.

Award	Qualifies for
Excellence Award (VRC/VEXU/VAIC)	World Championship
Tournament Champions (VRC/VEXU/VAIC)	World Championship
Tournament Finalists (VRC/VEXU/VAIC)	World Championship
Design Award (VRC/VEXU/VAIC)	World Championship
Robot Skills Champion (VRC/VEXU)	World Championship
Judges Award (VRC/VEXU/VAIC/RADC)	Does not qualify for any events.
Innovate Award (VRC/VEXU/VAIC)	World Championship
Think Award (VRC/VEXU/VAIC)	World Championship
Amaze Award (VRC/VEXU/VAIC)	World Championship
Build Award (VRC/VEXU/VAIC)	World Championship
Create Award (VRC/VEXU/VAIC)	World Championship
Inspire Award (VRC/VEXU/VAIC)	Does not qualify for any events.
Volunteer of the Year Award (VRC/VEXU/VAIC)	Does not qualify for any events.
Mentor of the Year Award (VRC/VEXU/VAIC)	Does not qualify for any events.



The SNY Tipping Point High School State Robotics Championship, Saturday March 12th, 2022

STEM Community Outreach: Vaughn College Co-Hosts “SNY Tipping Point Middle School State Robotics Championship” and “SNY Pitching In VEX IQ State Championship” on Sunday March 13th, 2022.

Vaughn College, in partnership with Overclock Robotics and Coast to Coast Robotics, hosted the Southern New York VRC Middle School and VEX IQ State Championship Events on Saturday March 13th, 2022, at the Cradle of Aviation. This event was the first in-person state championship event since the start of the COVID-19 pandemic. Teams who competed at this event had to first receive an invitation through winning specific awards at regional qualifier events. A total of 9 regional middle school teams from Queens, Brooklyn, Bronx, Nassau, and other New York counties attended the 2022 VRC State Championship at the Cradle of Aviation. The list of VRC middle school participants are as follows:



Team List

9 Teams

Team	Team Name	Organization	Location
955R	RNGesus	Play Ideas NY	New York, New York, United States
12357A	Infinite Robotics	Infinite Robotics	Jericho, New York, United States
15981A	Everts Engineers	D. R. Everts Library	Athens, New York, United States
16699Y	Overclock MS	NY Youth Tech	Flushing, New York, United States
47114A	VEXcellent Girls	North Shore Coding and Robotics Club	Great Neck, New York, United States
62880B	冰淇淋 (Bing Chi Ling)	Coast 2 Coast Robotics	Bayside, New York, United States
99561B	Starstruck	FALLSBURG JUNIOR SENIOR HIGH SCHOOL	Fallsburg, New York, United States
99588A	FlameX	PIA Tech League	Great Neck, New York, United States
99588X	Hyperion	PIA Tech League	Great Neck, New York, United States

In the VEX IQ Elementary and Middle School Blended State Championship event, there were 25 regional elementary and middle school teams from Queens, Brooklyn, Bronx, Nassau, and other New York counties. The list of VIQC elementary and middle school participants are as follows:

Team List

25 Teams

Team	Team Name	Organization	Location
1650A	Huntington Robotics	J TAYLOR FINLEY MIDDLE SCHOOL	Huntington, New York, United States
1650B	Huntington Robotics	J TAYLOR FINLEY MIDDLE SCHOOL	Huntington, New York, United States
1650C	Huntington Robotics	J TAYLOR FINLEY MIDDLE SCHOOL	Huntington, New York, United States
1876W	1876W Quakers	FRIENDS ACADEMY	Locust Valley, New York, United States
1876Z	1876Z Quakers	FRIENDS ACADEMY	Locust Valley, New York, United States
4755E	NMS Cyberian Tigers	NORTHPORT MIDDLE SCHOOL	Northport, New York, United States
6277X	6277X RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277Y	6277Y RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277Z	6277Z RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
11442A	Hewitt Robotics	THE HEWITT SCHOOL	New York, New York, United States
11442B	Hewitt Robotics	THE HEWITT SCHOOL	New York, New York, United States
20196A	Spiky Dinos	Northshore Coding and Robotics Club	Great Neck, New York, United States

37683A	Ram-botics	MERRICK AVENUE MIDDLE SCHOOL	Merrick, New York, United States
41854A	Tiger Tronics	EAST NORTHPORT MIDDLE SCHOOL	East Northport, New York, United States
61725A	Rom-botics	GRAND AVENUE MIDDLE SCHOOL	bellmore, New York, United States
65950A	Square Shaped Potatoes	Coast 2 Coast Robotics	BAYSIDE, New York, United States
78273A	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273B	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273C	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273D	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273E	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273F	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
78273G	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
84501A	Fallsburg Comets Team A	FALLSBURG JUNIOR SENIOR HIGH SCHOOL	FALLSBURG, New York, United States
92808A	Robo-Vengers	Community Robotics of Jericho	Jericho, New York, United States

Ryan Tang from Vaughn College was the Head Event Partner, Event Planner and Manager. Members from the VCAT robotics team prepared and ran the event as referees, judges, and event staff. John Sutura was the event electronics manager, Misael Marquez served as Head Referee, Christopher Walker, and Maharshi Patel as scorekeepers. Maharshi Patel was also an Event Manager, Tatiana Jaimes, Amanda Camacho, Nicholas Bentancur, Jo Morales, and Rebecca Snyder made up the judging panel. The following is a list of the awards given to the winning teams and the list of awards qualifying for the World Championship:

VRC MS:

VEX Robotics Competition - SNY

Award	Team #	Team Name	Affiliation	Location
Excellence Award (VRC/VEXU/VAIC)	16699Y	Overclock MS	NY Youth Tech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	16699Y	Overclock MS	NY Youth Tech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	62880B	冰淇淋 (Bing Chi Ling)	Coast 2 Coast Robotics	Bayside, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	99588A	FlameX	PIA Tech League	Great Neck, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	955R	RNGesus	Play Ideas NY	New York, New York, United States
Design Award (VRC/VEXU/VAIC)	62880B	冰淇淋 (Bing Chi Ling)	Coast 2 Coast Robotics	Bayside, New York, United States
Robot Skills Champion (VRC/VEXU)	62880B	冰淇淋 (Bing Chi Ling)	Coast 2 Coast Robotics	Bayside, New York, United States
Sportsmanship Award (VRC/VEXU/VAIC)	99561B	Starstruck	FALLSBURG JUNIOR SENIOR HIGH SCHOOL	Fallsburg, New York, United States

Awards

Award	Qualifies for
Excellence Award (VRC/VEXU/VAIC)	World Championship
Tournament Champions (VRC/VEXU/VAIC)	World Championship
Tournament Finalists (VRC/VEXU/VAIC)	Does not qualify for any events.
Design Award (VRC/VEXU/VAIC)	World Championship
Robot Skills Champion (VRC/VEXU)	Does not qualify for any events.
Sportsmanship Award (VRC/VEXU/VAIC)	Does not qualify for any events.

VIQC:

VEX IQ Challenge - SNY

Award	Team #	Team Name	Affiliation	Location
Excellence Award - Middle School (VIQC)	1876Z	1876Z Quakers	FRIENDS ACADEMY	Locust Valley, New York, United States
Excellence Award - Elementary School (VIQC)	78273B	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
Teamwork Champion Award (VIQC)	78273C	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
Teamwork Champion Award (VIQC)	20196A	Spiky Dinos	Northshore Coding and Robotics Club	Great Neck, New York, United States
Teamwork 2nd Place Award (VIQC)	6277Z	6277Z RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
Teamwork 2nd Place Award (VIQC)	78273A	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
Design Award (VIQC)	78273C	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States
Robot Skills Champion (VIQC)	20196A	Spiky Dinos	Northshore Coding and Robotics Club	Great Neck, New York, United States
Innovate Award (VIQC)	78273D	TechTitans	PS 124 OSMOND A CHURCH	South Ozone Park, New York, United States

Awards

Award	Qualifies for
Excellence Award - Middle School (VIQC)	World Championship
Excellence Award - Elementary School (VIQC)	World Championship
Teamwork Champion Award (VIQC)	World Championship
Teamwork 2nd Place Award (VIQC)	World Championship
Design Award (VIQC)	World Championship
Robot Skills Champion (VIQC)	World Championship
Innovate Award (VIQC)	World Championship



Teams During the Alliance Selection

Industry Connection Seminar Series National Drone Awareness Week, Sep 13-19, 2021

Thursday, September 16, 2021

11 a.m. to 12 p.m., both in-person (Rooms E101 & E103) and zoom Meeting

Presenters: Michael O’Shea, the UAS Program Manager with FAA
Yusuf Rafi, Vaughn’s UAV Club Secretary

Topic: Drone and UAV Safety Standards

On Thursday, September 16, the engineering department in collaboration with the Management department hosted a seminar to celebrate the National Drone Awareness Week. This seminar featured a presentation by UAV Club and FAA about Drone and UAV Safety Standards. Prof. Manuel Jesus, 3D/CNC curriculum designer, who served as the moderator of this event.

NATIONAL DRONE SAFETY AWARENESS WEEK
SEPT. 13-19, 2021
DRONESAFETYAWARENESSWEEK.COM

VaughnCollege
of aeronautics and technology
The Management and Engineering & Technology Departments
Present:

Thursday, September 16, 2021
11:00 a.m. to 12:00 p.m.

Room E101/103
OR
Join Zoom Meeting
<https://vaughn.zoom.us/j/88113424788?pwd=YVlnMGZjaHh0VnlnOHhmYWRR4ULUc4U109>

Meeting ID: 881 1342 4788
Passcode: 839596
Meeting ID: 881 1342 4788

Find your local number:
<https://vaughn.zoom.us/j/kb5q0YjmA7>

Professor Manuel Jesus will moderate
www.vaughn.edu

Unmanned Aerial Vehicle (UAV) Club
Vaughn College

Michael O’Shea
Program Manager
FAA Office of
Unmanned Aircraft
Systems (UAS)
Integration

Steven Jones
Deputy Regional
Administrator
Eastern Region
FAA

Federal Aviation Administration

Vaughn’s UAV club secretary, Yusuf Rafi started the event with a presentation that highlighted current club activities and past achievements, such as their 1st place award for Autonomous at the 2018 VFS Student Challenge Competition. UAV club students shared their findings on the topic of UAV safety, through their own experiences in drone operation, the Part 107 License, and best practices for UAV flight within the FAA restrictions.

2021 Activities

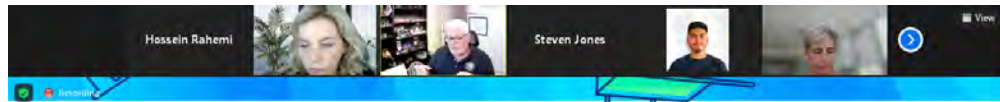
- + Competed AUVSI and VFS student design competitions
- + Due to covid-19 AUVSI was canceled and VFS was virtual
- + Vaughn was recognized for the compact design by Boeing at VFS Student design competition

How do you safely fly a drone?

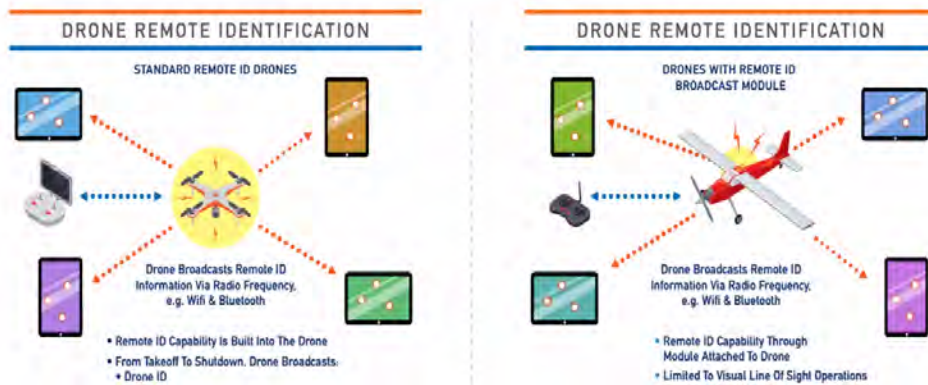
- + Line of Sight (LOS)
- + Spotter if doing First-Person-View (FPV)
- + Fly at or Below 400 feet
- + **NEVER** fly over people
- + **NEVER** fly near an airport
- + Verbalize what you are doing

Vertical Flight Society

Michael O’Shea, the UAS Program Manager with Federal Aviation Administration updated Vaughn community on drone safety mandates. Mr. O’Shea’s presentation showcased the FAA’s ongoing mission to provide the safest, most efficient aerospace system around the world. He gave an overview of the current UAS landscape with details such as there are a total of 1.6 million registered UAS flyers as of this year, and he also gave an update on remote ID compliance. Mr. O’Shea revealed that one of challenges he faces is getting commercial enterprises to approach the FAA from an airspace safety compliance mindset and to fully explain their airspace safety goals before running commercial UAS operations.



3 WAYS DRONE PILOTS CAN MEET REMOT



Throughout the presentation, various UAS safety topics were covered. Remote ID was covered in depth, and it was shared that UAS must attain operational compliance by September 16, 2023. Thankfully, current drone owners won’t have to purchase a new drone to attain compliance as most drones can be made compliant through manufacturer software updates. The remote ID system was shown to be a valuable part of the FAA regime that identifies drones in airspace and that broadcasts useful information including location, altitude, and drone velocity. Safety zones were highlighted via the FRIA system, where non-remote ID drones could fly, provided they were visible via line of sight within the FRIA zone. Drone Operation over people and vehicles was explained with strict mandates on drone weight and moving part restrictions to prevent injury to humans. Low Altitude Authorization Notification Capability (LAANC) was described as a method to restrict low altitude UAS into zones that prevent them from interfering with other aircraft flight operations. An emergency UAS flight authorization designated as The Special Governmental Interest system (SGI) was revealed as a method to allow first responders, law enforcement, and public utility firms quick authorization to respond to natural disasters and emergency situations.

Towards the end of the presentation, Mr. O’Shea stressed the importance of proactive compliance with FAA drone regulations, through rigorous review of local laws and use of tools such as the drone safety playbook and the B4UFLY app for recreational drone enthusiasts. As

the presentation drew to a close, a variety of resources and contacts were shared, so that folks can call or email program managers to gain valuable insight on FAA mandates. Both Michael and Steven graciously fielded questions from attendees, and they provided detailed answers. As a moderator, it was clear that we really could have continued the event another hour to field all the questions and concerns from students who seem determined to avoid any FAA violations and to enjoy the drones they love to create.



How do I Operate in Controlled Airspace? **Resources/Contacts**

What is LAANC?



UAS-Law Enforcement Overview Federal Aviation Administration 11

- **B4UFLY helps recreational flyers know where they can and cannot fly with interactive maps**
 - 2016: B4UFLY launched (FAA's first mobile app)
 - February 2019: FAA partnered with Kittyhawk to improve the B4UFLY user experience
 - July 31, 2019: The new B4UFLY app launched to the public



UAS-Law Enforcement Overview Federal Aviation Administration



Industry Connection Seminar – National Drone Awareness Week

Industry Connection Seminar

Thursday, February 17, 2022
11 a.m. to 12 p.m., A Zoom Virtual Seminar



Presenter: Mr. Carlo Asaro, Aircraft Avionics Systems Engineer with Sikorsky, a Lockheed Martin Company

Topic: Electronics Breadboard Hands-on Learning

Mr. Carlo Asaro, an Aircraft Avionics Systems Engineer, addressed the Vaughn community on Thursday, February 17 as part of the College's Industry Connection Seminar series. Mr. Asaro, has more than 30 years of experience in the industry in research and development, testing and evaluation of rotor-wing electronics with primary focus on power electronics and weapon systems. In this virtual seminar, Mr. Asaro presentation covered topics related to electronics breadboard design and hands-on learning.

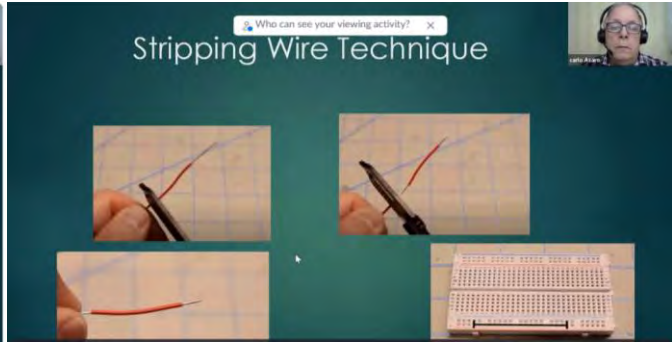
A banner for the Vaughn College Engineering and Technology Department Virtual Industry Connection Seminar Series. The banner has a black background with white and red text. On the right side, there is a small portrait of Mr. Carlo Asaro. Below the text, there is a photograph of an electronics breadboard with various components and jumper wires.

Vaughn College
Engineering and Technology Department
Virtual Industry Connection Seminar Series

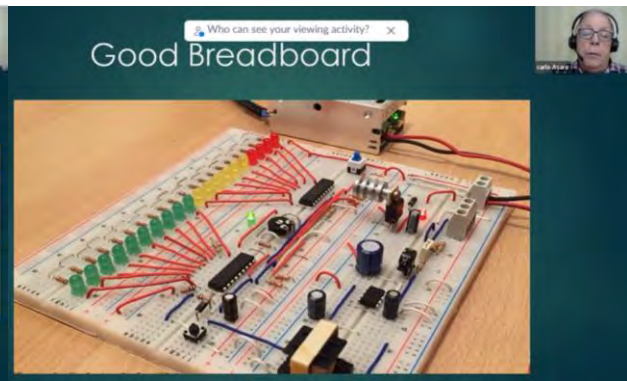
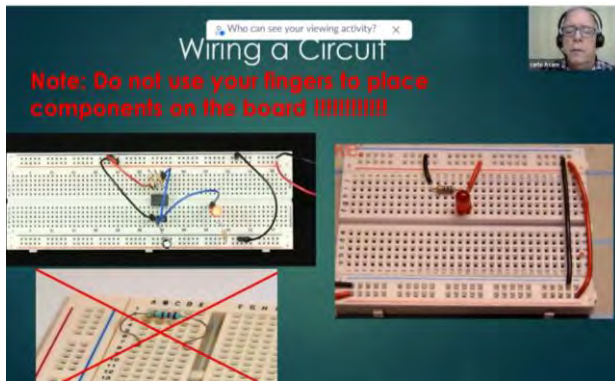
TOPIC: Electronics Breadboard Hands-on Learning
PRESENTER: Mr. Carlo Asaro, Senior Aircraft Electrical and Avionics Systems Engineer

Date: Thursday, February 17, 2022
Time: 11:00 am—12:00 pm
Zoom ID: 835 1469 1504
<https://vaughn.zoom.us/j/83514691504>

His presentation covered a few of the most important tools (wire stripper, wire cutter, etc.) required to do electronics work on a breadboard, wire types (22-gauge wire) to be used on a breadboard, kits for cutting wire insulation, and he explained that for a proper breadboard circuit design, it is a good practice to avoid usage of too many jumper wires that crowd the board visibility. This will help to keep the layout of the circuit clear, which makes it feasible to detect any possible error of design or assembly through a troubleshooting process.



Mr. Asaro continued to talk about breadboard schematic, measurement and stripping wire technique, process for proper circuit wiring, and testing to prevent damage to the board, and finally he talked about a good breadboard circuit lay-out design with proper wiring and visibility of all components' placement on the board.



At the conclusion of the presentation, the discussion was opened up for questions from students and faculty.

Engineering Seminar Series

Tuesday, December 7, 2021
11 a.m. to 12 a.m., Zoom Event

Presenters: Tatiana Jaimes, senior Mechatronic Engineering student and Alina Santander, senior Mechatronic Engineering student

Topics: An Overview of Summer Internship Programs with NASA and InstaHub

1) Osam-1: Servicing Satellite Mission 2) Solar and Datalogger

In this seminar, Tatiana and Alina, who participated in ten-week summer internship programs with NASA and InstaHub, addressed the Vaughn community about their summer internship programs and life-long learning experiences that they both gained through their projects.



The poster features the Vaughn College logo at the top center, flanked by the InstaHub logo on the left and the NASA Goddard Space Flight Center logo on the right. The main title is 'Engineering and Technology Department Engineering Seminar Series'. Below this is the seminar title 'An Overview of Summer Internship Programs with NASA and InstaHub'. The presenters are listed as Tatiana Jaimes and Alina Santander. The topics are '1) Osam-1: Servicing Satellite Mission' and '2) Solar and Datalogger'. The time is '11:00 am – 12:00 pm', the date is 'Tuesday, December 7, 2021', the Zoom Meeting ID is '853 7769 0399', and the URL is 'https://vaughn.zoom.us/j/85377690399'. Two photographs are included: one of a woman crouching next to a large NASA logo on a stone wall, and another of a woman standing next to a tall, slender rocket model outdoors.

Vaughn College
Engineering and Technology Department
Engineering Seminar Series

An Overview of Summer Internship Programs with NASA and InstaHub

Presenters: Tatiana Jaimes and Alina Santander
Topics: 1) Osam-1: Servicing Satellite Mission
2) Solar and Datalogger

Time: 11:00 am – 12:00 pm
Date: Tuesday, December 7, 2021
Zoom Meeting ID: 853 7769 0399
https://vaughn.zoom.us/j/85377690399

Tatiana Jaimes spoke of her summer internship at NASA where she worked on the Osam 1: Satellite Servicing Mission. This project centered around developing technology to service satellites in orbit, a crucial task to perform since the retirement of the manned space shuttle fleet and its unique ability to rendezvous with and service satellite hardware. Tatiana shared valuable insight into the internship application process and subsequent interviews conducted online. She stressed the importance of how a positive proactive approach helped her navigate the entire interview procedure. Participation in club activities, student associations, and conferences were key aspects that piqued NASA's interest. Tatiana was given a tour of NASA space flight facilities and assigned to the OSAM mission where she worked alongside engineering cohorts who not only valued her work but who sought her contributions on satellite hardware development tasks. Much of the work centered around CAD part development and although

CREO CAD Software was used by NASA, Tatiana was able to show resilience by switching over to a new program easily due to the training she received in Vaughn College courses related to SolidWorks and CATIA. At the end of the internship Tatiana felt great satisfaction in being credited for her work on the OSAM NASA mission. Most importantly she established a strong connection with NASA by “getting her foot in the door” of one of the most prestigious space agencies in the world and she looks forward to working with them again, but next time on a long-term professional basis.

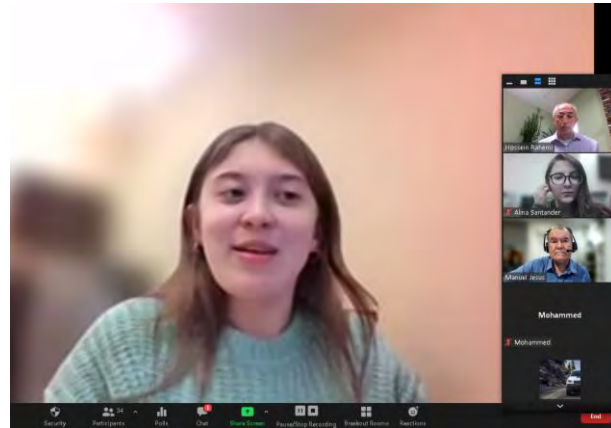


Tatiana

Position: Engineering Student Trainee

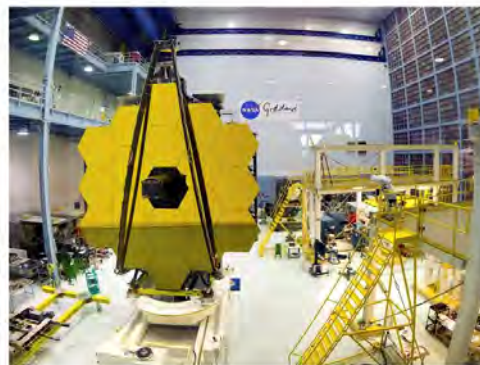
Branch: GSFC 544, Electromechanical System

Projects: OSAM-1, HDL



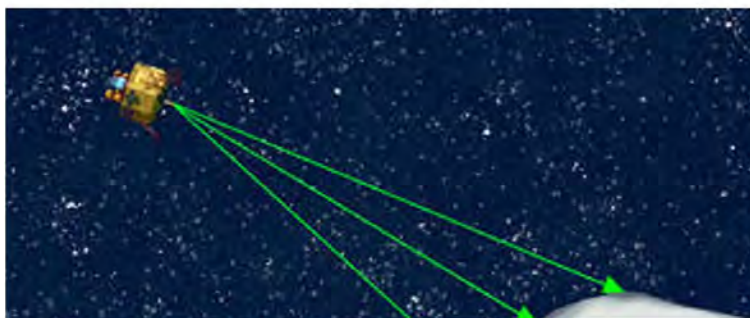
FACTS:

- NASA'S OLDEST SPACE FLIGHT COMPLEX
- HAS DEVELOPED MORE INSTRUMENTS FOR PLANETARY EXPLORATION THAN ANY OTHER ORGANIZATION

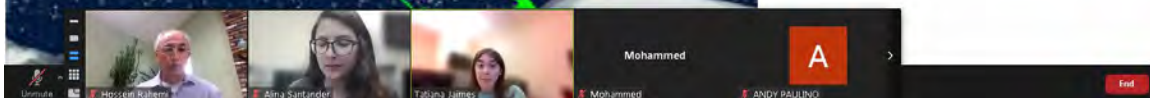


JAMES WEBB SPACE TELESCOPE

Responsibilities: HDL



Hazardous
Detection
Lidar



Alina Santander had the opportunity to spend the summer with InstaHub, a northeast US developer of building automation hardware solutions. InstaHub's two main products are Datalogger, a device used to measure environmental levels in the workplace for analytics, and SoLAR, a light measuring vacancy system. The work was conducted remotely but this did not diminish her engagement as Alina had direct feedback with the company CEO and student peer interns. The primary focus was on CAD work and programming language C++ coding to bring up some of the sensor hardware in InstaHUB projects. Again, Vaughn College students were able to draw on the CAD experience to easily switch to other CAD applications and function in the workplace due to their experience with club activities, additive manufacturing, and CAD part design and assembly creation course tasks.

Overview

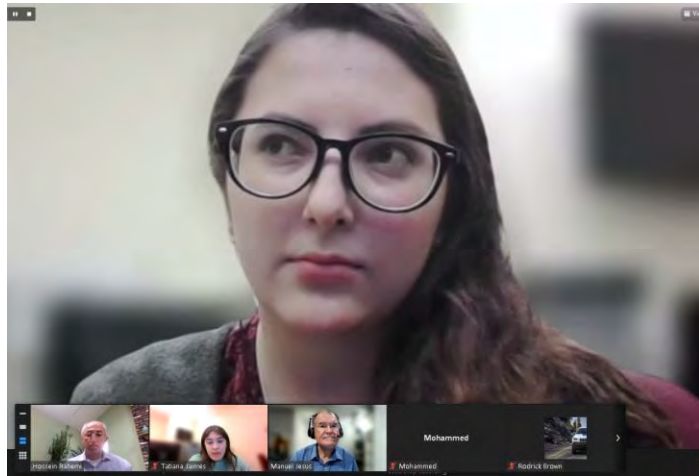


Alina

Position: Mechanical Engineering Intern

Branch: Mechanical Engineering

Projects: SoLAR, Datalogger



Responsibilities

DATALOGGER

WIRELESS TECHNOLOGY IMPLEMENTATION

The engineering department is extremely proud of these two high profile student accomplishments. We hope these examples of industry engagement inspire fellow students to take advantage of school industry connections in manufacturing technology for aerospace and industrial automation. Their presentation was followed with 15 minutes of open discussion.

Engineering Seminar Series

Thursday, Feb 24, 2022

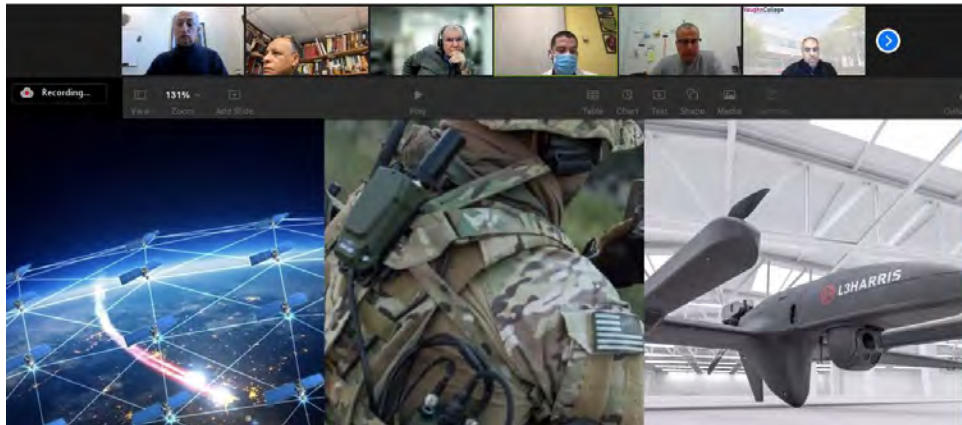
11 a.m. to 12 p.m., Zoom Event

Presenters: Eben Rockwell, a senior in Electronics Engineering Technology Program

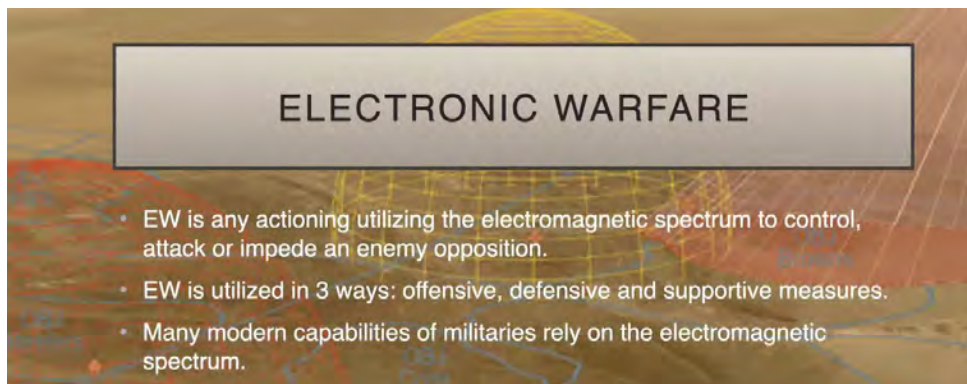
Topics: An Overview of Internship Programs with L3Harris

Project: F-18 super hornet counter measures system IDECM AN/ALQ-214

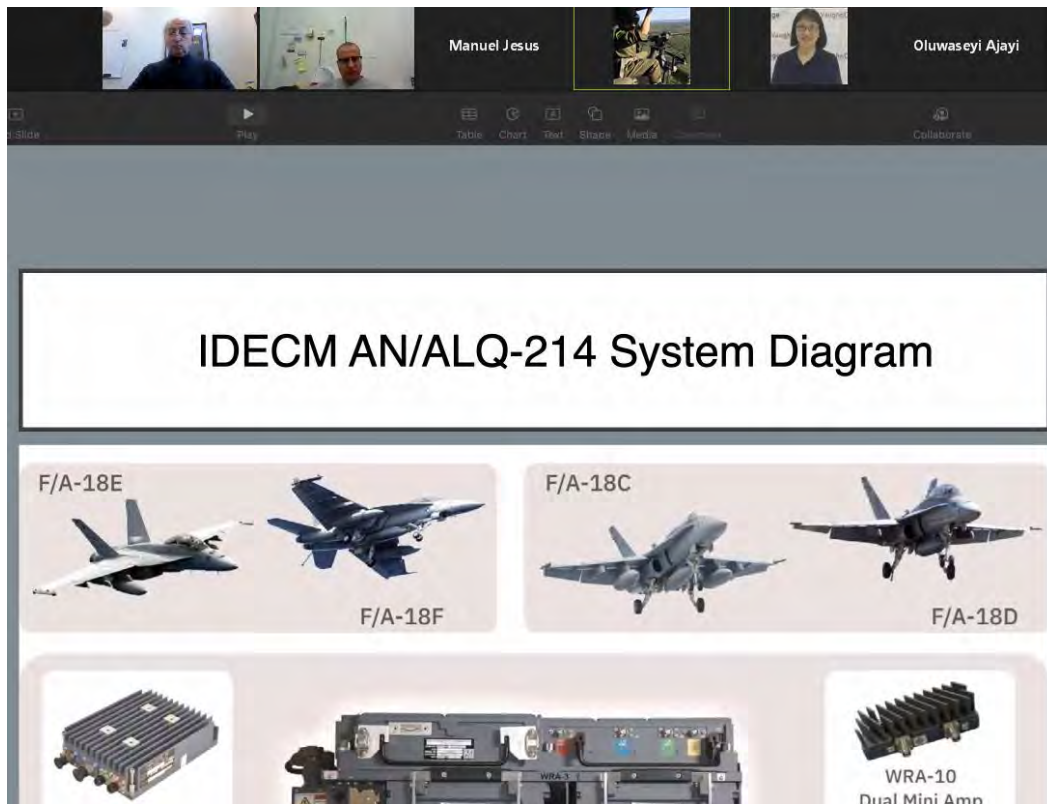
On Thursday, February 24th, Eben Rockwell, a senior student in the Electronics Engineering Technology program shared his experience as an intern at Level3 Harris Technologies. As part of this internship program, he was assigned the task of F-18 super hornet counter measures system IDECM AN/ALQ-214 which utilizes the electromagnetic spectrum to protect these aircraft from enemy threats. The IDECM's powerful suite of electronics offers safeguard from air to air and surface to air missiles. Despite strict security restrictions Eben was still able to offer an engaging overview of the project.



L3Harris (Harris Corp and L3 Technologies) emerged in 2019 to become a global leader and to provide far reaching security and communication systems for both the civilian and military aerospace fields. Eben expressed great satisfaction in his interactions with cohorts at L3Harris team. Eben spent much of his time in the Space and Airborne Systems division. This department creates electromagnetic spectrum situational awareness equipment for airborne and maritime countermeasures for electronic warfare systems. Electronic warfare systems operate in a variety of offensive, defensive, and support capacities to protect aircraft.



The IDECM system consists of a receiver, dual transmitter, and modulator. The receiver detects any enemy radar that attempts to lock onto the aircraft. The modulator will detect the EM spectrum band and frequency used to acquire the radar lock. The dual transmitter will then emit a jamming signal that works to confuse enemy radar locks with decoy radar signatures. All of these systems function in unison to protect the F-18 aircraft. Aspects of the inner electronics such as signal modulation, FPGA implementation, Digital System Processors, or programming details weren't shared to respect security concerns.



Eben revealed that courses related to digital electronics, avionics, radar systems and microprocessors helped him understand the coding languages and troubleshooting procedures used as standard at L3Harris every day. Lab work dealing with basic multimeter and oscilloscope functions prepared him for testing and troubleshooting.

At the end of the presentation, Eben spoke about how course content and delivery at Vaughn could focus on using current trade practices, industry trends, operating system versions, and testing software relevant to digital system design.

**Vaughn's 7th Annual Manufacturing Day,
Virtual Conference and STEM Workshops
October 29th 2021, 10 am to 1 pm**



Leadership Session of Manufacturing Day Conference – Presentation of Industry Leaders

The Engineering and Technology department hosted its 7th Annual Manufacturing Day Virtual-Zoom conference on Friday, October 29th from 10 am to 1 pm to celebrate National Manufacturing Day. Vaughn College invited six industry leaders to address invited guests and the Vaughn community about manufacturing innovation. The presentation featured a diverse variety of presenters in the field of manufacturing and topics such as biomedical manufacturing; Industry 4.0, robotics, 3D scanning, and reverse engineering were covered in 25-minute presentations followed by 5 minutes question-and-answer sessions.

Professor Manuel Jesus, 3D & CNC curriculum developer and STEM Activity Liaison, assisted the department chair and HSI-STEM project director with organizing and hosting the 7th Annual Manufacturing Day conference, and he also served as a moderator for this event. Dr. Sharon DeVivo, the School President opened the ceremony with introductory remarks citing the challenges of providing manufacturing education solutions to the Vaughn College Community of Students.

Our first presenter was Diogo Roquette Osorio who spoke about the challenges of producing surgical masks during the early days of the Covid-19 pandemic. As masks were in short supply local firms sought to fill in gaps throughout the supply chain. A local manufacturing automated production line was established to rapidly produce masks while maintaining ISO standards compliance. Challenges related to quality control and production capacity were covered such as material quality and troubleshooting assembly line mishaps. At the end of this rapid manufacturing journey, Diogo and his team were able to beat competing domestic mask suppliers' delivery to market by two years.



Jefferson Maldonado, a former Vaughn College student and Robotics Club President now manages the Robotics department as a Senior Robotics Engineer for ArcBect Technologies. He spoke about his professional robotics work managing industrial robots. Jefferson's presentation focused on Autonomous Mobile Robots and various robot deployment regimes for manufacturing and logistics. The progress of emerging technologies such as AMR (Autonomous Mobile Robots) and their advantages when compared to AGV (Automatic Guided Vehicles) were discussed in detail. Concerns such as path planning, cybersecurity, and efficient deployment were covered as part of Jefferson's informative presentation. At the end of the presentation Jefferson was keen to note how his employer is eager to hire new engineers for career opportunities in robotics development.

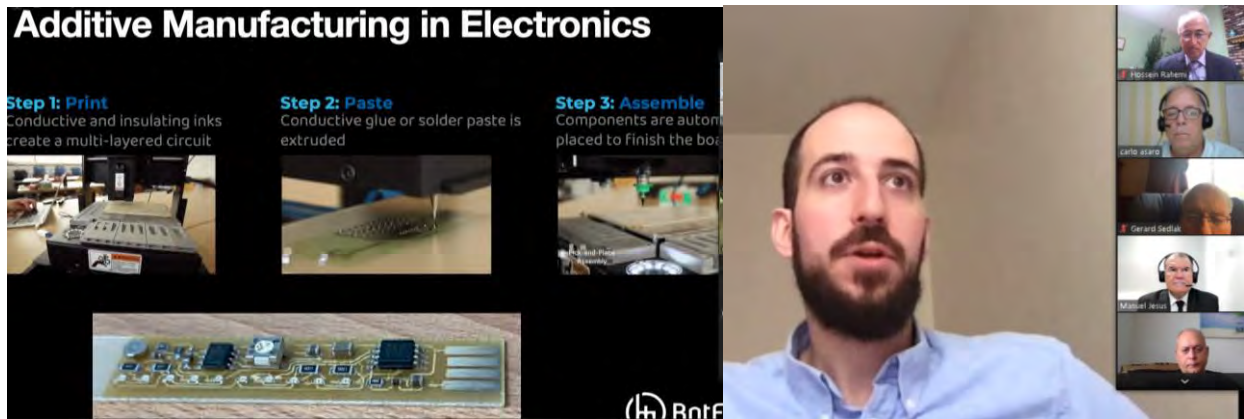


EMS technology 3D Scanning experts Christian Gerbick and Dan Mconnel presented on the topic of Metrology Grade Advanced 3D Scanners. An informative overview of scanning technology was shown followed by a demonstration of several high profile 3d scanning case studies in the military and consumer aerospace fields. Various high-end precision scanning technologies were covered from companies such as Creaform and Fargo. The scanners shown could scan a variety of objects from small tabletop objects up to full scale aircraft interiors and exteriors at high resolution.



Dr. George Kyriakou Cofounder and COO of BotFactory spoke about his extensive work developing AM for Electronics. His company produces circuit board 3D printers and he explained how this new aspect of the 3D printing landscape is changing the way PCB and electronics design is conducted. Unless a company has a board and chip fab capacity on site PCB related electronics development can take weeks to design and iterate. The use of his 3D PCB

printing technology allows fully functional prototypes to be developed in rapid sequence to speed up the design and iteration process before investing in test PCB's and prototyping for mass production. At the end of the presentation, the question of future innovations such as thinner board layers and higher printing resolution were discussed as prime innovations in this burgeoning field.

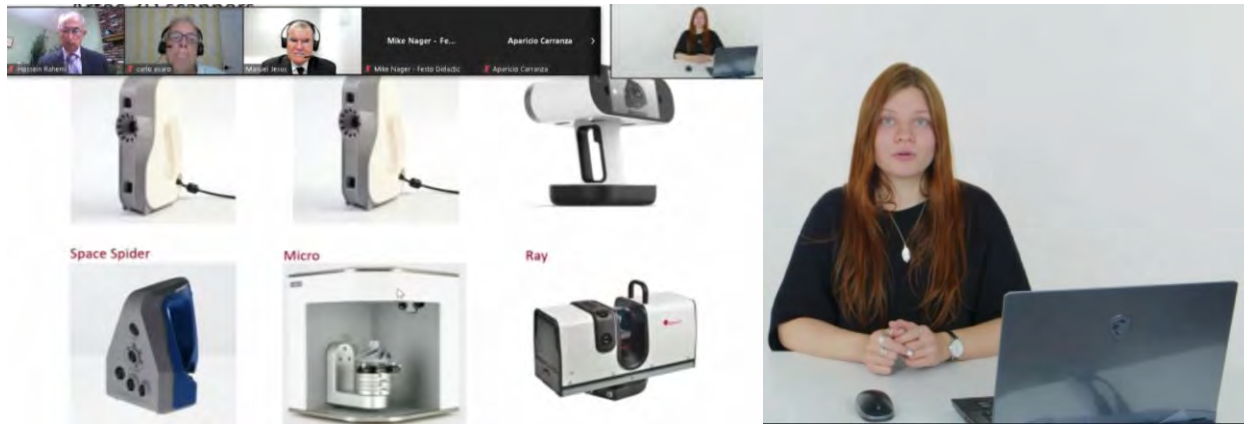


Mike Nager expanded on the topic of manufacturing innovation via his discussion of Cyber Security and Artificial Intelligence in Manufacturing. As an industry 4.0 expert he was uniquely positioned to deliver insight on the subject. He started off by identifying industry 4.0 manufacturing career opportunity roles such as collaborative robotics experts and lean engineers who leverage robotics and management experience to deliver solutions in modern manufacturing. In terms of cybersecurity, PLC devices and interconnected network devices were seen as a venerable attack surface in the industry 4.0 manufacturing infrastructure. Network security tactics such as DMZ, subnetting, and proper sub segmenting of networks were covered as methods to protect factory PLC's from attack. Moreover, a comprehensive curriculum and courseware training product has been developed by Festo to properly train engineers in manufacturing cybersecurity. It was made clear that the skills required to maintain secure manufacturing networks has grown beyond “on the job training” and requires a focused educational program to deliver results.



Lastly, Olesya Kopteva continued with the topic of 3D Scanning with her presentation on Artec 3D Scanner hardware such as the new Space Spider and Eva range of scanners. Artec scanners feature high quality and comparative low cost with best-in-class 3D scanning technology for the education and engineering design markets. Post processing of 3D scans was

presented, and Scan Studio 16 was shown as an asset in post processing 3D scans for consumer, medical, reverse engineering, and entertainment computer graphic industries. New innovations such as easier high-resolution scanning and photogrammetry cement Artec's position as a market leader. Vaughn College has successfully used their products since 2015 for student work in club activities, technology presentations, degree projects, outreach activities, and course offerings. Through this engagement with Artec, Vaughn College can respect its commitment to technology in engineering and design related education.



In conclusion, Dr. Rahemi, expressed his sincere gratitude to all guest speakers, industry advisory members, and invited guests for their participation at Vaughn's 7th annual manufacturing day conference, as well as for their continuous support in every aspect of the department and institution. Dr. Rahemi expressed his gratitude for the support provided by the Department of Education federal fund as part of Title III, HSI-STEM and Articulation grant.

STEM Outreach Workshops



HSI-STEM
SCIENCE - TECHNOLOGY
ENGINEERING - MATH



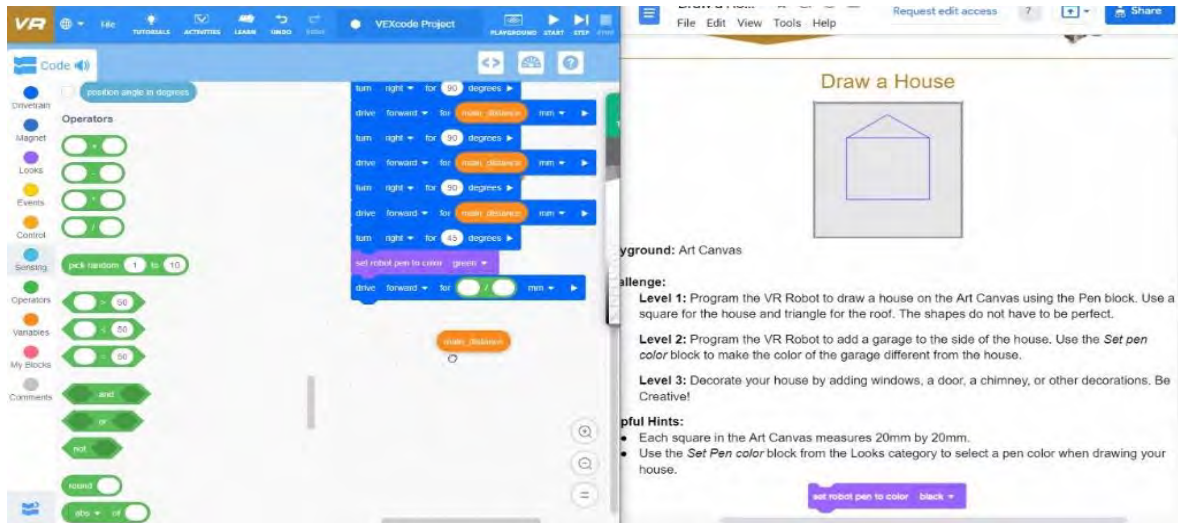
In a parallel session, from 10 am to 12:00 pm, Vaughn's UAV, Robotics, and SHPE clubs organized and hosted STEM workshops for the high school students. These workshops covered the following topics:

1. Robotics Workshop - Robotics design & programming
2. UAV Workshop - An informational session about the basics of drones control system and the PCB board

Robotics Workshop Session

The robotics workshop section was focused on the concept of computer programming using a free browser-based program called Vex Virtual Reality (VR) which simulates real robots in a virtual environment. The coding language used is python but for this workshop a block-based variant was used to lower the barrier of entry to programming, with the participants having a chance to use text-based python. This Vex VR programming workshop session not only provided participants with learning and necessary resources but also provided them proper direction and the tools to

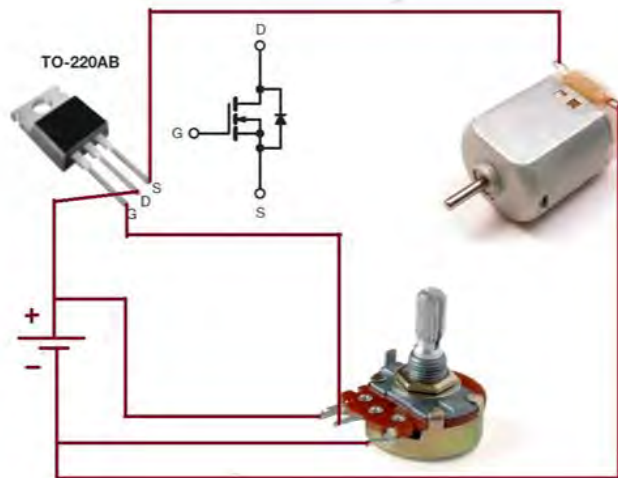
continue to learn and explore in the robotics ecosystem.



Daniel Doscher demonstrating Robotics Engineering Design Process

UAV Workshop Session

Vaughn's UAV Team workshop showcased what the team works on throughout the year leading up to their competitions. The workshop consisted of a potentiometer to control the speed of the motor. The connection diagram shown demonstrates how the motor is connected using a PCB board. The potentiometer is a three-terminal resistor with a rotating contact that allows for gradual increase on the rpm of the motor. In the real world, our team uses ESC to simulate what the potentiometer does. Just like the potentiometer the ESC sends signals to the motors, it is connected in the form of pings and through this it tells the motor to turn at a given revolution. Furthermore, the PCB board serves as a power distribution board that allows all the instruments to have power to work.



Vaughn's STEM Day Virtual Workshop April 8, 2022, 10 am to 12 pm

The engineering and technology department hosted its third Annual STEM Day virtual workshop event for community colleges and high schools students on Friday, April 8.


This virtual event introduced participants to the following STEM related activities:

- **Welcome:** A presentation of Vaughn College's program offerings and student involvement in professional and scholarly activities.
- **Makerspace and CNC Video Tour:** In this session participants were introduced to a virtual tour of Vaughn's 3D Makerspace and CNC centers as well as their usage and hands-on application in STEM related programs.
- **3D Scanning Workshop:** In this session participants were introduced to reverse engineering parts from 3D Scan data using CATIA.
- **CAM and CNC Workshop:** Participants were introduced to HASS VF-2SS CNC and cutting machine, Okuma lathe machine, Coordinate Measuring Machine (CMM), and manufacturing processes. For this session, STEM liaison showed a video of a part development and details of manufacturing process using CNC milling, lathe, and CMM.
- **Virtual Reality:** In this session, participants were introduced to the world of Virtual Reality (VR) and simulations. For this session, participants learned about the VR usage and application by Vaughn's UAV club, and the institution plan is to further expand and include VR application as part of Vaughn's NYSED approved UAS certificate program.
- **Student STEM Engagement:** There was an introduction to student engagement in technical clubs, competitions, conference participation, presentation and publications. For this session, participants were introduced to a presentation by Vaughn's NSBE, SHPE, and SWE clubs.

Vaughn College
Engineering and Technology Department
4th Annual STEM Day Workshops

Agenda
Department's STEM Presentation Session
A Virtual Event, Zoom ID: 833 4107 6282

April 8, 2022
10:00 am to 12:00 pm







3D Printing and Additive Manufacturing
Using CAD applications to develop parts for 3D printing.

DESIGN FOR AM

1. Generative Shape Design
2. Part Consolidation
3. Hole Positioning
4. Exploit Material options
5. Complexity for "free"



Virtual Reality: Explore the world of Virtual Reality (VR) for entertainments and simulations.

Makerspace and CNC Lab Video tours—Introducing participants to Vaughn's Makerspace and CNC Lab

3D Printing and Additive Manufacturing Workshop: Using CAD applications to develop parts for 3D printing.

3D Scanning: Reverse engineering parts from 3D Scan data using CATIA

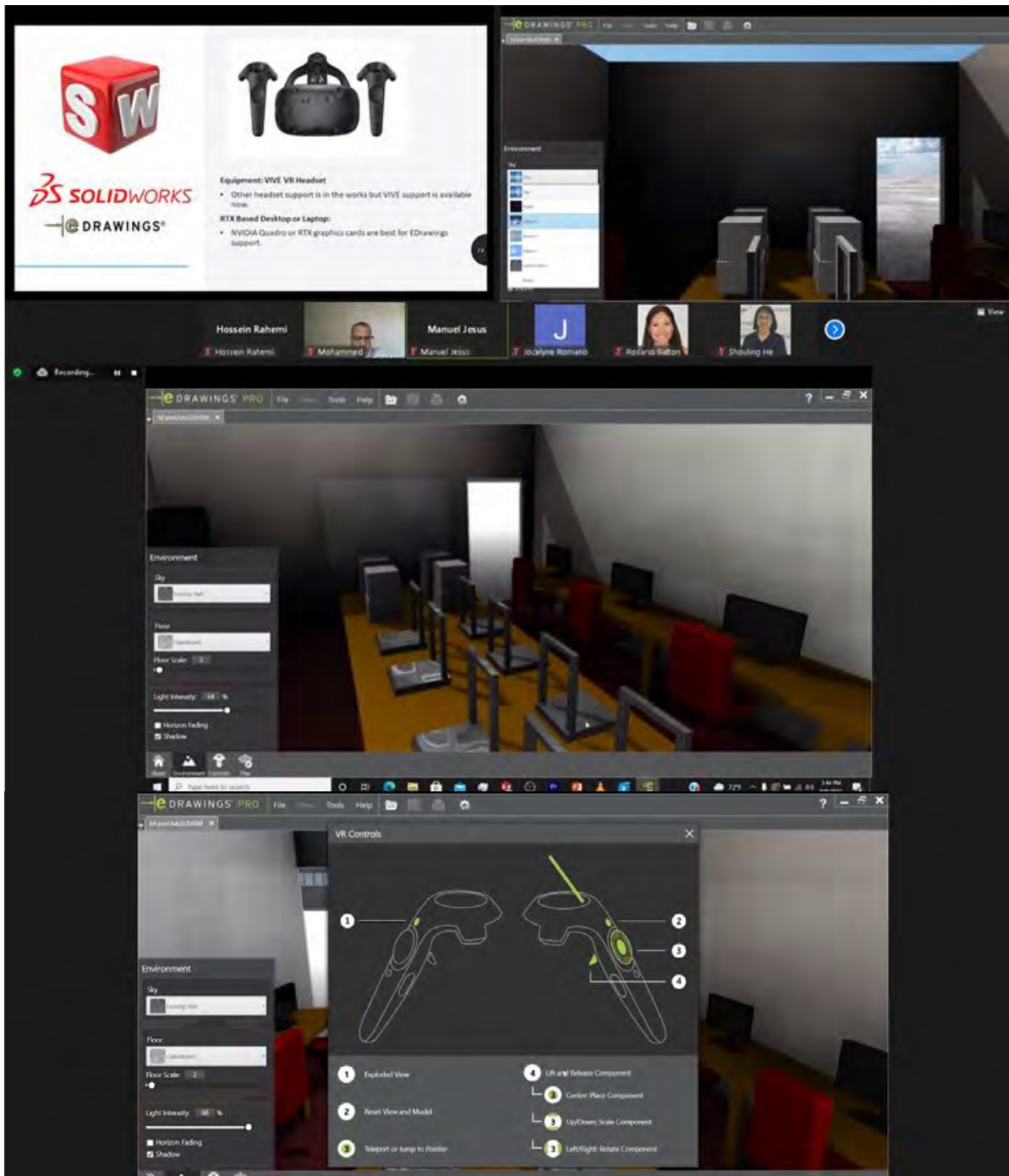
CAM and CNC Workshop: An introduction to HASS VF-2SS CNC milling and manufacturing process. Develop a part for CNC milling.

Robotics and UAV Clubs Workshop Session
Zoom ID: 721 261 4601 Passcode: 1234

- 1) Robotics Workshop—Robot Programming
- 2) UAV Workshop: Drone Safety and Circuit Development

The participants of Vaughn's STEM Day virtual workshop event were students and faculty from Vaughn College, Passaic County Community College, Queensborough Community College,

Aviation High, and Thomas Edison high school. For this virtual event, Vaughn’s STEM Liaison and 3D/CNC curriculum developer, Prof. Manuel Jesus, introduced participants to Vaughn College’s program offerings in engineering and engineering technology disciplines, as well as to student involvement in various STEM related clubs and professional activities. Prof. Jesus provided participants with a video tour of Vaughn’s 3D Makerspace and CNC manufacturing centers. Finally, he organized and hosted couple of virtual STEM workshops related to 3D Scanning, CAM and CNC, and Virtual Reality.



Virtual Reality Workshop

3D Printing and CNC Manufacturing Tours: For this virtual event session, Prof. Jesus provided audiences with a video tour of Vaughn’s manufacturing centers, and through this video tour, he discussed these centers are used by Vaughn’s students and faculty to design and manufacture parts and components for their class and capstone design projects. He explained how these centers are actively used by Vaughn’s clubs’ students to manufacture parts for their robots, drone, and rover projects. Finally, he emphasized that the engineering department, with assistance of manufacturing Lab Techs, uses these centers to host STEM workshops for community colleges and high schools students during Vaughn’s Annual Manufacturing Day, Annual STEM Day, and Vaughn’s International Drone Day.

Creality3D LD-002R
UV Resin LCD 3D Printer

UV LIGHT CURED RESIN AM

- 1) CAD Part Development, CATIA, SolidWorks, 3ds Max, Maya.
- 2) Export to .stl, fix file errors, and slice.
- 3) Prepare printer.
- 4) Load .STL file into printer.
- 5) Print part and monitor first layers.
- 6) Support removal and post processing.

3D Printing and Additive Manufacturing
Vat Photopolymerization, Creality LD-002R

3D Printing and Additive Manufacturing
Using CAD applications to develop parts for 3D printing

CAD PART DEVELOPMENT FOR ADDITIVE MANUFACTURING 1

DESIGN FOR AM

1. Generative Shape Design
2. Part Consolidation
3. Hole Positioning
4. Exploit Material options
5. Complexity for "free".

3D Printing and Additive Manufacturing
Using CAD applications to develop parts for 3D printing.

DESIGN FOR AM

1. Generative Shape Design
2. Part Consolidation
3. Hole Positioning
4. Exploit Material options
5. Complexity for "free".

3D Printing and Additive Manufacturing Workshop



CNC and 3D Scanning Workshop

Student STEM Engagement and Technical Clubs Presentations: Vaughn’s SWE, NSBE, and SHPE Club leaders talked about their experiences and after-class involvement in professional clubs and technical competitions, as well as their conference participation, presentations, publications, and accomplishments in STEM fields. They emphasized how involvement in technical competitions, student chapters of professional societies, and conferences helps them to get several internship offers, as well as full-time positions with well-known engineering companies.

National and Regional Conferences

NSBE primarily has two conferences:

- Fall Regional Conference: Respective regions hold these conferences
- Spring National Conference: All regions in the country come together for this.

In both conferences, a number of professional development workshops are held and Career fairs as well. Members in good standing are funded by the college to attend these conferences

Presented by:
Vaughn College National Society of Black Engineers Chapter

SHPE COMPETITION OPPORTUNITIES

Nissan Design, Extreme Engineering Competition & Innovation Challenge



SWE Conference 2021 success summary



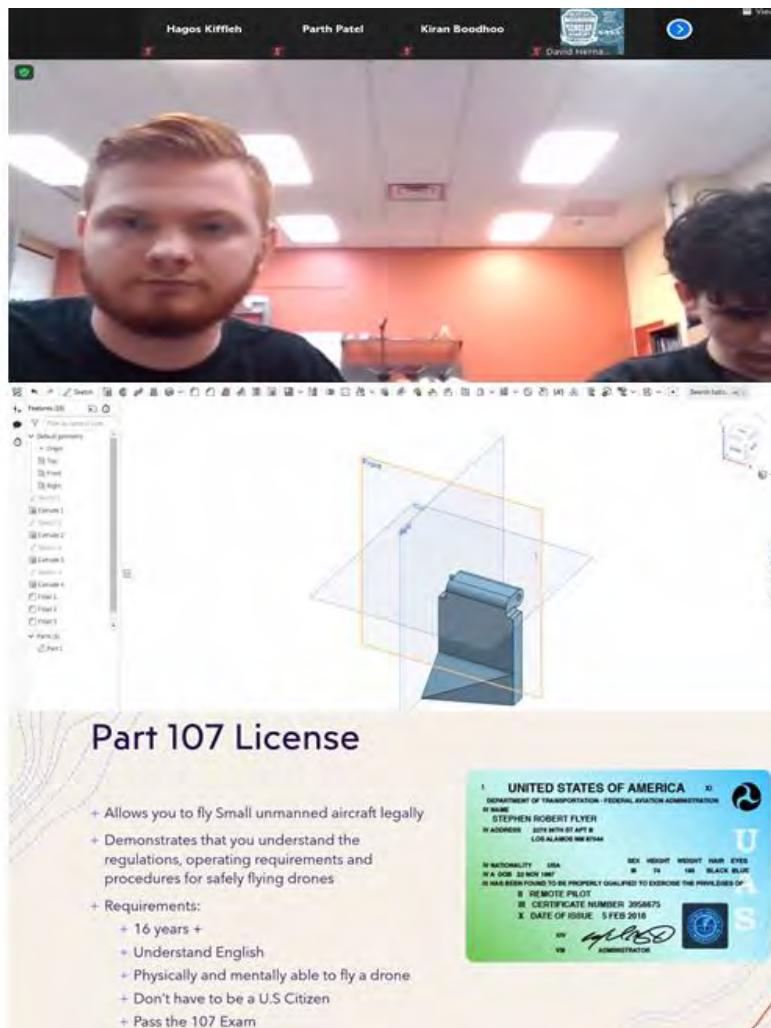
Company	Offers
Northrop Grumman	1
Honeywell	2
Carrier	3
OTIS Elevators	1
Corning	1
Daimler Trucks of North America	1
Trane	1
Collins Aerospace	1

NSBE, SHPE, and SWE Presentation

STEM Outreach Workshops

In a parallel session, from 10 am to 12:00 pm, Vaughn's Robotics and UAV clubs organized and hosted STEM workshops for students. These workshops covered the following topics:

- **Robotics Workshop:** The workshop introduced participants to embedded C Programming through the VEX Robotics VEXCode Platform. The Vaughn College Robotics team presented the basics in developing a program code using the competition template required for the VEX Robotics Competition. Students in the program learned about declaring variables, creating functions, and the layout of the competition template. This Hands-on workshop provided students with the opportunity to program alongside the instructors.
- **UAV Workshop:** The workshop introduced students to what are drones and the different types of drones that are used. Furthermore, the UAV team talked about the applications of drones in solving modern day problems and the benefits of UAS systems. The UAV team also presented the concepts of how drone systems work with the hands-on development of a motor controller using the TinkerCAD circuits' software.



Robotics and UAV Virtual Workshop

Also, from 10 am to 12 pm, 10 students and faculty mentor from Thomas Edison High school, attended for an in-person Robotics and UAV workshop session.



In-person Robotics and UAV Workshop Session

Acknowledgement: In conclusion, Dr. Rahemi thanked all partner institutions for their participation, and he expressed his sincere gratitude to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support for laboratory development to engage students in manufacturing hands-on activities that are current with today's industry standards.



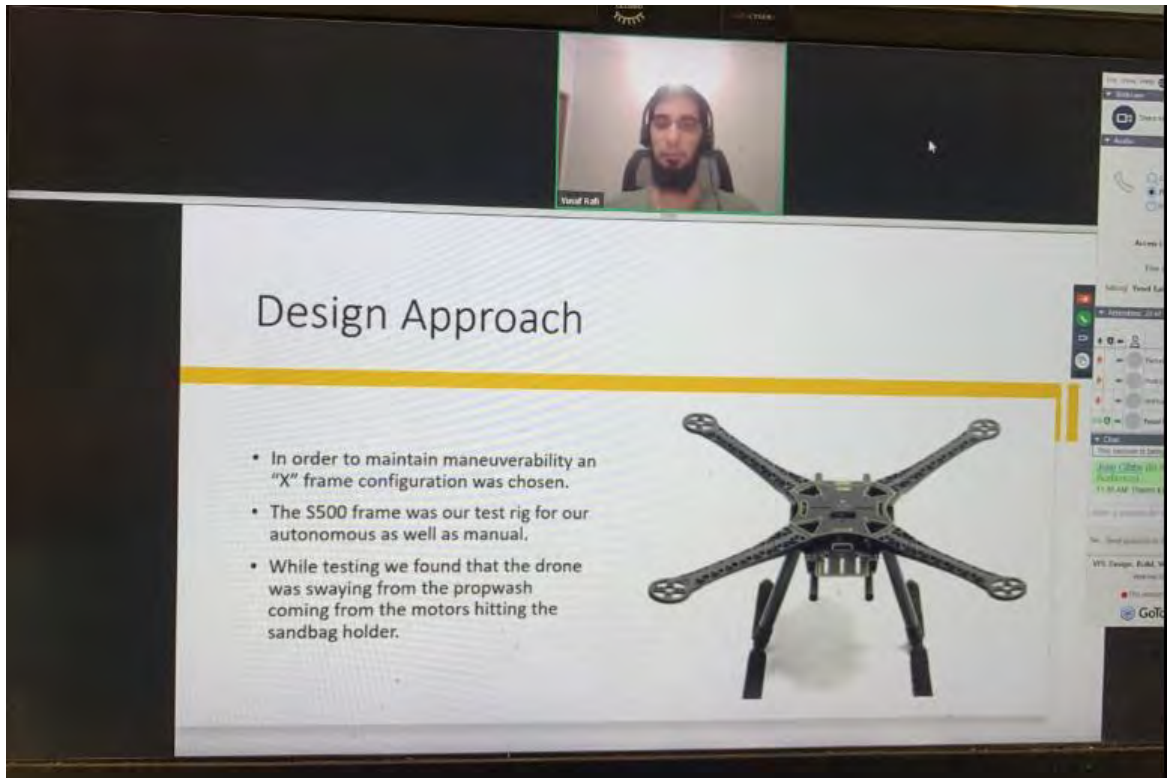
Vaughn's UAV team participated in the Vertical Flight Society Virtual Design-Build-Vertical Flight Competition, April 16, 2021

Vaughn's UAV team project was selected as one of the finalists along with Penn State, Ohio State, Oregon State, University of Michigan, and University of Maryland to participate in the Design-Build-Vertical Flight Competition in Graces Quarters Army Test Site, Maryland. Vaughn's UAV Team developed a drone to compete in both the manual and autonomous categories. The drone was designed to perform vertical takeoff & landing (VTOL) with onboard flight-stabilization and camera. The drone's weight was less than 2lbs fully built and had a lift capacity of 12lbs. The drone successfully flew through an obstacle course while avoiding objects and having 10lbs of payload onboard. Vaughn's drones are designed to be lightweight and compact, while not sacrificing their autonomous, computational, and flying control.

For both the autonomous and manual challenges, a drone with a pre-determined package will take off from a base station, move through an obstacle course, and execute three vertical takeoffs and landings for the maneuverability course. For the flight duration, the drone will take off and fly a course as many times as it can before having to land due to low power. This tests the drone's endurance as well as range capabilities. Among all participating teams, Vaughn College was recognized by Boeing for having a compact design and being able to have a great lift capacity with the given design. Boeing was particularly interested in the use of our 90° bore clamps to create a 3x3 square giving the drone self-supporting elements. For the autonomous section, Vaughn's autonomous team was able to fly their drone with vertical takeoff and hovering using code developed over the years through Ubuntu and MAVProxy. Due to Covid-19, this year competition was postponed and moved to a virtual design competition.



On Friday, April 16, Judges from the aerospace industry evaluated teams' performance for both the remote and autonomous control categories. Among the judges, Boeing and Aerojet were in attendance to view the many designs; teams from across the country had to offer for Urban Environment Maneuverability (UAM). Five members of the Vaughn College UAV team (Jairo Andrew Ramos, Nicolas Bentancur, Kiran Boodhoo, Yusuf Rafi, Kevin Gonzalez) were all part of the 2021 VFS Design-Build Vertical Flight competition.



Virtual presentation of Vaughn's UAV team about their drone design approach

Vaughn's Engineering Faculty and Students Participated in LACCEI2021 Virtual Conference

LACCEI 2021 - The OAS Summit of Engineering for the Americas

[About](#) ▾ [Papers](#) ▾ [Student Competitions](#) ▾ [Reviewers](#) ▾ [Registration](#) [Program](#) ▾ [Plenaries](#) ▾



From July 19-23, 2021 Vaughn's engineering students along with Dr. Hossein Rahemi, the engineering department chair, attended the 19th LACCEI International Virtual Multi-Conference. Two of Vaughn's student team research papers were accepted for presentation and publication in the LACCEI 2021 international conference. Vaughn's student papers as listed below were selected to compete among ten finalists for the student paper session, and two submitted papers were accepted for the poster session of LACCEI 2021 as well.

Finalist for LACCEI Paper Session

1. Intelligent Robot Design for VEX U Skills Challenge by Misael Marquez
2. BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy by Tatiana Jaimes, Alina Santander Vinokurova, August Rodriguez

From 11 am to 1 pm on Wednesday, July 21, two of Vaughn's student team papers, as listed above, were presented to the international conference audience during the student paper session of LACCEI 2021.

Misael Marquez's paper addressed the design and development process of a robot for VEX U skills challenge. His paper and presentation detailed the design, manufacturing, and development process of a robot as well as autonomous programming that allowed his team to compete successfully in the skills competition of VEX U Robotics. The overall objective is to have a robot with an effective mechanism, and to score consistently through both autonomous and driver-controlled modes of skills challenge. His robot competed in VEX U World Robotics championship and received third place ranking of 2021 world skills challenge. Judges selected his paper as a recipient of the **third place award** of 2021 LACCEI student paper session competition.




LACCEI
Latin American and Caribbean Consortium of Engineering Institutions

19th LACCEI International Multi-Conference for Engineering, Education and Technology
 “Prospective and trends in technology and skills for sustainable social development”
 “Leveraging emerging technologies to construct the future”
The OAS Summit of Engineering for the Americas

The LACCEI 2020 International Engineering Research/Project Competitions Committee confirms the
Third-Place Winner of the **Student Paper Competition** to be:
INTELLIGENT ROBOT DESIGN FOR VEX U SKILLS CHALLENGE "CHANGE UP"
SF # 644

MISAEI MARQUEZ (US)



Virtual Edition
July 19 – 23, 2021



Luis Fernando Martínez Arconada, PhD.
LACCEI President



María M. Larrondo Petrie, PhD.
LACCEI Executive Director

**The Third Place Winner of the LACCEI 2021 Student Paper Session Competition
 “Intelligent Robot Design for VEX U Skills Challenge.” by Misael Marquez**

Tatiana, Alina, and August talked about their “**BrailleBud Learning Systems**” project. Their presentation detailed the development process of a Transitional Learning Tool from Pre-Literacy to Braille Literacy for people who are blind or visually impaired. The main objective of their project is to develop an inexpensive, small, user-friendly braille cell learning device. Their presentation covered braille learning systems design concept, working mechanism of design, manufacturing process using 3D printing, and electrical construction and Arduino software design. Their paper was selected as a finalist of 2021 LACCEI student paper session competition.



LACCEI2021 Student Finalist Paper Session Competition “Braillebud, a Transitional Learning Tool from Pre-Literacy to Braille Literacy.” by Tatiana Jaimes, Alina Santander Vinokurova, and August Rodriguez

Virtual LACCEI 2021 Poster Competition

From 2:30 pm to 4:30 pm on Tuesday, July 20, two of Vaughn’s student team posters were selected for the LACCEI 2021 Virtual poster session competition. Vaughn’s student poster by Misael Marquez outlined development and design of an **Intelligent Robot for VEX U Skills Challenge**. His poster presentation provided an insight into robot design, manufacturing, and programming for the skills challenge that improves the competition outcomes. The second Vaughn student poster, made by Tatiana, Alina, and August, outlined the conceptual design of **BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy**. Their presentation provided an insight into their design concept and the development process of braille learning systems. Both posters were selected as finalists of 2021 LACCEI student poster session competition.

2021 Women Engineering Conference



The Vaughn College chapter of the Society of Women Engineers (SWE) attended the 2021 Women Engineers Conference in Indianapolis, Indiana from October 21st through October 23rd, 2021. During the conference, nine members of the chapter had the opportunity to attend leadership seminars and technology talks. In addition to attending those, SWE students attended the in-person and virtual career fairs, where some interviewed with industry-leading companies such as Honeywell, Carrier, Raytheon Technologies, Accenture, and EBI. The conference was successful, as 7 internship positions were offered on-site; interview opportunities were given both on-site and during the remote career fair.



From right to left and back to front, the WE21 attendees are Kenny Harris, Cristian Sorto, Daniel Doscher, Misael Marquez, Suraiya Nawaz, Alina Santander Vinokurova, Sagufta Kapadia (SWE chapter 2019 Ex-President), Chasisty Melo, Tatiana Jaimes, and Mariah Villalon.

THE OVERVIEW OF THE SUCCESS OF WE21 CONFERENCE

Note: Some of the SWE members are still in the process of receiving interviews as some of the company's selection processes were exclusively virtual.

NAME	MAJOR	YEAR	COMPANY	FULL TIME OFFER	INTERNSHIP OFFER
Alina Santander	Mechatronics Engineering	Junior	Carrier		Yes
			Honeywell		Yes
			OTIS Elevators		Yes
Tatiana Jaimes	Mechatronics Engineering	Junior	Honeywell		Yes
			Daimler Trucks North America		Yes
			Northrop Grumman		Pending
Mariah Villalon	Electrical Engineering	Junior	Cleveland-Cliffs		Pending
			Accenture		Pending
			Sleep Number		Pending
Suraiya Nawaz	Mechatronics Engineering	Sophomore	American Airlines (Co-op)		Pending
			Textron		Pending
Chasisty Melo	Mechatronics Engineering	Sophomore	Carrier		Yes
			Milwaukee Tools		Pending
			Rolls Royce		Pending
			Textron		Pending
			Trane Technologies		Pending
			Corning		Pending
			Daimler Trucks North America		Pending
Misael Marquez	Mechatronics Engineering	Senior	Stryker	Pending	
			Tesla	Pending	
			EBI – Honeybee Robotics	Pending	
			Rockwell Automation	Pending	
Cristian Sorto	Mechatronics Engineering	Junior	Georgia Tech Institute of Technology		
			UCONM		

Daniel Doscher	Mechatronics Engineering	Junior	Collins Aerospace		Yes
Kenny Harris	Mechatronics Engineering	Junior	Hoover		Pending
			Whirlpool		Pending
			Proctor and Gamble		Pending

Seminars

Stephanie C. Hill, Executive Vice President of Lockheed Martin, delivered the opening keynote address at the SWE conference. All SWE E-board members attended this keynote to hear Hill speak about "Bringing Purpose and Authenticity to Your Work." This keynote included a light breakfast that everyone enjoyed, as well as Hill's motivational speech. Following that, there was a two-hour rapid resume session, which was attended by some of the members. People from Lutron, Raytheon Technologies, 3M, as well as other companies were there to assist participants with their resume.



Hospitality Suites and Interviews



A few of the companies at the career fair such as Trane Technologies, Milwaukee Tools, and Eli Lilly hosted hospitality suites in the evening. These events allowed members of the SWE chapter to meet with recruiters in a more informal setting to demonstrate how their outlook and perspective contributes to their work ethic. A few members of our SWE chapter such as Suraiya Nawaz, Chasisty Melo, and Alina Santander were offered interviews from Trane Technologies and Milwaukee Tools at this event. In addition, private events were also hosted by companies by invite only. Members

Tatiana Jaimes and Suraiya Nawaz were invited to Daimler's Hospitality suite and Chasisty Melo was invited to a breakfast by Emerson.

Hosted Events and Keynotes

The conference also offered keynotes sponsored by Lockheed Martin, Intel, Rolls-Royce, and others. Members attended the opening and closing keynote hosted by Stephanie Hill and Patti Poppe, respectively, where they had the opportunity to listen to the inspiring and empowering career stories led by these industry leaders. Following the conference's theme "Aspire to Inspire", both keynote speakers reminded the attendees of the impact one can make by staying true to oneself and by paving one's way in spite of hardship and challenge. Aspire to be the inclusive role model one would have looked up to as a youth, in order to make a positive impact in the community, industry, workforce.



Leadership Section: Networking session



VCAT SWE E-board members had the opportunity to attend different network sessions. The president, Alina Santander, along with Tatiana Jaimes, Chasisty Melo, Suraiya Nawaz and Mariah Villalon, were invited to the SWE Collegiate Leaders' Reception. The E-board members had the chance to meet with other college chapters and to discuss future collaborations in hosting workshops and events.

EVENTS IN WHICH THE SWE CHAPTER PARTICIPATED

Note: these events varied from educational growth in youth to creating a balance between a work life and personal life. Each event was hosted by different companies and had guest speakers who often discussed experiences in the industry.

Name	Event	Date
Daniel Doscher	Opening Keynote by Lockheed Martin	10/21/2021
	Self-Care	10/21/2021
	Using Artistic Expression in STEM	10/21/2021
	Closing Keynote	10/23/2021
Tatiana Jaimes	Rapid Resume Review	10/21/2021
	Building Momentum in the industry	10/21/2021
	Opening Keynote by Lockheed Martin	10/21/2021

	Closing Keynote	10/23/2021
	SWE Se Puede	10/22/2021
Chasisty Melo	Opening Keynote by Lockheed Martin	10/21/2021
	Using Artistic Expression in STEM	10/21/2021
Cristian Sorto	Using Artistic Expression in STEM	10/21/2021
	Self-Care	10/21/2021
	If an Ally Doesn't Speak	10/21/2021
	Ball Aerospace	10/21/2021
Suraiya Nawaz	Opening Keynote by Lockheed Martin	10/21/2021
	Rapid Resume Review	10/21/2021
Misael Marquez	Opening Keynote by Lockheed Martin	10/21/2021
	Self-Care	10/21/2021
	Using Artistic Expression in STEM	10/21/2021
	Closing Keynote	10/23/2021
Alina Santander	Rapid Resume Review	10/21/2021
	Building Momentum in the industry	10/21/2021
	Opening Keynote by Lockheed Martin	10/21/2021
	Closing Keynote	10/23/2021

Acknowledgement: We are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn's students in STEM related scholarly and professional activities.



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2021 Society of Hispanic Professional Engineers (SHPE) National Conference, November 10 to November 14, 2021

A group of 13 engineering students from Vaughn College attended the 2021 Society of Hispanic Professional Engineers (SHPE) Conference in Orlando, Florida from November 10 to November 14, 2021. Vaughn's students participated in student challenge competitions as well as various professional development workshops aimed to promote leadership, unity, and exposure to diverse STEM career opportunities.



As the Vaughn College SHPE Chapter, we are part of a large organization called The Society of Hispanic Professional Engineers. This organization hosts major conventions known as the SHPE National Convention for STEM chapter students and professionals. The annual SHPE National Convention is the largest conference in the nation, and it provides chapter students and professionals the opportunity to engage in networking and to learn from a variety of corporate representatives through attendance at workshops, hospitality suites, career expos, and SHPE events, as well as through participation in STEM competitions. These are significant opportunities for Vaughn College students who have been highly active and successful in their major. This is an opportunity for STEM students to showcase their talent to leading companies who are looking to recruit top STEM talent for their organizations. The Society of Hispanic Professional Engineers (SHPE) provides opportunities for SHPE chapter students and professionals from all over the nation who are seeking full time or internship/co-op opportunities. SHPE students have the opportunity to network with major engineering corporations, leading towards the fulfillment of

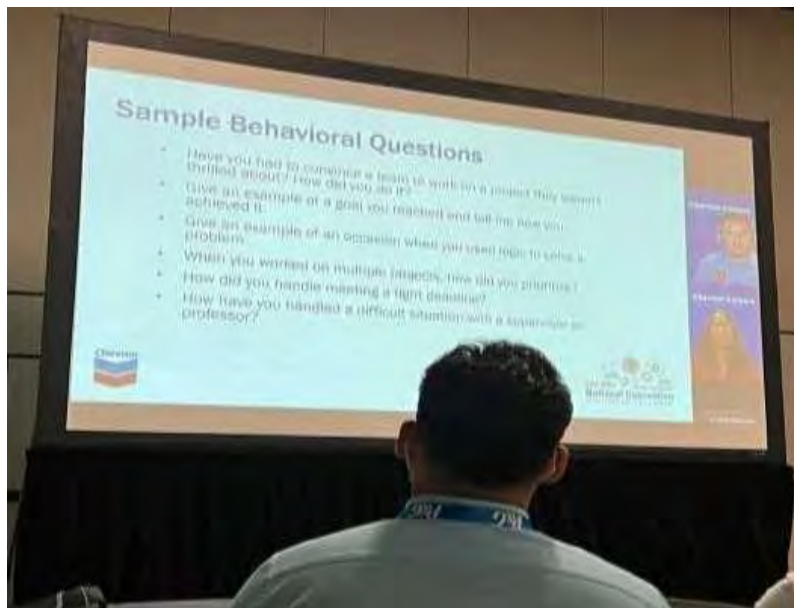
SHPE's mission to "impact the world through STEM awareness, access, support, and development."

Convention Readiness

The SHPE Executive Board organizes, presents, and encourages our Chapter Members to attend our Professional Development oriented workshops which are held three weeks prior to the National Conference, as well as during the Spring Semester, prior to the upcoming Regional Leadership Development Conventions (RLDC). These workshops help Chapter Members further develop their resumes, portfolios, and elevator pitches and give them insight into the proper approach for researching companies of interest and professional interview presentations for the career fair.

We highly encourage our SHPE National Attendees to participate in the Professional Development Workshops held on the first day of the conference, such as the one hosted by professional engineers representing Chevron. The workshop included the experiences of professionals in the industry who discussed topics such as Resume Building, Interview Skills and the Elevator Pitch, one of which was used by one of the presenting engineers and which helped him land a full-time Mechanical engineer position with Chevron.

These workshops grant Vaughn SHPE Chapter Students the opportunity to acquire knowledge based on the experience of both the Executive leaders at past conferences and current professionals who share the challenges they have faced throughout their everyday work experience.



Professional Speaker Panelist

At the SHPE National Convention, there are a variety of technical, career, and graduate workshop opportunities hosted by corporate representatives such as Chevron, Exxon Mobil, Airbus, Delta Air Lines, Navy, General Motors, P&G, Samsung, Intel, Johnson & Johnson,

Huntington Ingalls Industries, ThermoFisher Scientific, Textron, DuPont, Milwaukee Tool Corporation, Amazon, Eaton, NSA and Raytheon Technologies. These workshops occur throughout the duration of the SHPE National Convention and present opportunities for STEM students and professionals to prepare for the career fair and for work in the industry. Preparation workshops are presented by alumni and professional engineers on topics designed to educate and inspire students through professional sharing of their industry and personal experience. Workshops are also an opportunity for other chapters to interact with each other and to discuss the workshops in which each member has participated. For example, we had the opportunity to connect with a new SHPE member from Houston, Texas who was seeking advice on starting and running a successful chapter at her college.



What do Mechanical Engineers do in industry? (Panel 1) – Vaughn College alumni panelist, Praneel Kumar

Hospitality Suites



These events are hosted by company professionals to give an opportunity to students, recruiters, and industry professionals to communicate and to network with one another in building mentor relationships with industry innovators. These hospitality suites were hosted by Johnson & Johnson, Honeywell, Huntington Ingalls, and ThermoFisher Scientific.

Johnson & Johnson and Honeywell Hospitality Suite

These companies are also in high demand at the career fair, since they cater to all our member's interests and majors. We highly encourage Vaughn Students to take advantage of these opportunities to meet and build a foundation with other attendees and recruiters. These newly formed relationships are the key for success at the career fair, since they often open the door to future opportunities. As our chapter waited online for these events, our members made connections with other chapters of SHPE's Regions 4 and 7, respectively the Stony Brook's SHPE Chapter and the University of South Florida's SHPE Chapter.

SHPE National Career Fair



The SHPE National Career Fair is the highlight and main attraction of this conference. Held from Nov 11th-12th, thousands of students from across the nation line up to speak with company recruiters and to secure an interview for an opportunity to receive an internship or a full-time position.

With 279 companies at the Career Fair, both in person and virtual, there were many opportunities for Vaughn Students to present their projects, pursue their interest in technology and network with industry professionals. Prior to the conference, the Executive Board led Professional Development Workshops which were put into practice, resulted in numerous interviews for our SHPE attendees. In addition, our members successfully impressed recruiters with the knowledge and discipline they acquired through personal projects, Capstone projects and club involvement, all funded by the Vaughn College Department of Engineering.



SHPE National Convention Attendee Outcomes

Attendees Name	Major	Academic Year	Company	Company Offer
Mariah Villalon	Electrical Engineering	Junior	DuPont Elanco Lockheed Martin Air Force STEM L3Harris Technologies	Pending
Manolo Duenas	Mechatronics Engineering	Senior	Rockwell Automation	Internship (Summer 2022)
Alanke Perera	Mechatronics Engineering	Junior	Cummins	Pending
Cesar Valle	Mechanical Engineering	Senior	Tesla	Pending
Jairo Ramos	Mechanical Engineering	Junior	Amazon Honeywell	Pending
Kirill Solokov	Mechatronics Engineering	Junior	No interviews	Pending
Alina Satander	Mechatronics Engineering	Junior	Nordstrom	Pending
Wole Barnade	Electrical Engineering	Senior	Honeywell Rivian	Pending
Joshua Harripaul	Mechanical Engineering	Junior	No interviews	Pending
Kevin Osada	Mechanical Engineering	Senior	Raytheon	Raytheon (Immediate Hire)

SHPE Engineering Challenge Competitions



Innovation Challenge - Third Place Winner



Nissan Design Challenge - Second Place Winner

At the SHPE National Convention there are a variety of competition opportunities in which SHPE chapter students can participate, such as the Engineering Science Symposium, Innovation Challenge, Cybersecurity Challenge, and the Nissan Design Challenge. Participation in these challenges is a requirement for Vaughn Attendees, since it grants them exposure to recruiters and to the opportunity to actively work with professionals who direct these challenges.

These experiences are crucial for they help Vaughn Students adapt to the real-world problems they will confront when they work for the companies participating in the convention.

In previous years, the Vaughn College SHPE Chapter earned awards as either first, second or third place winners, through the work of SHPE chapter members who pushed their talents to excel beyond their limits.

This year the competitions were held virtually from November 2nd to 7th. Kevin Kenta Osada won second place in the Nissan Design Challenge for his contribution with an innovative solution to monitoring Child Safety Seats, through the integration of controls and weight sensors under these seats. Kirill Sokolov won third place in the Innovation Challenge for his contribution to an innovative solution to monitor passengers on Roller Coaster Rides, through the integration of Facial Recognition to determines the wellbeing of passengers and to regulate safe parameters of speed for them. To achieve such awards at the SHPE National Convention Competitions confirms Vaughn College students are innovative thinkers who prove our motto of being “Future Proof.”

SHPE – Title III HSI STEM and CSTEP Collaboration

Impact of the Title III HSI-STEM on student success: The Title III HSI-STEM provided funding to support expansion of student involvement in STEM-related scholarly, practical hands-on, and community outreach activities including student engagement in paper and poster sessions and engineering challenge competitions at technical conferences—American Society for Engineering Education (ASEE), Latin American and Caribbean Consortium of Engineering Institutions (LACEEI), Institute of Electrical and Electronics Engineers (IEEE), *American Institute of Aeronautics and Astronautics (AIAA)*, Society of Women Engineers (SWE) and Society of Hispanic Professional Engineers (SHEP).

This year the HSI-STEM title III grant project sponsored nine Vaughn College SHPE Chapter students to attend the national conference. Vaughn’s SHPE students participated in the professional workshops, hospitality suites, and engineering challenge competitions. Several of the Vaughn HSI-STEM grant-supported students had the opportunity to participate in Innovation Challenge, Cybersecurity Challenge, and the Nissan Design Challenge. Vaughn’s student, Kevin Kenta Osada, won second place in the Nissan Design Challenge and Kirill Sokolov won third place in the Innovation Challenge of the SHPE national Conference.

The HSI-STEM grant supported activities assist Vaughn’s SHPE students in developing an appreciation for lifelong learning to sustain them in meeting their future professional challenges. The involvement in the SHPE chapter of professional society empowers us with a competitive edge and provides us with valuable experiences for the workplace. We as Vaughn’s SHPE chapter are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage us in STEM related scholarly and professional activities.



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The Collegiate Science and Technology Entry Program (CSTEP) is a program intended to increase access for minority and economically disadvantaged students in academic programs at the college level in scientific and technical fields. This year, the CSTEP program sponsored four Vaughn College students, enrolled in our SHPE Chapter, to attend the national conference. After participation in the professional workshops, hospitality suites, and engineering challenge competitions, two of these attendees had the opportunity to receive multiple interviews from industry-leading Companies. We are grateful for CSTEP's interest in our Vaughn College SHPE Chapter and appreciate their efforts and continued support for our members and program.



Southern Biomedical Engineering Conference, 37th Annual meeting, New Orleans LA, December 2-5, 2021

From December 2-5, four Vaughn's engineering students, Alina Santander, Tatiana Jaimes, Aaron Arana, and Mariah Villalon, along with Dr. Hossein Rahemi, engineering department chair, and engineering faculty, Drs. Mohammed Benalla, Shouling He, and Prof. Khalid Mouaouya participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA, Figure 1. Three Vaughn student team research papers were accepted for publication and presentation in this annual gathering.

From December 3-5, Vaughn's faculty and students attended Plenary Speaker, Scientific Writing Workshop, and many technical sessions related to Nanoparticles, Tissue Engineering, Neuroscience, Biomaterials, Chemical Engineering, Rehabilitation, and Device Development.



Figure 1, (a & b) Lunch speaker, At the Interface of Polymer Science and Biology: A Multidisciplinary Endeavor by Dr. Amol Janorkar, 37th SBEC,

On Friday December 3rd, from 8:30 AM to 9:45 AM, Dr. Benalla served as a session chair for the Biochemistry/Nanoparticles, Figure 2. Authors for this session addressed their research works on 3D Cell Culture Modeling of Midgut, Protective Effect of PRP in Degenerative disk disease, and other related research.

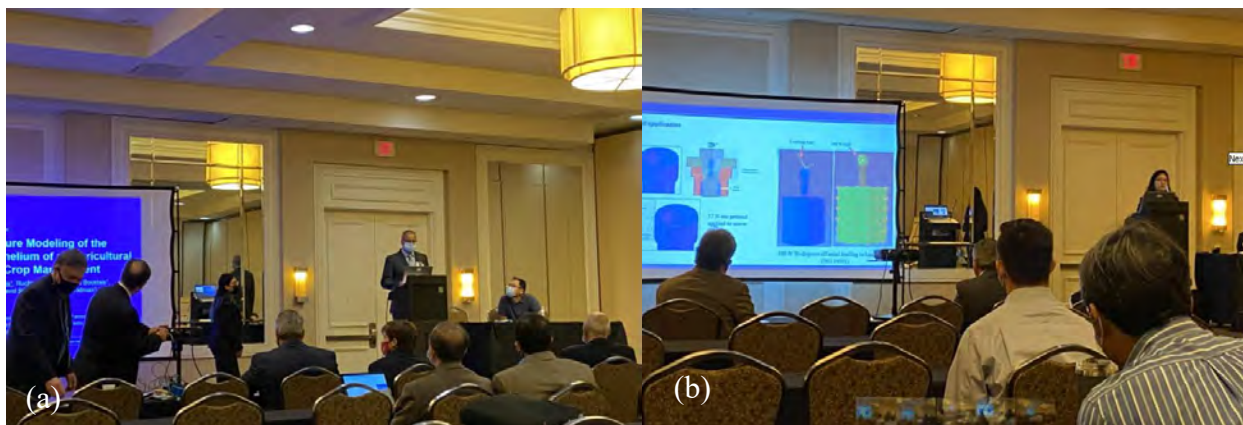


Figure 2, (a) Dr. Benalla Chairing the Biochemistry & Nanoparticles session, (b) PhD student presentation from Austin State University

On Saturday December 4th from 2:15 AM to 2:45 AM, three Vaughn student papers as listed below were presented during the Device Development session of the 37th Southern Biomedical Engineering Conference, Figure 3.

1. “Electromechanical Device for Inceptive Braille Learning” by Alina Santander, Tatiana Jaimes, and August Rodriguez.
Advisor: Dr. Mohammed Benalla
2. “Non-Invasive Glucose Monitoring System with Server Link” by Mariah Villalon, Isa Al-Maktoum, and Rebeca Snyder.
Advisor: Dr. Mohammed Benalla
3. “Assistive Partial Limb Exoskeleton (APLE)” by Aaron Arana.
Advisors: Drs. Shouling He, Hossein Rahemi, and Mohammed Benalla

These papers were also accepted for publication in the Biomedical Science Instrumentation Journal. This occasion provides our student with an excellent opportunity to discuss their current projects in public and to receive feedback from biomedical industries, researchers, and faculty as well as graduate and undergraduate students from other colleges and universities.



Figure 3. Vaughn college oral presentations, (a & b) Alina Santander and Tatiana Jaimes, (c) Mariah Villalon, (d) Aaron Arana

NSBE 48th National Convention Report



The 48th national convention for the National Society for Black Engineers (NSBE) was held in Anaheim California from March 23rd through 27th 2022. This was NSBE's first ever hybrid convention, where over nine thousand attendees from all six regions in the NSBE organization came together to have an amazing experience with each other. The theme of the conference was Inspiring Engineers and it featured numerous events such as educational and certification workshops, seminars, and career fairs geared towards the rounded development of engineers. Eight of Vaughn College's NSBE chapter were privileged to attend this convention where every attendee received interviews, both on-site and virtual, and some

received offers.



From the left: Franken Mercurius, Philip Bredu, Joshua Harripaul (Senator 2), Josiah Lovell (President), Wole Barnarde (Senator 1), Mohamed Youssef, Mina Morcos and Delano Donaldson (Secretary)

Opening and closing Keynotes

The opening session was hosted by Chevron, an oil and energy company headquartered in California, and the closing session was hosted by NSBE Women in Science and Engineering Special Interest Group (WISE SIG). All eight of the members attended both sessions where the speakers addressed topics in accordance with the convention theme, “Inspiring Engineers”. The speakers encouraged engineers of color to take up more leadership roles in society, so that they will be more prominent in the engineering fields. They gave personal stories about the ways they overcame challenges and stepped out of their comfort zone on their journey towards achieving success.



Workshops and seminars

The convention had a variety of workshops catering to everyone’s interests. One most notable workshop was the lean six sigma yellow belt certification event held on the first day of the convention. Six of the attending members attended this workshop where they learned the essentials of how to analyze company processes in the efforts of reducing waste and ultimately saving the company money. At the end of this nine-hour workshop and a short assessment, attending individuals proudly received the first level certification of the three stages in the lean six sigma course.



Activities Attended by Members

Name	Date	Events
Franken Mercurius	03/23/2022	Lean Six Sigma Yellow Belt Certification
		Opening Session by Chevron
	03/24/2022	In-person Career Fair
	03/25/2022	In-person Career Fair
		The Art of Engineering
		Microsoft Tech Talk
	03/26/2022	Black Faces in High Places
Diversity and Belonging in IT		
Closing Session- NSBE WISE		
Philip Bredu	03/23/2022	Lean Six Sigma Yellow Belt Certification
		Opening Session by Chevron
	03/24/2022	In-person Career Fair
		Hospitality Suites – Southern Company

	03/25/2022	In-person Career Fair	
		NSBE48 Tech Talk - Pfizer	
	03/26/2022	Black Faces in High Places	
		Diversity and Belonging in IT	
		Closing Session- NSBE WISE	
Joshua Harripaul	03/23/2022	Lean Six Sigma Yellow Belt Certification	
		Opening Session by Chevron	
	03/24/2022	In-person Career Fair	
		Hospitality Suites - Boeing	
	03/25/2022	In-person Career Fair	
		Strategize your Future	
		Launching a Career at NASA	
	03/26/2022	Black Faces in High Places	
		The Life of a Patent	
		Closing Session- NSBE WISE	
	Josiah Lovell	03/23/2022	Lean Six Sigma Yellow Belt Certification
			Opening Session by Chevron
03/24/2022		In-person Career Fair	
		Hospitality Suites - Trimble	
03/25/2022		In-person Career Fair	
		The Art of Engineering	
		Microsoft Tech Talk	
03/26/2022		Black Faces in High Places	
		The Life of a Patent	
		Closing Session- NSBE WISE	
Wole Barnarde		03/23/2022	Lean Six Sigma Yellow Belt Certification
			Opening Session by Chevron
	03/24/2022	In-person Career Fair	
		Hospitality Suites - Boeing	
	03/25/2022	In-person Career Fair	
		Strategize your Future	
		Launching a Career at NASA	
	03/26/2022	Black Faces in High Places	
		The Life of a Patent	
		Closing Session- NSBE WISE	
	Mohamed Youssef	03/23/2022	Virtual Career Fair
			Opening Session by Chevron
03/24/2022		In-person Career Fair	
		Networking Suites - Honeywell	
03/25/2022		In-person Career Fair	
		Pushing Higher AC Voltage	
	Negotiate! It's Your Life!		

	03/26/2022	Black Faces in High Places
		Engineering Change
		Closing Session- NSBE WISE
Mina Morcos	03/23/2022	Virtual Career Fair
		Opening Session by Chevron
	03/24/2022	In-person Career Fair
		Hospitality Suites - Honeywell
	03/25/2022	In-person Career Fair
		Pushing Higher AC Voltage
		Negotiate! It's Your Life!
	03/26/2022	Black Faces in High Places
		Engineering Change
Closing Session- NSBE WISE		
Delano Donaldson	03/23/2022	Lean Six Sigma Yellow Belt Certification
		Opening Session by Chevron
	03/24/2022	In-person Career Fair
	03/25/2022	In-person Career Fair
		The Art of Engineering
		Microsoft Tech Talk
	03/26/2022	Black Faces in High Places
		Diversity and Belonging in IT
		Closing Session- NSBE WISE

Career Fair

The career fair was held on the first three days of the convention, with the first day being virtual only and the remaining two days only in-person. The career fair features many companies who were actively recruiting members like Delta, Raytheon Technologies, Boeing, Caterpillar Inc. General Motors, Amazon, Cummins, etc. The career fair was highly successful, as all the attendees' received interviews, and a few received offers on the spot.

Career Fair Results

Name	Major	company	Job offer	Internship offer
Franken Mercurius	Mechanical Engineering	Caterpillar Inc.	Pending	
		Southern Company	Pending	
Philip Bredu	Mechanical Engineering	Southern Company	Yes	
		City of Los Angeles Bureau of Engineers	pending	
Joshua Harripaul	Mechanical Engineering	Delta	 	Pending
Josiah Lovell	Mechatronics Engineering	Whiting Turner Construction	 	Pending
		Trimble	 	Pending

		Qualcomm	 	Pending
Wole Barnarde	Electrical Engineering	Aurora Flight Sciences	Pending	
		Honeywell	Pending	
		Raytheon Technologies (Pratt and Whitney)	Pending	
		Delta	Yes	
Mohamed Youssef	Mechatronics Engineering	Boeing	 	Pending
		Caterpillar	 	Pending
Mina Morcos	Mechatronics Engineering	Eaton	 	Pending
		Caterpillar	 	Pending
		American Express	 	Pending
Delano Donaldson	Mechanical Engineering	Nucor	 	Pending
		Caterpillar	 	Pending

Note: Pending status is assigned to individuals who are currently interviewing for positions

Acknowledgement



We are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn's NSBE students in STEM related scholarly and professional activities.



We extend our gratitude to the CSTEP organization for their continuous support towards our club in aiding our chapter with workshops and development activities.

**2021 VEX U In-Person Robotics Championship “Change Up Game”
Vaughn Robotics Team finished 6th place in overall ranking and 3rd place in Robot Skills ranking**

Every year, VEX Robotics challenges the problem-solving skills of science, technology, engineering, and math (STEM) scholars. Competition participants used robotics platforms and engineering processes to solve this year’s challenge entitled “VEX Change Up Game.” For this purpose, Vaughn’s team designed, built, and programmed two robots to compete in matches consisting of a forty-five second autonomous period followed by a minute and fifteen seconds of driver-controlled manipulation, and a third robot to compete in the skills competition. The team constructed their robots to attain the following objectives:

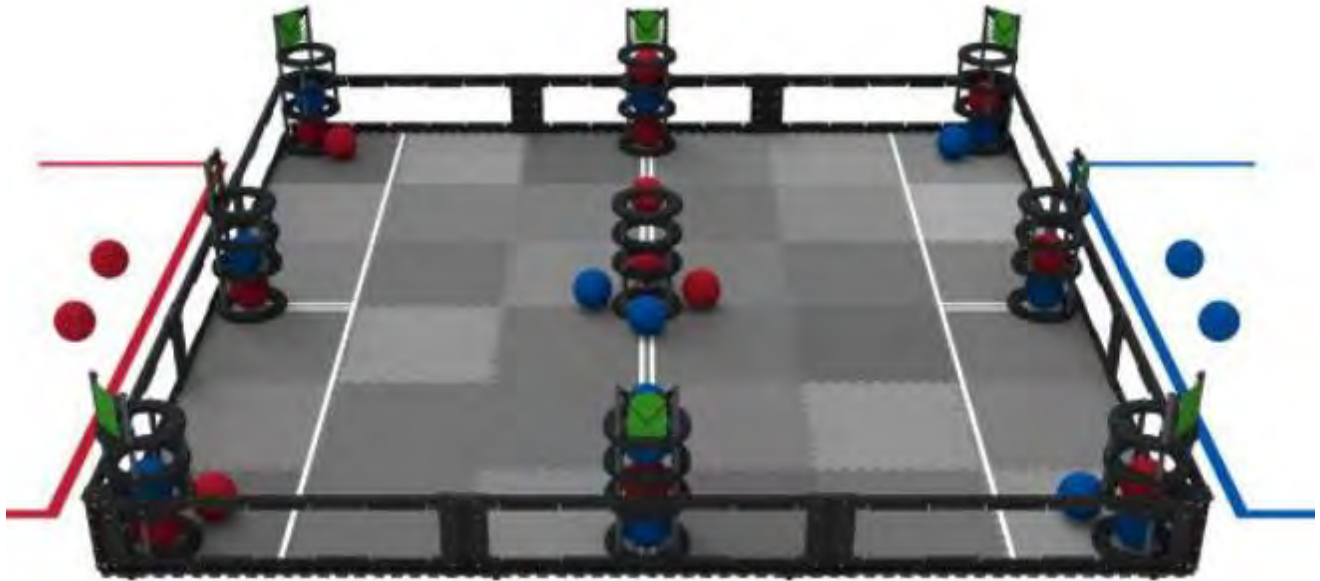
1. One tether robot that can be separated by a connecting cable to two robots; perform fast, and score consistently through both autonomous and driver-controlled modes
2. Both tether and smaller robots with an effective mechanism that can intake balls to pass through a conveyor belt and be placed at the top of goals.
3. Both robots designed with control algorithms to score and de-score red and blue balls, respectively, for a high skill score and rank.
4. Structurally reliable robots in compliance with the limitations and constraints of the challenge.

The tether robot, through a connecting wiring mechanism, can be separated into two robots during competition matches to perform better than the opposing alliance, with an effective capability that can intake balls to pass through a conveyor belt and be placed at the top of goals. Tether robots, together with a second robot, provide Vaughn’s team with an opportunity to be both offensive and defensive, as well as to score faster than the opposing alliance.



Vaughn’s Tether Robot

The Game: VEX Robotics Competition Change Up is played on a 12'x12' square field configured as seen above. Two (2) Alliances – one (1) “red” and one (1) “blue” – composed of two (2) Teams each who compete in matches consisting of a forty-five (45) second Autonomous Period, followed by a one minute and fifteen second (1:15) Driver Controlled Period. The objective of the game is to attain a higher score than the opposing Alliance by placing **Balls** in **Goals** and **Connecting Rows**.



Scoring:

Each Ball Scored in a goal	1 point for the Alliance corresponding to the Ball color
Each Connected Row	6 points for the Alliance corresponding to the Ball color
Autonomous Bonus	6 points
Completed Home Row in Autonomous	1 Win Point

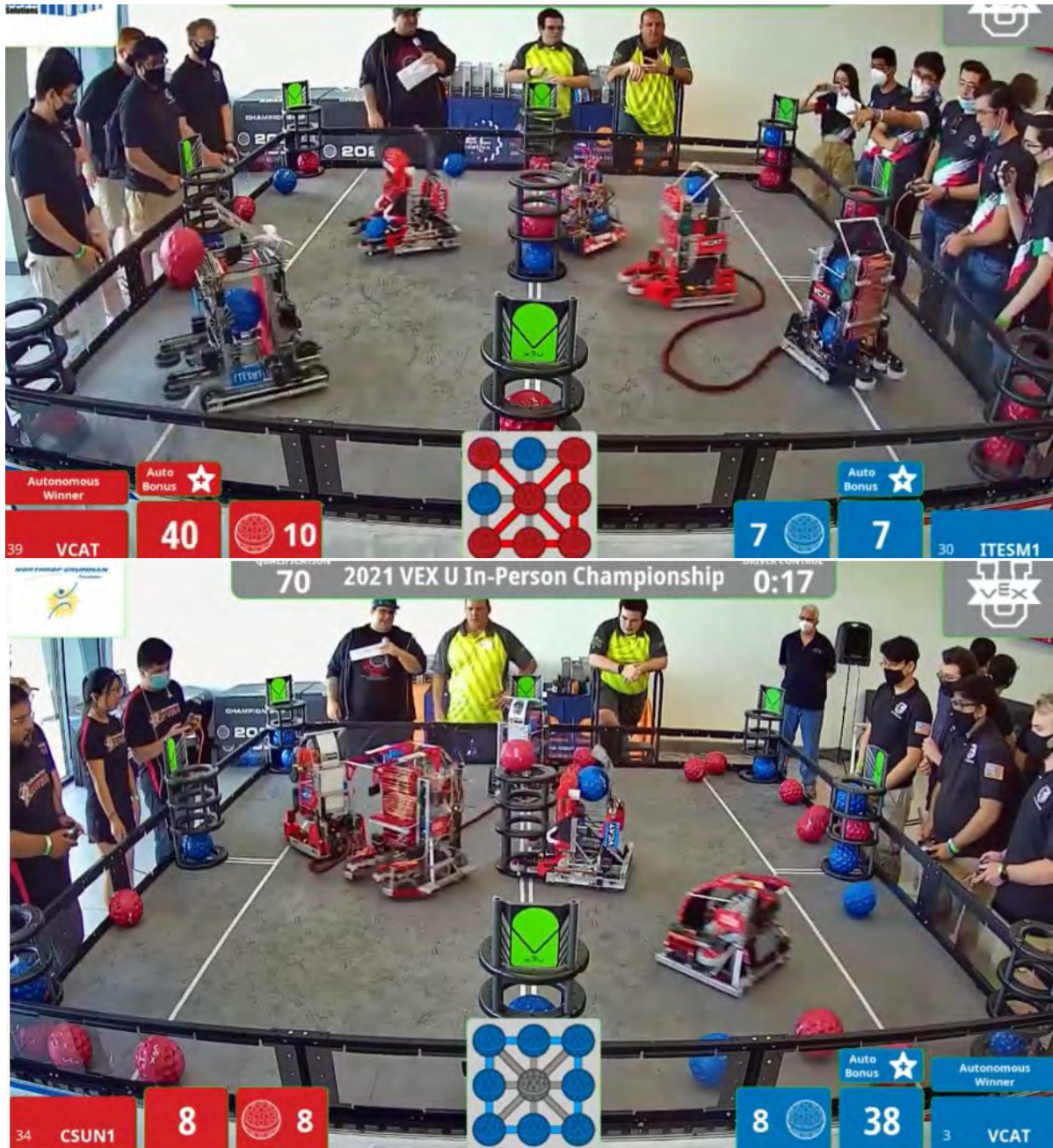
Game and Scoring Details:

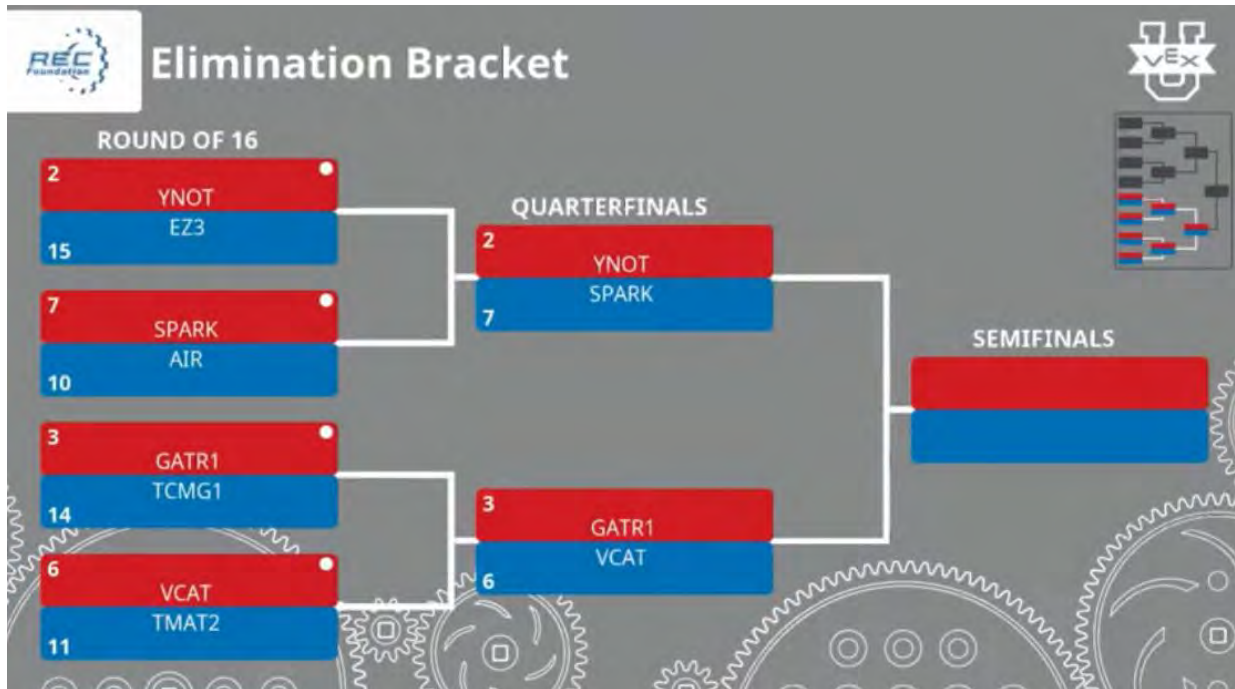
There are thirty-two (32) **Balls** on a Change Up Field, sixteen (16) **Red** and sixteen (16) **Blue**. There are also nine (9) **Goals** placed around the field. Balls are to be scored in **Goals**. Each scored ball is worth 1 point for the corresponding Alliance color. The highest scored ball in a Goal will be **owned** by the corresponding Alliance color. If an Alliance owns three goals in any direction (vertical, horizontal, or diagonal), they will receive a 6-point bonus for a **Connected Row**. Nevertheless, balls can be de-scored by the opposing Alliance at any time during the Driver-Control period. The alliance that scores more points in the Autonomous period is awarded with (6) bonus points, added to the final score at the end of the match. Each Alliance also can earn an additional Win Point by completing their **Home Row** during the Autonomous Period. This Bonus can be earned by both Alliances, regardless of who wins the Autonomous Bonus. From June 26-27, Forty one national and international universities and colleges were invited to the 2021 VEX U In-Person Championship in Greenville, Texas, Innovation First International (IFI) Center. Invitation to the VEX U Robotics in-person championship was only granted to a

team that is a tournament champion or an “Excellence” award recipient of a regional competition as well as top place in “Robot Skills”. Vaughn’s Robotics team won both the “Robot Skills” award of Vaughn College and the “**Excellence Award**” of the West Virginia VEX U Robotics Regional Qualifier Competition. .

This intense two-day competition was challenging, and during the first day our team completed its inspection process and competed in the Robot Skills challenge. A total of 41 national and international teams participated in Robot Skills, and Vaughn’s team with a total of 213 skills points (120 points for driver and 93 points for autonomous skills) finished **3rd place in skill ranking** of this challenging competition. During Saturday, June 27, Vaughn’s team competed and won five out of six qualifying matches, and received **6th place overall ranking of 2021 VEX U Robotics Championship** and advanced to the single elimination playoff round. .







In the playoff round, the top sixteen teams competed, and Vaughn’s team defeated a team from Mexico, thus advancing to the quarterfinal playoff round against GATR1 (a team from University of Florida). In an intense close scoring match, the VCAT team, with a total score of 10 points, lost to the GATR1 team, with a total score of 11 points.

Round of 16 8-1

Seed	Team	Seed	Team
6	VCAT VCAT Robotics Queens, New York, United States	11	TMAT2 TMAT 2 Matamoros, Tamaulipas, Mexico
40		2	

Quarterfinals 4-1

Seed	Team	Seed	Team
3	GATR1 Gator VEX Gainesville, Florida, United States	6	VCAT VCAT Robotics Queens, New York, United States
11		10	

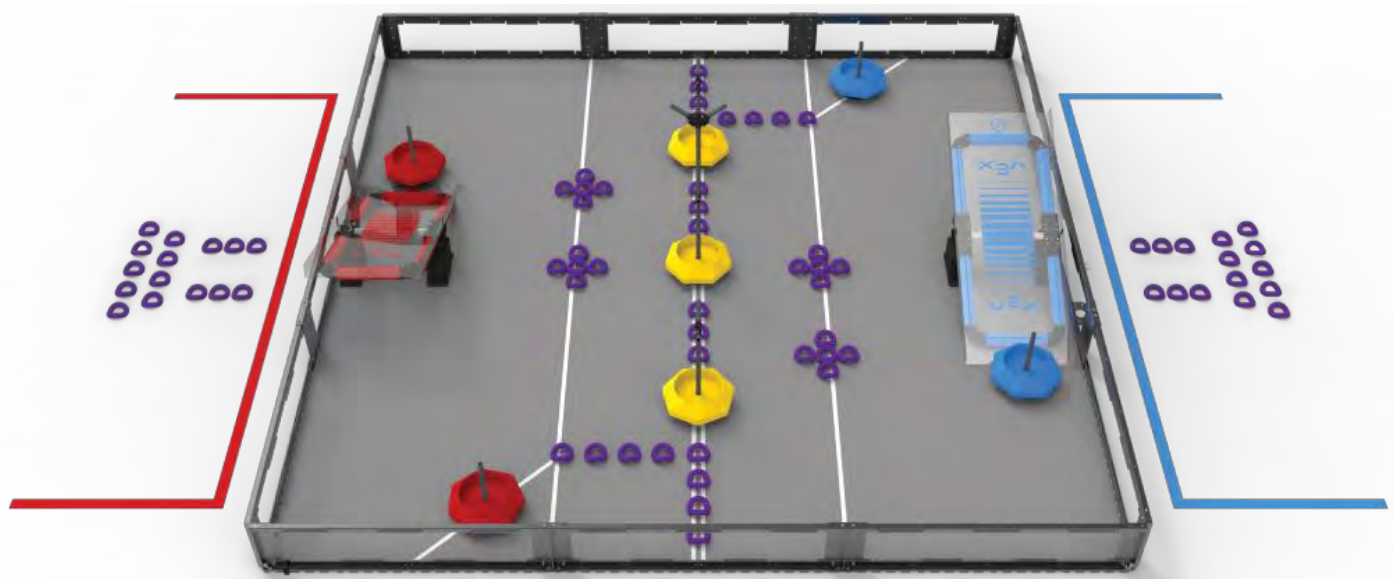
The VEX U Robotics championship is a tough and challenging competition in which only the top US regional and world champions qualify to participate. Vaughn’s team finished 6th place in overall ranking and 3rd place in the Robot Skills ranking, and they retained their standing as one of the top ranked competitors in the 2021 VEX U In-Person Robotics championship, by advancing to the playoff round of this intense competition for eight years in a row.



2021 VEX U In-Person Robotics Championship

2021-2022 VEX Robotics “Tipping Point” Game: Every year, VEX Robotics challenges the problem-solving skills of science, technology, engineering, and math (STEM) scholars. Competition participants used robotics platforms and engineering processes to solve this year’s challenge entitled “VEX Tipping Point Game.” For this purpose, Vaughn’s team designed, built, and programmed two robots to compete in matches consisting of a forty-five-second autonomous period followed by a minute and fifteen seconds of driver-controlled manipulation, and a third robot to compete in the skills competition. The team constructed their robots to attain the following objectives:

1. A robot with an effective mechanism that can intake rings to pass through a conveyor belt and on alliance branches.
2. A robot with control algorithms to score rings, possess goals, place goals on the platform and climb for a high skill score and rank.
3. A structurally reliable robot in compliance with the limitations and constraints of the challenge.



The Game: VEX Robotics Competition Tipping Point is played on a 12’x12’ square field configured as seen above. Two (2) Alliances – one (1) “red” and one (1) “blue” – composed of two (2) Teams each, compete in matches consisting of a fifteen (15) second Autonomous Period, followed by a one minute and forty-five second (1:45) Driver Controlled Period. The object of the game is to attain a higher score than the opposing Alliance by Scoring **Rings**, moving **Mobile Goals** to **Alliance Zones**, and by **Elevating** on **Platforms** at the end of a Match.

Scoring:

Each Ring Scored on a Neutral Mobile Goal High Branch	10 Points
Each Ring Scored on any other Mobile Goal Branch	3 Points
Each Ring Scored in a Mobile Goal Base	1 Point
Each Mobile Goal Scored in an Alliance Home Zone	20 Points
Each Robot that is Elevated	30 Points
Each Mobile Goal that is Elevated	40 Points
One Ring scored on/in each Alliance Mobile Goal and a Cleared AWP Line in Autonomous	1 Win Point

Game and Scoring Details

There are seventy-two (72) **Rings** and seven (7) **Mobile Goals** on a VRC Tipping Point Field. Each Alliance has two (2) **Alliance Mobile Goals**, with the remaining three (3) Goals being neutral. Each **Alliance** also has a **Platform** located in their **Home Zone**. Rings scored on an Alliance Mobile Goal will count for the respective Alliance, regardless of where it ends the match. However, Rings scored on Neutral Goals will only count for an Alliance if the Mobile Goal ends the match in their Home Zone. As the match draws to a close, Robots will start heading back towards their Alliance Platforms. Alliances can earn additional points for each Robot and Mobile Goal that ends the match Elevated on a **Balanced** Alliance Platform. The Alliance that scores more points in the Autonomous period is awarded with six (6) bonus points, added to the final score at the end of the match. Each Alliance also has the opportunity to earn an additional Win Point by scoring at least one Ring on each of their Alliance's Mobile Goals, and "Clearing" their **Autonomous Win Point Line**. This Bonus can be earned by both Alliances, regardless of who wins the Autonomous Bonus.

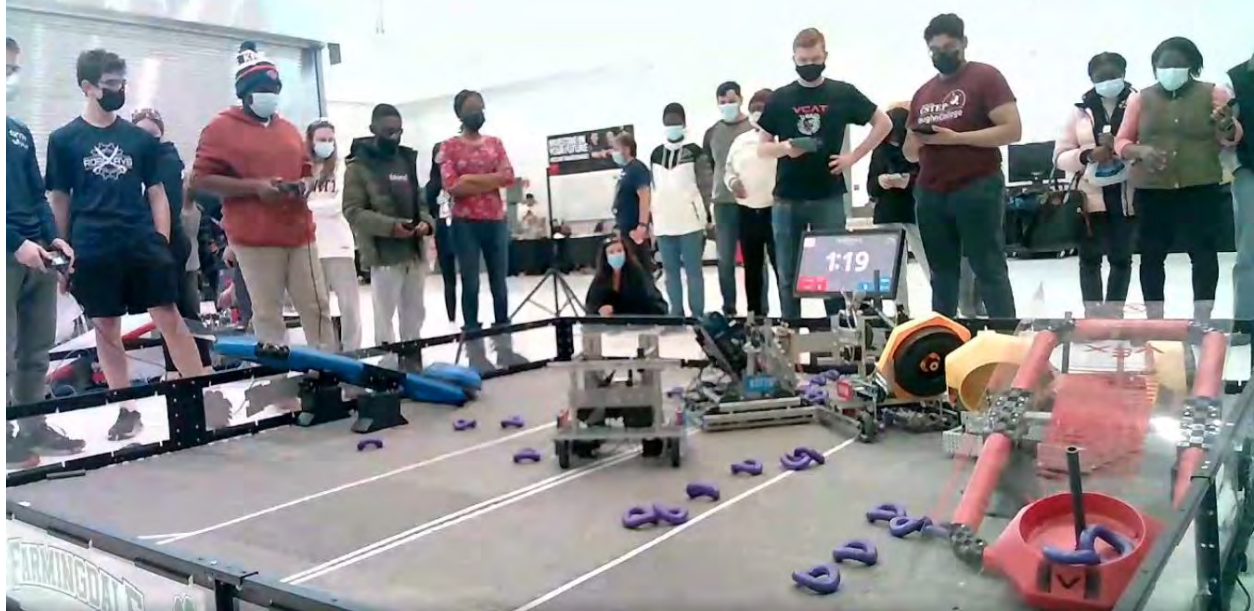
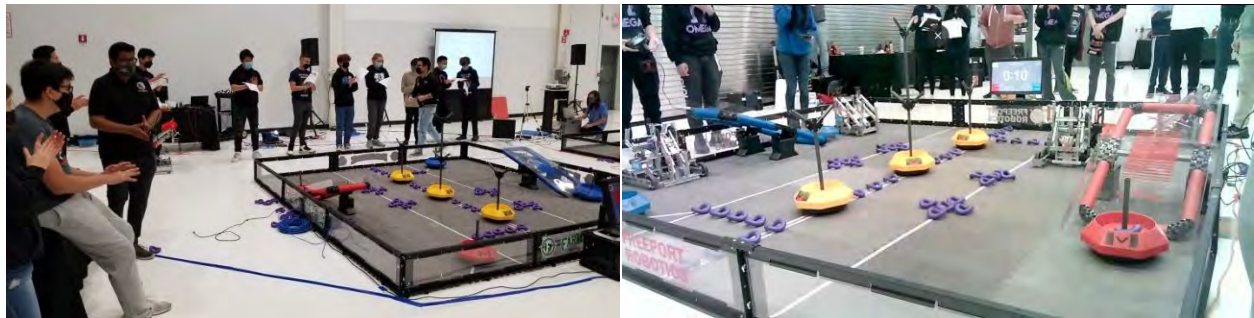
Vaughn College Hosted VEX High School Robotics VRC Tournament on Saturday December 11th, 2021

Vaughn College hosted the VRC Tournament on December 11th, 2021. A total of 22 teams from Queens, Nassau, and Suffolk as well as others from Massachusetts participated in this regional Robotics VRC Tournament. The teams competed in the tournament and skills competition where the top competitors were qualified for the state championship. The list of teams is as follows:

Team	Team Name	Organization	Location
817A	SpartidesBludSwatZipTys	EAST LONGMEADOW HIGH	East Longmeadow, Massachusetts, United States
817B	Spartides Oh Hi Mark!	EAST LONGMEADOW HIGH	East Longmeadow, Massachusetts, United States
955R	RNGesus	Play Ideas NY	New York, New York, United States
1569A	OMEGA	OMEGA Robotics	Great Neck, New York, United States
1569B	OMEGA	OMEGA Robotics	Great Neck, New York, United States
6277A	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277B	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277D	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
8880A	Adelphi STEP	Adelphi University STEP Program	Garden City, New York, United States
8880B	Adelphi STEP	Adelphi University STEP Program	Garden City, New York, United States
11021G	Uber Monkey	GPS ACADEMY	Great Neck, New York, United States
11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States
16099B	Overclock	KG Computech	Flushing, New York, United States
16099C	Overclock	KG Computech	Flushing, New York, United States
38211A	Centereach Cougars	CENTEREACH HIGH SCHOOL	Centereach, New York, United States
47114A	VEXcellent Girls	North Shore Coding and Robotics Club	Great Neck, New York, United States
55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
97140A	Kennedy Gaels	Kennedy Catholic Preparatory School	Somers, New York, United States
97140B	Kennedy Gaels Too	Kennedy Catholic Preparatory School	Somers, New York, United States
97140C	Kennedy Gaels La Mata	Kennedy Catholic Preparatory School	Somers, New York, United States
99588A	FlameX	PIA Tech League	Great Neck, New York, United States
99588X	Hyperion	PIA Tech League	Great Neck, New York, United States

Members from the VCAT robotics team prepared and ran the event as referees, judges, and event staff. John Sutera was the event planner and manager, Daniel Doscher was the head referee, and Misael Marquez was the announcer. Maharshi Patel, Christopher Walker, Tatiana Jaimes, and Cristian Sorto made up the scorekeepers. Staff from Vaughn College (Ryan Tang), Freeport High School (Kevin Harrison), and students from Vaughn College (Tatiana Jaimes, Nicholas Bentancur, Johanna Morales, Jairo Ramos, Nigel John, and Kiran Boodhoo) made up the judging panel. The following is a list of the awards given to the winning teams:

Award	Team #	Team Name	Affiliation	Location
Excellence Award (VRC/VEXU/VAIC)	16099B	Overclock	KG Computech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
Tournament Champions (VRC/VEXU/VAIC)	11442X	Hewitt Robotics	The Hewitt School	New York, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	16099B	Overclock	KG Computech	Flushing, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	16099C	Overclock	KG Computech	Flushing, New York, United States
Design Award (VRC/VEXU/VAIC)	38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
Robot Skills Champion (VRC/VEXU)	16099B	Overclock	KG Computech	Flushing, New York, United States
Judges Award (VRC/VEXU/VAIC/RADC)	47114A	VEXcellent Girls	North Shore Coding and Robotics Club	Great Neck, New York, United States
Innovate Award (VRC/VEXU/VAIC)	55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
Build Award (VRC/VEXU/VAIC)	6277B	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States





The two teams that won the tournament were the Centereach Cougears and Hewitt Robotics team from Centereach High School and The Hewitt School. Tournament finalists were two teams from Overclock from Flushing, New York. The excellence and skills awards were given to one of the Overclock teams as well. The design award was given to the Centereach Cougears. The innovate award was presented to Arsenal, a team from Jericho, New York. The Judges award was given to VEXcellent Girls from Great Neck, New York. Finally, the Build Award was awarded to RoboCavs from the Harvey School in Katonah, New York.

2022 WPI VEX U Robotics Regional Qualifier Competition, January 30, 2022

On Sunday, January 30, 2022, Vaughn College's Robotics team participated at the WPI VEX U Tournament. The team was composed of nine members (Misael Marquez, Christopher Walker, Daniel Doscher, Tatiana Jaimes, Amanda Camacho, Ataly Erem, John Sutera, Cristian Sorto, and Samuel Aremu).

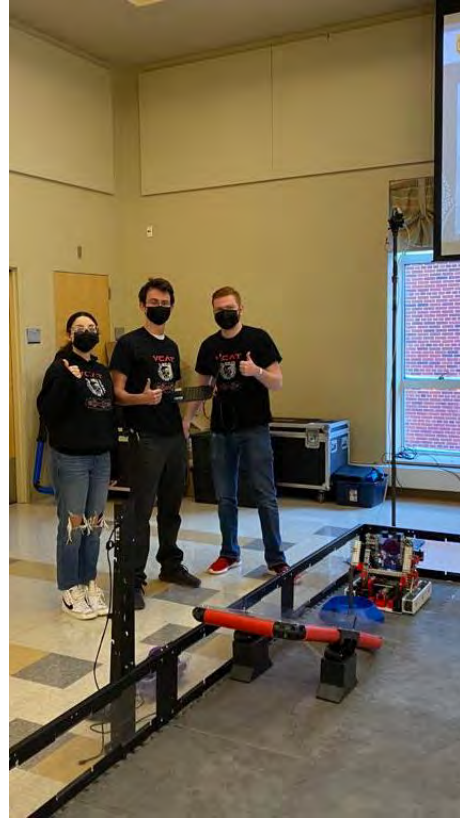
At the WPI competition, Christopher and Misael were the drivers, while Tatiana and Daniel were their coaches respectively. Amanda and John were secondary coaches who helped with match loads, scorekeeping, and timekeeping. Samuel and Ataly were the scouts that looked found any weaknesses in the other team's strategies. Finally, Cristian managed the pit area, making sure it was prepared for incoming robots needing repair.

A total of six colleges and universities participated in the event. The participant teams included Aquidneck Island Robotics (AIR), Rochester Institute of Technology (RIT1), Worcester Polytechnic Institute (WPI and GOATS), Northeastern University (HSKY) and Vaughn College of Aeronautics and Technology (VCAT).

Each participating team had a total of five matches, and VCAT was ranked 4th in the qualification matches and during the skills challenge matches, Vaughn's team finished 1st in "Robot Skills." With this win, the team is currently ranked 3rd in the world in "Robot Skills. The team also won the Excellence Award which qualifies the team to participate in the 2022 World VEX U Robotics Championship.



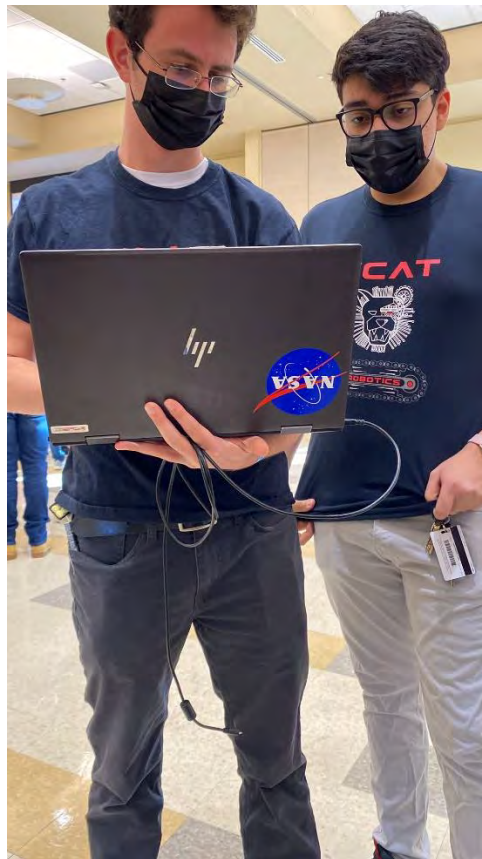
Team Picture with Excellence Award



Drive-team Setting Up for Skills Matches



Practice and Autonomous Testing



Programmers Trouble Shooting

Vaughn College hosted VEX U Robotics Tournament on Sunday, February 13th, 2022; Vaughn Robotics Team wins 2022 VEX U Skill Challenge, Tournament Finalists and Excellence Awards.

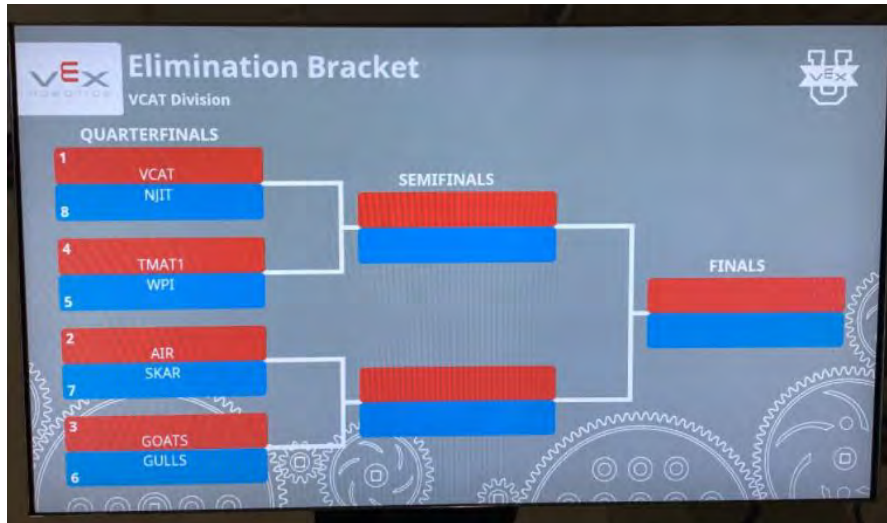
Vaughn College of Aeronautics and Technology hosted its Eighth Annual VEX U College Regional Robotics competition on Sunday, February 13th, 2022. A total of Nine college teams participated at this event. The participant teams included Aquidneck Island Robotics (AIR), East Bridgewater (GOATS), Salisbury University (GULLS), New Jersey Institute of Technology (NJIT), Rutgers University (SKAR), Technological University of Matamoros (TMAT1), Vaughn College of Aeronautics and Technology (VCAT) and (VCAT2), and Worcester Polytechnic Institute (WPI).

Members of Vaughn College robotic club (Maharshi Patel, Tatiana Jaimes, August Rodriguez, Misael Marquez, Daniel Doscher, John Sutera, Christopher Walker, Amanda Camacho, Nicholas Bentancur, Rebecca Snyder, Cristian Sorto, Kevin Velasquez, August Rodriguez) represented the Vaughn teams (VCAT and VCAT2) at this competition. Also, Maharshi Patel served as referee, and Professor Ryan Tang served as the event manager. August and Ryan served as announcer, while other Vaughn’s robotics team members were involved with Robot’s inspection, setting up the fields and facilitating the implementation process for this event. Also, Professor Donald Jimmo served as a judge for this competition.

During the skills challenge matches, Vaughn’s team finished first in “Robot Skills” (496 points). Each participating team had a total of ten matches. With seven wins Vaughn’s team received first ranking in qualification matches and advanced to the playoff elimination round. During the elimination of playoff rounds, VCAT defeated all of their opponents thus advancing to the finals where they faced QOATS. In an intense final game of tournament matches (2 best out of three); VCAT won the first match, QOATS won the 2nd match, and in a very close match, QOATS won the third match and the tournament championship, and the VCAT team won the tournament finalist award.

In this regional completion, Vaughn’s robotics team won both first place “Robot Skills” and “Excellence” awards which qualifies our team to participate in the 2022 VEX U world championship. The team was also tournament finalists at this event.





Elimination Bracket For VEX U Competition



VCAT Robotics Team

Acknowledgement: We are thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn's Robotics students in STEM professional activities and competitions.



Vaughn College Hosted VEX High School Robotics Qualifier Competition on Saturday, Feb 12th, 2022

Vaughn College of Aeronautics and Technology hosted its eighth annual high school robotics competition on Saturday February 12th, 2022. A total of 25 regional high schools from Queens, Bronx, Nassau, and Suffolk and other NY counties attended the 2022 VEX state qualifier at Vaughn College. The list of high school participants is as follows:

Team List

25 Teams

Team	Team Name	Organization	Location
228A	Team Fuego	Gus Robotics Team, Inc.	Meriden, Connecticut, United States
955R	RNGesus	Play Ideas NY	New York, New York, United States
1569B	OMEGA	OMEGA Robotics	Great Neck, New York, United States
5059B	Quakers	FRIENDS ACADEMY	Locust Valley, New York, United States
6277B	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277C	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277D	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
6277E	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
9717A	St. Catharine Comets	ST CATHARINE ACADEMY	Bronx, New York, United States
9717B	St. Catharine Comets	ST CATHARINE ACADEMY	Bronx, New York, United States
11021G	OMEGA	OMEGA Robotics	Great Neck, New York, United States
11442Y	Hewitt Robotics	The Hewitt School	NEW YORK, New York, United States
12357A	Infinite Robotics	Infinite Robotics	Jericho, New York, United States
16099A	Overclock	KG Computech	Flushing, New York, United States
16099B	Overclock	KG Computech	Flushing, New York, United States
16099C	Overclock	KG Computech	Flushing, New York, United States
16699Y	Overclock MS	NY Youth Tech	Flushing, New York, United States
19396A	Bayside Commodores	Bayside High School	BAYSIDE, New York, United States
38211A	Centereach Cougears	CENTEREACH HIGH SCHOOL	Centereach , New York, United States
55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
97140A	Kennedy Gaels	Kennedy Catholic Preparatory School	Somers, New York, United States
97140B	Kennedy Gaels Too	Kennedy Catholic Preparatory School	Somers, New York, United States
97140C	Kennedy Gaels - La Mata	Kennedy Catholic Preparatory School	Somers, New York, United States
99588A	FlameX	PIA Tech League	Great Neck, New York, United States
99588X	Hyperion	PIA Tech League	Great Neck, New York, United States

The members of the VCAT robotics team organized and acted as referees for the event. John Sutera served as manager and event planner; Professor Ryan Tang served as the announcer; Misael Marquez served as head referee. Faculty from Vaughn (Dr. Shouling He), Freeport High school (Mr. Kevin Harrison), as well as two of VCAT members (Nicholas Bentancur and Rebecca Snyder) served as the judges for this competition. Other VCAT members (Christopher Walker, Cristian Sorto, Tatiana Jaimes, and Kevin Velasquez) were assistant referees for the competition.



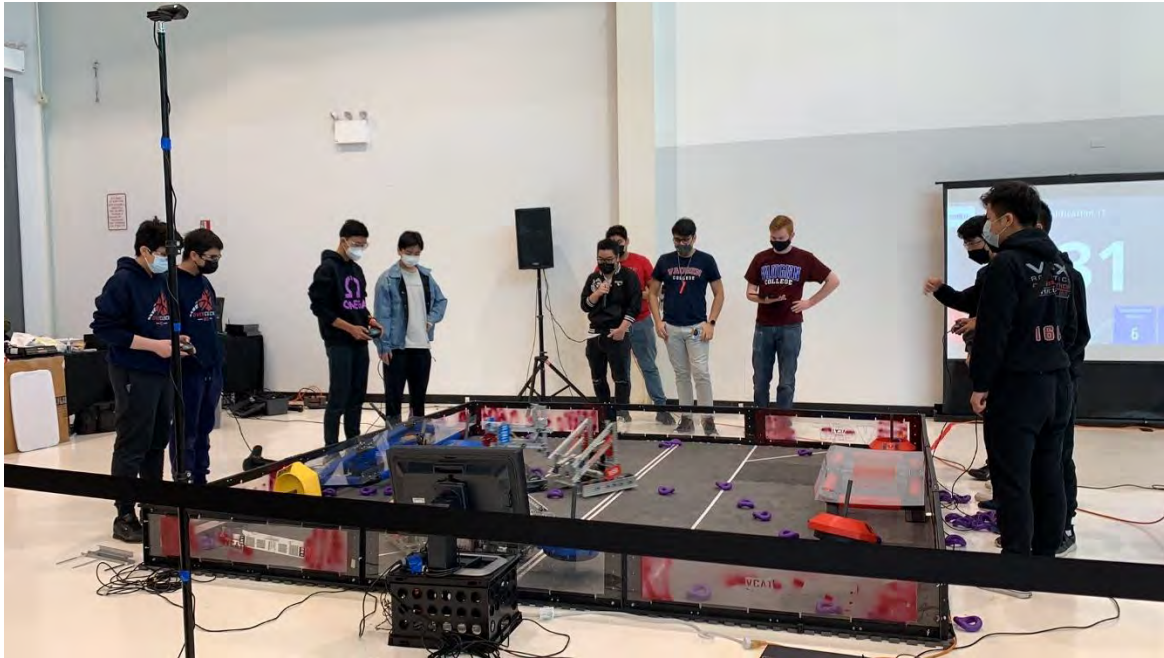
High School VEX Robotics State Qualifier Competition, Saturday, February 12th, 2022

The table below provides the list of award recipients for the 2022 regional High School VEX Robotics State Qualifier Competition. An alliance of a team from Jericho, New York and Great Neck, New York won the tournament championship, while a team from KG Computech from Flushing, New York won the “Excellence” Award, “Design” Award, “Robot Skills” Award and “Innovate” Award. A team from Great Neck, New York and Meriden, Connecticut were tournament finalists. The same team from Jericho, New York also won the “Judges” award. Two teams won the “Think” and “Amaze” award as well. Tournament champions, Tournament Finalists, “Excellence” Award, “Design” Award, “Robot Skills” Award, “Innovate” Award, “Think” Award, “Amaze” Award Winners qualified to participate in the New York State VEX Championship.

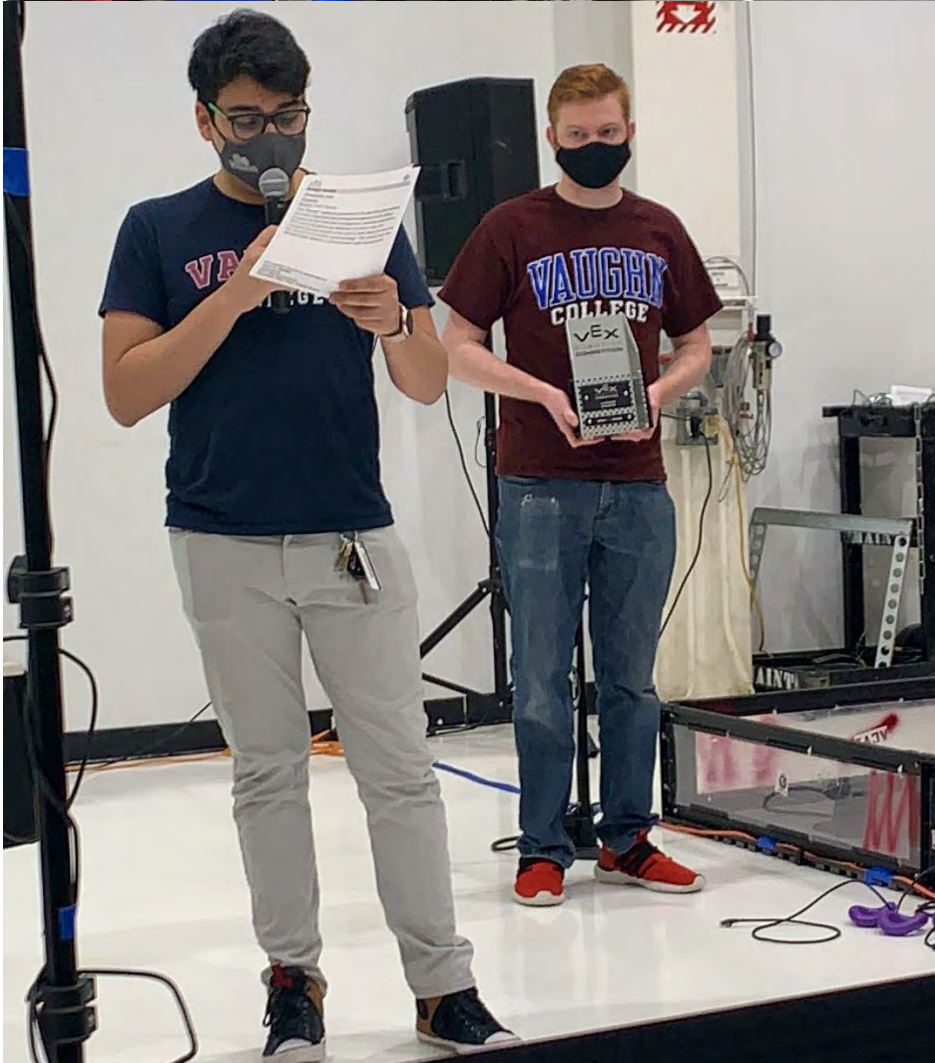
VEX Robotics Competition - VCAT Division

Award	Team #	Team Name	Affiliation	Location
Excellence Award (VRC/VEXU/VAIC)	16099B	Overclock	KG Computech	Flushing, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	11021G	OMEGA	OMEGA Robotics	Great Neck, New York, United States
Tournament Champions (VRC/VEXU/VAIC)	55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
Tournament Finalists (VRC/VEXU/VAIC)	228A	Team Fuego	Gus Robotics Team, Inc.	Meriden, Connecticut, United States
Tournament Finalists (VRC/VEXU/VAIC)	1569B	OMEGA	OMEGA Robotics	Great Neck, New York, United States
Design Award (VRC/VEXU/VAIC)	16099C	Overclock	KG Computech	Flushing, New York, United States
Robot Skills Champion (VRC/VEXU)	16099B	Overclock	KG Computech	Flushing, New York, United States
Judges Award (VRC/VEXU/VAIC/RADC)	55645X	Arsenal	Fifth Gear Robotics	Jericho, New York, United States
Innovate Award (VRC/VEXU/VAIC)	16099A	Overclock	KG Computech	Flushing, New York, United States
Think Award (VRC/VEXU/VAIC)	6277D	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
Amaze Award (VRC/VEXU/VAIC)	6277C	RoboCavs	THE HARVEY SCHOOL	Katonah, New York, United States
Build Award (VRC/VEXU/VAIC)	228A	Team Fuego	Gus Robotics Team, Inc.	Meriden, Connecticut, United States

Award Winners



Competition Match in Progress



Award Ceremony

Vaughn College UAV Club 2021-2022 Activities Report



The Unmanned Aerial Vehicle (UAV) Team at Vaughn College had a successful year during which the club participated in the Vertical Flight Society (VFS). Vaughn's UAV team project was selected as a finalist along with Penn State, Ohio State, Oregon State, University of Michigan, and University of Maryland for the Virtual Design-Build-Vertical Flight Competition. Vaughn's UAV Team developed a drone to compete in both the manual and autonomous categories. The drone was designed to perform vertical takeoff & landing (VTOL) with onboard flight-stabilization and a camera. Among all participating teams, Vaughn's UAV team was recognized by Boeing for having a compact design and a great lift capacity. Judges awarded Vaughn's UAV team with an **"Honorable mention with the *Most Manufacturable Award*"**. This is the fourth year in a row that Vaughn's UAV team has won the top award in the challenging VFS competition. The UAV club now strives to build upon these achievements to continue as a top performing team at these competitions, as well as to maintain its community service impact.

VFS Student Design Competition: Design-Build-Fly

The UAV Team has been working on indoor navigation of drones as part of the Design-Build Vertical Flight student competition hosted by the Vertical Flight Society (VFS) at the 78th Annual Forum in Grace Quarters, Baltimore, Maryland. The outdoor navigational challenge is to deliver as much sand inside a SoftGrip weight as possible, using either manually operated or autonomous drones in a limited amount of time. The UAV Club has chosen to participate in both the Manual and Autonomous Category. Both teams have worked diligently to satisfy the Gate 1 proposal designs as well as the feasibility studies on both drones.



Outreach

Throughout the year, the UAV Club hosts various workshops and events including Vaughn's Annual Manufacturing Day, Annual STEM Day, and Vaughn's International Drone Day. These workshops were supported by the Title III HSI-STEM project to educate students about small unmanned aerial systems (sUAS). Due to Covid-19 many of our workshops and events had to be held



through Zoom. The UAV Club hosted a Build a drone workshop; this workshop taught students the intricate process of soldering components as well as techniques such as wire management, part selection, and build verifications. Students also had the opportunity to build with some of the advanced components such as Pixhawk Cube flight controller and single board computers that the club uses for its autonomous flight testing.

The UAV Club has also partnered with the Vaughn College CSTEP Program to host a drone workshop at the CSTEP conference hosted at Vaughn College. CSTEP is a New York State funded program dedicated to preparing historically underrepresented and economically disadvantaged secondary school students for entry into a postsecondary degree. Through this workshop, the UAV Club strives to impact its community and to spark the interest of the young generation of students.



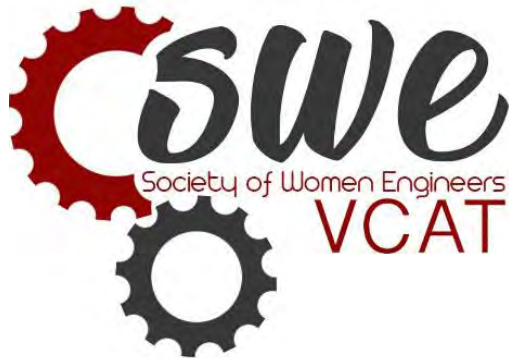
The UAV Club will host its signature event, Vaughn Drone Day in May again this year. Vaughn Drone Day is an annual event held at Vaughn College, where everyone is invited to attend free of charge. At this event, the UAV Club has various workshops for participants to attend, and the hanger is set up with a net within which people can fly drones. Drone enthusiasts and professionals show off their drones and equipment at their booths, and a discussion panel is held regarding drone rules and regulations. Every year people come from all over the 5 boroughs to take advantage of this event.



In addition, Vaughn UAV has partnered with Cradle of Aviation to bring back our annual Tiny Whoop Race. After Covid-19 had put a halt on everyone's life in 2020-2021, the Vaughn College UAV Team hosted its Third annual "Community Outreach Drone Awareness and Tiny Whoop Race" event at the Cradle of Aviation Museum on February 27th. The event

was free and open to the community. Many drone hobbyists and FPV pilots, as well as the locals from the area, attended the event. All visitors had the opportunity to fly at the event. Some flew their own drone during the free fly period, or during the race of flying drones that the UAV club brought for the visitors. The UAV club also held a raffle for a hands-free drone, and many excited attendees took part. There were also prizes given to the winners of the races. The hobbyists, the FPV pilots and the Vaughn College students truly enjoyed having the opportunity to fly in the race at the Cradle of Aviation, while the younger children who attended the event had fun flying during the free fly period. The younger attendees also really enjoyed watching the Tiny Whoops go through the hoops and around the obstacles as the pilots raced each other. After the race, the attendees were able to free fly again, and many younger attendees enjoyed speaking to the pilots who took part in the race. The event was concluded by announcing the raffle winner and the winners of the race. This event provided the pilots with the opportunity to demonstrate their skills, and it allowed the community to learn more about drones by speaking to drone hobbyists and professionals, as well as to the Vaughn UAV team.

2021-2022 Society of Women Engineers (SWE) Activities



The Vaughn College of Aeronautics and Technology (VCAT) Chapter of the Society of Women Engineers (SWE) is an organization supporting and empowering female students specializing in engineering. The Chapter's goal is to highlight the importance of diversity and strengthen its legacy in a very competitive field. Not only does the Chapter groom its members to excel as engineers, but it also helps them to become well-prepared professionals who will be highly productive in their chosen field of endeavor.

Furthermore, the Chapter prides itself on its STEM

Outreach work to increase future female involvement and current student interest in engineering.

Women Engineering Conference 2021

From October 21st to October 23rd, 2021, with the support of HSI-STEM grant funding, the Vaughn College chapter of the Society of Women Engineers (SWE) attended the 2021 Women Engineers Conference in Indianapolis, Indiana. Nine members of the chapter were able to attend leadership workshops and technological sessions during the conference. SWE students also attended in-person and virtual career fairs, where they interviewed industry-leading companies such as Honeywell, Carrier, Raytheon Technologies, Accenture, and EBI. The conference was a success, with eleven internship offers given on-site and interview possibilities available both on-site and remotely during the career fair.



Seminars



The opening keynote talk of the SWE conference was presented by Stephanie C. Hill, Executive Vice President of Lockheed Martin. Hill spoke about "Bringing Purpose and Authenticity to Your Work." All members of SWE attended this unique speech. In addition, to these seminars, many members were invited to private hospitality suites. These hospitality suites were hosted by large companies such as Trane Technologies, Milwaukee Tools, Daimler, Emerson, and Eli Lilly.

Results

As seen in the chart below, a total of 11 offers for internship positions were given to the SWE members.

Company	Offers
Northrop Grumman	1
Honeywell	2
Carrier	3
OTIS Elevators	1
Corning	1
Daimler Trucks of North America	1
Trane	1
Collins Aerospace	1

Speaker events

**WOMEN'S HISTORY MONTH:
Women in STEM Panel**

Guest Speaker:
Nathalie Quintero

- Aerospace Engineer
- Systems Engineering Masters
- Test and Launch Operations
- Systems Engineer at Boeing

Join us!

Hosted by:
UPWARD BOUND
swe
CSTEP
Vaughn College

Date:
March 8th, 2022
6PM - 8PM

Zoom ID:
868 3902 2370

Part of SWE's mission is to convey the message of women empowerment. To celebrate Women's History Month, SWE, HSI-STEM, CSTEP and Upward Bound hosted a speaker's event with Nathalie Quintero.



The Chapter's goal is to highlight the importance of female representation in engineering.

The speaker was invited to share her experience as a Test and Launch Operations System Engineer at Boeing.

2021-2022 Workshops

SWE hosted professional and networking events throughout the academic year to prepare members assisting the WE21 conference, help members applying to internships through their own means, and allow SWE members to meet each other and discuss their interests and field experience. Additionally, members ask for any resume and interview tips from those who have gone through the process beforehand. Throughout the 2021-2022 year, SWE hosted a total of six workshops.

September 2021



VaughnCollege 

OPPORTUNITIES WITH THE PORT AUTHORITY

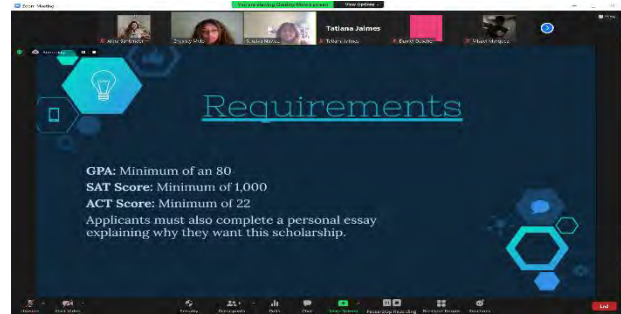
Join us to learn about career opportunities (full-time jobs and internships) at The Port Authority of NY & NJ from our panelists **Chasisty Melo** and **Suraiya Nawaz**, recipients of the 2020 Port Authority scholarship

September 28, 2021 11AM - 12PM  864 0140 0157



We hope to see you there!

Opportunities with the Port Authority: The event speakers were Chasisty Melo and Suraiya Nawaz, current E-Board members and recipients of the 2020 Port Authority Scholarship. They discussed the process involved in getting the scholarship, their internship experience over the summer, dos and don'ts when applying and interviewing with the Port Authority, day-to-day experiences in working with the company, and key takeaways for future experiences and members interested in the field.



October 2021

Career Development Skills: SWE partnered up with HSI-STEM, CSTEP, and Career Services to host this to prepare SWE members assisting the WE21 conference two weeks away. During this workshop, Philip Meade and Cecelia Izzo detailed the process of getting ready for the conference, such as how to do company research, how to dress professionally to impress, what to bring to the conference (portfolio, resume, cover letter, etc.), how to put together an elevator pitch, examples of technical and behavioral questions and how to answer them using the STAR (situation, task, action, and result) method, example questions to ask the interviewer, and overall dos and don'ts before and during the interview. The workshop was open to all SWE members and mandatory for conference attendees.



SWE

Career Skills Development

SWE, CSTEP and Career Services are hosting a career development workshops to help prepare SWE members to attend the upcoming WE21 conference

OCTOBER 5, 2021 | 11:00 AM
MEETING ID: 829 6167 5767
PASSWORD: SWE

CONTACT INFO:
ALINA SANTANDER
alina.santandervinokurova@vaughn.edu


  

November 2021



Join us to learn more about tips and tricks when building your engineering resume, keywords, organization, presentation, and more!

NOVEMBER 18, 2021 | 11AM - 12PM

 Zoom ID: 826 4558 0007

We hope to see you there!

VaughnCollege

The **Preparation Tips for Career Fairs** workshop was carried out by Misael Marquez and Daniel Doscher in which they discussed how to approach recruiters, network at conferences, and organize your days based on your company list and events/talks of interest. Additionally, they presented feedback from other attendees to demonstrate, from first-hand experiences, do's and don'ts at future conferences.



PREPARATION TIPS FOR CAREER FAIRS




Join us to learn the do's and don'ts when preparing for an upcoming career fair!

- ✓ How to approach recruiters
- ✓ How to organize your days
- ✓ How to network
- ✓ How to create your dream list



November 23, 2021 | 11AM - 11:30 AM

 Zoom ID: 894 3047 3646

We hope to see you there!

VaughnCollege

After the WE21 conference, the SWE chapter E-Board decided to give conference attendees a space to share their conference learning experiences. Two workshops were hosted for this purpose.

The **Tips for Resume Building** workshop was carried out by Cristian Sorto and Kenny Harris, where they shared tips they used to build their engineering resume, along with feedback from career services professionals and recruiters. They emphasized the importance of keywords and organization, along with how to hold a conversation based on experiences and projects through the STAR method to keep one's interview organized and to the point.

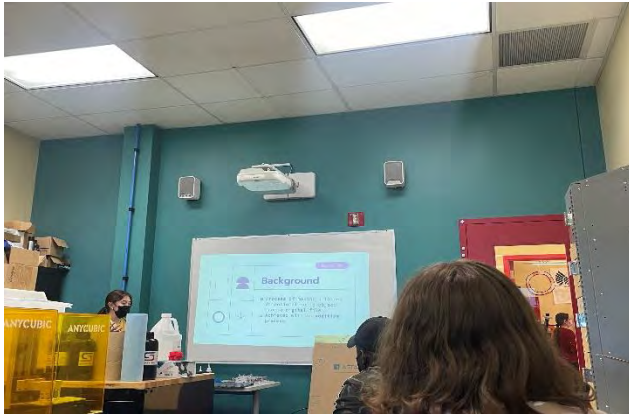
February 2022



Internship Interview Questions: This workshop was presented by the E-Board members, and the goal of the event was to allow chapter members to have a one-on-one mock interview session. During this time, members had the chance to practice behavioral and technical interview questions and to apply the STAR method to feel more comfortable and confident during real interviews. Each E-board member met with an attendee to practice questions they have been asked in previous interviews and to give feedback based on their experience.

The SWE chapter plans to host more workshops targeted to review technical questions, which differ from industry to industry.

Valentine's Day Special – Introduction to 3D Printing: This workshop was presented by



Alina Santander and Tatiana Jaimes, in which they went over the process of converting a 3D model on CAD software to a 3D part. At the end of the event, members had the opportunity to search on Thingiverse for a 3D part of interest to them, prepare it for printing (considering the printer options, filament size, fillings, and supports), and send it to the 3D printing lab to print.



Campus Involvement

December 2021

For this **Engineering Seminar Series** hosted by the Engineering and Technology Department of the college, Alina Santander and Tatiana Jaimes were guest speakers who discussed their internship experience over the summer, including their tasks and details about the project(s). Alina presented the responsibilities and tasks assigned to her as a solar and data logger for InstaHub. She detailed her day-to-day implementation of CAD software and coding to prepare a product for the company. Tatiana presented the responsibilities and tasks assigned to her as an electromechanical systems engineer at Goddard Space Flight Center, where she had the opportunity to support both OSAM-1 and HDL, a satellite refueling and a hazardous detection lidar mission, respectively.



These opportunities allowed the students to apply the skills they acquire in their engineering classes to solve real-life problems.

Other conferences



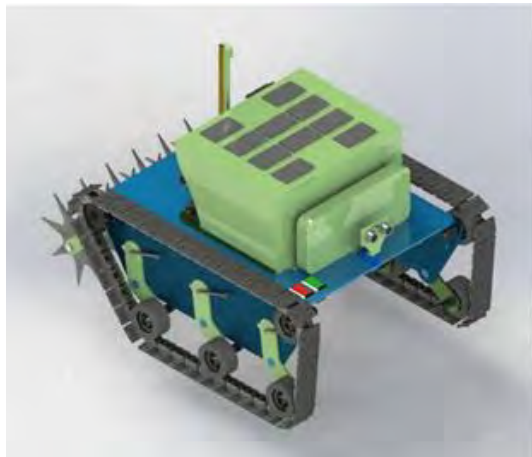
ILEW 2021: During the general body meeting hosted at the beginning of the 2021-2022 academic year, other opportunities for SWE members were presented, such as the International Latina Engineer Week (ILEW). Some SWE members, including Carla Vasquez, attended different workshops and seminars during this conference and had the opportunity to network with Latinas in the engineering industry. She authored a

report on her first experience of attending a virtual conference, and her findings helped her to be prepared for the different challenges that come when applying for internships.

Student research

SWE chapter members know the importance of taking up projects and writing papers to apply skills and learn how to express their ideas according to engineering standards.

37th Southern Biomedical Engineering Conference: SWE chapter members Alina Santander and Tatiana Jaimes, with the support of HSI-STEM, attended and presented their project at the 37th Southern Biomedical Engineering Conference in New Orleans. The conference was hosted from December 3-5, 2021. The paper was called “Braille Tech: Electromechanical Device for Inceptive Braille Learning”, and Dr. Benalla was the advisor for this paper.



LACCEI 2022: Several members of the club decided to present projects this year. Among them, Alina Santander, Tatiana Jaimes, and Cristian Sorto worked on a low-cost, multilevel agricultural robot that collects data of burnt soil in South American forests to inform about its state and to allow the user to take action to prepare the soil for replantation. From here, the supplement needed to restore the state of the soil is also distributed by the robot.

The paper was submitted to LACCEI, and the team is currently waiting for confirmation.

Future Workshops

The club plans to host a minimum of two more workshops during the Spring semester:

Raffle: SWE plans to hold a fundraising event in which raffle tickets will be chosen to attract the attention of the student body. Three lucky winners will receive prizes, which will be randomly picked by the E-board. This event will assist SWE in replenishing its funds, so that the next SWE E-board may use it.

Stem outreach – piano workshop: SWE is planning to host a STEM outreach event for middle school students in coordination with Professor Benbelkacem. The STEM outreach will include students creating an electrical piano with Arduino with basic electrical components. This

outreach event will help to spark interest towards engineering and teach simple concepts of electrical circuits.

Preparation for WE22: SWE will also be prepping for the WE22 conference, which will be held in Houston, Texas on October 20-22. To accomplish this, E-board will begin announcing the conference early in the next semester, ensuring that enough individuals will be able to attend. Following that, the SWE E-board will hold professional workshops with the assistance of career services, HSI-STEM, and CSTEP to help students prepare for the conference.



Guest Speakers: The impact of previous guest speakers was remarkably positive. SWE will invite people from engineering companies to speak about their experience. It will help people within this major to understand the work and life balance after college.

Acknowledgment



VCAT SWE is thankful for the Department of Education federal grant (Title III, Part F, HSI-STEM, and Articulation grant) which provided necessary funding support to engage Vaughn's students in STEM-related scholarly and professional activities

2021-2022 National society of Black Engineers (NSBE) Club Activities



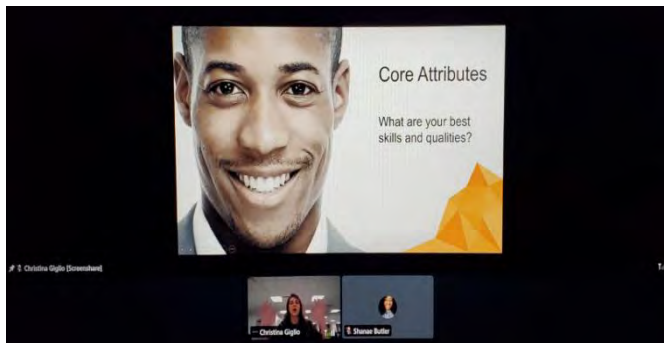
The National Society of Black Engineers is a worldwide organization geared towards the professional, academic, and social development of members. The goal of the national society of engineers is to “increase the number of culturally responsible black engineers who excel academically, succeed professionally, and positively impact the community.” To promote these developments, our organization hosts and organizes a series of events yearly. These events include webinars, workshops, career fairs, conferences, and conventions where members can be exposed to many enrichment activities. During each of these events members are exposed to multiple industry connections and internship

opportunities that will help them on their path to becoming successful engineers.

Vaughn College’s chapter of The National Society for Engineers, established in February 2017, also provides development opportunities to continue in alignment with the goals of the organization. Although our organization aims for the development of Black engineers, our club is open to individuals of all ethnicities who are interested in gaining valuable experiences throughout their career path. During the 2021 – 2022 year, our chapter has continued to collaborate with other regional chapters and has organized several events and activities to help our members gain necessary skills and talents they need on their path to becoming professionals. Most events were held online without in person interactions, however with continuous support from the college and with the extraordinary efforts of our club’s leadership we were still able to conduct effective, enjoyable events beneficial to members and nonmembers alike.



Conference Preparation Workshop – October 2021



In alignment with our goal of professional development and in preparation for NSBE’s Fall Regional Conference, NSBE held a workshop where our E-Board members spoke with conference attendees and club members about prior conference experience. The guest speaker of this workshop was Christina Giglio, who did a presentation on how to polish our brands. This workshop centered around how to

present ourselves to employers and how to give an accurate representation of who we are as well as which skills we show to recruiters. This workshop taught attendees the basic and necessary

skills, verbal and written, to communicate effectively to obtain the job or internship they are seeking.

Region 1 Fall Regional Conference – November 2021

This regional conference was held in the fall on November 17th through 20th 2021 and was fully virtual. Thirteen of our members attended this conference. The conference featured a variety of workshops and industry connection events; members were also exposed to career and internship fairs where companies were actively seeking potential candidates. This conference provided an opportunity for individuals to speak one-on-one with local professionals from the engineering businesses. The goal of the conference was to enhance and develop the potential of members to become leaders in industry and in the community. Pepsi.co held a thrilling seminar to start the conference. Employee Elizabeth Shokunbi presented at the seminar, and she spoke about increasing diversity in the engineering field and ethical behavior in the workplace. As a result of attending this conference, six of our members received interviews and internship offers from companies including: General Electric, Schneider Electric, Dell inc, Teradyne and Amazon.



48th National NSBE Convention – March 2022

The 48th National Convention will be held in Anaheim, California on March 23-27, 2022. This event is a hybrid convention whose theme is “NSBE 48: Inspiring Engineers” and will feature many workshops, seminars, and networking events where attendees will have opportunities to connect with professionals and to improve their chances of securing an internship and job. This conference will have NSBE’s largest career fair and will feature over 150 companies who are actively recruiting. Our club will be sending eight passionate members who have been dedicated to preparing for this convention.



Acknowledgement

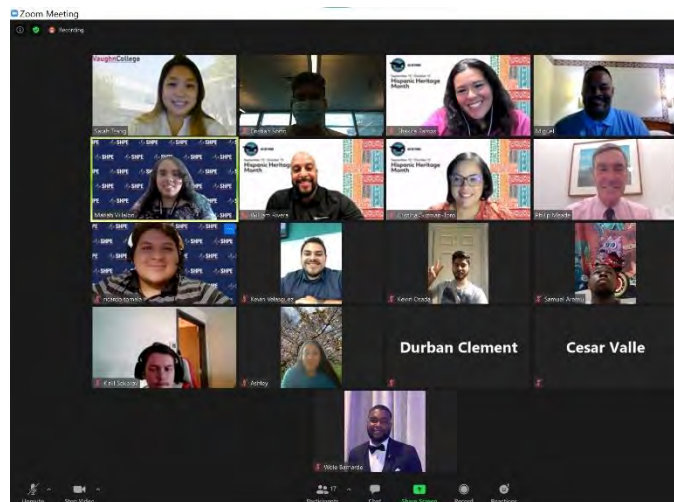
Vaughn College’s NSBE chapter is thankful to the Department of Education federal grant (Title III, Part F, HSI-STEM and Articulation grant) which provided necessary funding support to engage Vaughn's NSBE students in STEM related scholarly and professional activities.



2021-2022 Society of Hispanic Professional Engineers (SHPE) Club Activities

Alumni Meet and Greet [July 2021]

This was the first event this new term’s executive board hosted in collaboration with SHPE Alumni. This was a social event held at Sunken Meadow State Park in Long Island. We had a fantastic time catching up with the alumni and learning what was happening in their lives after graduating and making the transition into the professional engineering industry. Everyone in attendance brought food and drinks for all to enjoy. While the social event was far rather away, it was still a success and a wonderful experience for everyone who was in attendance.



Pratt & Whitney Panelist [Oct. 2021]

For Hispanic Heritage month this year, SHPE hosted a panelist with the help of Career Services and Sarah Tsang. The SHPE executive board introduced themselves and invited the panelists to introduce themselves and to ask questions. The Pratt & Whitney panelist explained to Vaughn College students the importance of understanding the work/life balance.

Manufacturing Day [Oct. 2021]

At the start of fall semester, with the support of HSI-STEM, the college hosts a schoolwide event in which clubs and chapters hold presentations describing their organizations, as well as a STEM related workshop. For the most recent Manufacturing Day, the president and vice president of the chapter gave a presentation about the SHPE chapter. While the treasurer and secretary, along with two other chapter members, held a workshop to educate the student body in cryptocurrencies and blockchain technology.



SHPE National Convention Readiness [Oct 2021]

With the funding support of HSI-STEM, the Vaughn College SHPE Chapter attended the 2021 Regional Leadership Development Conference in Orlando, Florida from November 10th to November 14th. To prepare all the Vaughn SHPE Chapter attendees, the executive board hosted several convention readiness workshops explaining the importance and format of essentials such as professional engineering resumes and project portfolios. In addition, the board provided mock interview practice. Resumes were revised to be clear and concise and to highlight the experiences of each attendee. The sessions were held virtually over zoom to ensure better attendance by all the members selected for the conference; some workshops were cohosted by SHPE alumni and members to share their experiences in engineering careers.

SHPE National Convention [Nov. 2021]



The Society of Hispanic Professional Engineers (SHPE) is an excellent opportunity for students to develop networking, soft skills, and leadership abilities. The SHPE National Convention is considered the most technical and career-focused conference for professional development. In addition, the members who attend can gain the opportunity for an interview which could provide

either an internship or full-time position. The Vaughn College SHPE chapter is beneficial for future members interested in joining the chapter and attending the conference. The chapter provides networking opportunities, professional skills, and hands-on experiences.



Nissan Design Challenge Finalist [Nov 2021]



The November 2021 SHPE National Convention held various engineering challenges, such as hackathons, design challenges, and cyber security challenges. Two-chapter members participated in the Nissan Design Challenge, sponsored by Nissan. Chapter member Kevin Kenta Osada participated in Team 4 and won 2nd place for their idea and design for technology that integrated controls and weight sensors to monitor child safety seats. This idea satisfied the challenge in which each team had to design a solution to improve child safety in modern vehicles.

Innovation Challenge Finalist [Nov. 2021]



Members attending the 2021 SHPE National Convention had been asked to participate in the SHPE Innovation challenge. This is a hackathon event hosted by the national SHPE organization with sponsors from companies such as Boeing, Walmart, and Rockwell Automation. The event is structured by randomly assigning all the participants into groups of three to five members and they have 48 hours to complete the challenge of making a prototype along with a three-minute presentation of a solution to a problem in at least one of the three categories of safety, sustainability, and profitability. One of the

members from the Vaughn College SHPE Chapter, Kirill Sokolov, earned 3rd place, with a reward of \$2,000 to be split amongst the team members. This outcome will serve to encourage attendees of the 2022 SHPE National Conference to also participate in the Innovation Challenge and join the Vaughn SHPE Chapter.

Blockchain and Cryptocurrency Workshop [Dec. 2021]



The Blockchain and Cryptocurrency Workshop was one of the STEM workshops introducing and further elaborating on an upcoming technology called blockchain and its contextual background for cryptocurrencies. The workshop was to explain the fundamental concepts making it unique and the potential for many career opportunities which will result from its progress. The presentation was hosted in person on campus and on zoom with a webcam available to present a real cryptocurrency mining rig for Ethereum. Some attendees were new to the topic and some had some background or were already mining themselves. Further workshops are planned for the spring 2022 semester to go further in depth with topics of interest surveyed from the first workshop.

SHPE Paint Night [Feb. 2022]

SHPE Paint Night was one of many planned in person events of the spring semester. This event involved 3D prints that came in various designs like astronauts, a rubber duck, a butterfly, and a shark. The 3D prints were made with the assistance of the UAV club and 3D printing lab, as well as the use of personal printers. The event was held in the downstairs cafeteria and was RSVP. This event was very successful, with all reserved members at attendance and more who arrived to simply spend time and enjoy pizza while listening to classic Latin music.



RLDC 2022 Convention Readiness [Mar. 2022]



The Vaughn College SHPE Chapter will be attending this year's Regional Leadership Development Conference (RLDC 2022) in Albany, NY from March 17th to March 20th. In preparation for the conference, the executive board prepared multiple workshops and held two in-person sessions. Workshops primarily focused on resume and portfolio building, along with a convention readiness presentation. The in-person sessions were a follow-up to resume building and mock-interviews, with assistance from Donald Jimmo of the Writing Center and members of the VCAT Robotics team respectively.

HSI-STEM Grant Activities



Through “Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students,” Vaughn College continues to develop a much needed pathway for Hispanic students to increase accessibility to the College’s engineering degree programs. Project goals include:

1. Close academic achievement gaps where students are at high risk of failure or withdrawal, including increasing the percent of Hispanic and low-income students who participate in grant-supported services or programs and who successfully complete gateway courses, and increase the percentage of Hispanic and low-income students who participate in grant-supported services or programs and who are in good academic standing
2. Expand focus on persistence to include the development or redesign of instructional programs and support strategies that facilitate Hispanic and low-income student transition through upper division studies in high demand STEM fields.
3. Strengthen college capacity for offering opportunity equity for all students, through stronger outreach to high school and community college students.

Progress Summary: We are pleased with the noteworthy progress made toward meeting overall goals and objectives, including steady increases in enrollment in STEM related programs. The Engineering and Technology department is making considerable progress toward implementation of those goals. Below are current initiatives the College is implementing to attain those goals:

- **Supplemental Instruction - SI and Mentoring** group is a student academic assistance program that increases academic performance and retention through the use of collaborative learning strategies. The SI program at Vaughn targets challenging mathematics, engineering, and physics courses and provides regularly scheduled, out-of-class, peer-facilitated sessions that give students the opportunity to process the information learned in class. Supplemental instruction is a proactive approach to student learning and engagement which increases student persistence and retention.

Under the college’s current Title III grant, Vaughn assigned ten to fifteen SIs in fall 2021 and spring 2022 to assist and improve students’ performance through fundamental engineering and engineering technology related courses. In January 2022, the Project Director of HSI-STEM with the assistant of success center coordinator emailed a rubric survey to students who received help from supplemental instructors (SI) during the fall 2021 semester. As a summative evaluation, we used survey results and students’ comments to assess the impact of SIs on students’ performance and attainment of student outcomes through courses within STEM programs. Overall, 100% of students who responded, rated all questions related to supplemental instructions as good to excellent to improve student learning within STEM courses.

Also, Vaughn’s two writing specialists in the Teaching and Learning Center (TLC) assisted many students with their capstone degree projects, technical writing and presentation. As a result of this program, some of our students’ research projects were accepted for publication and presentation in technical conferences such as Southern

Biomedical Engineering Conference, Latin American and Caribbean Consortium of Engineering Institutions, and Society of Hispanic Professional Engineers (SHPE) (**attaining goals 1 & 2**).

- **Recitation Problem Solving Session** - In an effort to increase learning effectiveness for incoming freshmen and community college transfer students, the engineering and technology department with the support of supplemental HSI-STEM title III grant is establishing a formal Virtual recitation Problem Solving session that increases academic performance and retention through the use of collaborative learning strategies. The Virtual Problem Solving program at Vaughn targets challenging mathematics, physics, engineering, and engineering technology courses and provides regularly scheduled, peer-facilitated sessions by faculty that gives students the opportunity to process the information learned in class and improve their problem solving skills. The main objective of this program is to enhance student performance and learning in STEM related fields to increase student persistence and retention (**attaining goals 1 & 2**). In early January 2022, PD emailed a rubric survey to faculty to measure the effectiveness of recitation sessions in fundamental STEM courses. As a summative evaluation, we used recitation survey results and faculty comments to assess the impact of recitation sessions on students' performance and attainment of student outcomes through courses within STEM programs. Overall, based on a summative evaluation, 80% of students who were in failure risk were able successfully to pass those courses.
- **Student Engagement** - The College's current Title III grant (P031C160021) provided additional funding support to further expand student involvement in STEM related scholarly and practical hands-on activities. This includes student engagement in paper and poster session competitions of technical conferences (LACCEI, AIAA, SWE, and SHPE) as well as their involvement in robotics and UAV club activities and competitions. As a result of this program, Vaughn's engineering students participated and presented their research papers in the 2021 LACCEI International Virtual Conference and received the third place award for the student paper session competition of this international virtual conference. Three groups of Vaughn's engineering students participated and presented their papers in the 37th Southern Biomedical Engineering Conference. Vaughn College's Robotics team participated at the WPI VEX U Tournament. Vaughn's team finished 1st in "Robot Skills." With this win, the team is currently ranked 3rd in the world in "Robot Skills. The team also won the Excellence Award which qualifies them to participate in the 2022 World VEX U Robotics Championship. Vaughn's SHPE student chapter participated in the 2021 Society of Hispanic Professional Engineers (SHPE) Conference, and Vaughn's students participated in innovation, Nissan Design, and Extreme Engineering challenges as well as various professional development workshops that aimed to promote leadership, unity, and expose them to the diverse career opportunities in the STEM fields. Vaughn's student, Kevin Kenta Osada, won **second place in the Nissan Design Challenge** and Kirill Sokolov won **third place in the Innovation Challenge** of the SHPE national Conference. The Vaughn College chapter of the Society of Women Engineers attended the 2021 Women Engineers (SWE) Conference (**attaining goals 1 & 2**).
- **Outreach** - For the academic year 2021-2022, students in Vaughn's technical clubs (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE,

EWB, NSBE, and SHPE) organized and hosted several STEM related workshops for middle school, high school, and community college students during Vaughn's Annual Manufacturing Day and Vaughn's Annual STEM Day. They also provided assistance to many high schools to host their regional robotics and drone competitions. Vaughn's UAV team continually assists the Cradle of Aviation Museum in developing and hosting drone awareness events and games for high school students. The Project Director of HSI-STEM along with faculty attended some of these events to increase awareness about Vaughn's engineering programs (**attaining goal 3-outreach**).

➤ **Advanced Manufacturing Training and Workshops:**

1. **STEM Pathway Workshop:** On Friday, April 9, 2021, the department chair along with faculty, lab techs, and STEM pathway Liaison hosted its **3rd annual STEM Day workshop** for community colleges and high schools students. The participants of Vaughn's STEM Day virtual workshop event were students and faculty from Passaic CC, Queensborough CC, Bergen CC, Aviation High, and Humanities & Arts high school. For these virtual events, Vaughn's STEM Liaison and 3D/CNC curriculum developer, Prof. Manuel Jesus, introduced participants to Vaughn College's program offerings in engineering and engineering technology disciplines as well as student involvement in various STEM related clubs and professional activities. Prof. Jesus, provided participants with a video tour of Vaughn's 3D Makerspace and CNC manufacturing centers. Finally, department hosted virtual STEM workshops related to 3D Scanning, CAM and CNC, and Virtual Reality
2. **13th Annual Technology Day Virtual Conference:** On Friday, May 28, 2021, the Engineering and Technology department chair together with the 3D/CNC curriculum designer hosted the Thirteenth Annual Industry Advisory Meeting and Technology Day Conference. In this virtual conference, Dr. Rahemi, updated Advisory Council members on recent developments in the Engineering and Technology Department, such as the fall 2020 EAC-ABET virtual visit for the purpose of initial EAC accreditation of ME and EE programs, HSI-STEM grant activities including the development process of stackable manufacturing certificate programs in CNC machining, Composite, and 3D additive and subtractive manufacturing and UAS design, the application and operation as well as establishment of manufacturing centers (CNC machining, composite, additive manufacturing, and PLC & automation), and UAS) to support courses within these certificate programs. The PD updated advisory members on grant-supported STEM activities and student engagement and outreach activities. Each technical club (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE, SHPE, and NSBE) provided their annual activities and accomplishments to the audiences of the 2021 Virtual Tech Day Conference, and finally capstone degree presenters talked about their innovative research project. The top 3 research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper awards of this session. In conclusion, Dr. Rahemi, congratulated all the capstone paper and technical club presenters.
3. **7th Annual Manufacturing Day Virtual Conference:** The Engineering and Technology department chair and Title III HSI-STEM project director together with the 3D/CNC curriculum designer hosted the 7th annual manufacturing day conference

on Friday, October 29, 2021 (10 am to 1 pm) to celebrate national Manufacturing Day. The guest speakers addressed Vaughn community, faculty, and invited guests about manufacturing innovation in the manufacture of surgical masks, OT Cyber Security & Artificial Intelligence, Autonomous Mobile Robots, AM in Electronics, 3D Scanning and Precision measurement tools, and Virtual Reality in aerospace and manufacturing industries. In a parallel session, from 10 am to 1:00 pm, Vaughn's Robotics and UAV clubs organized and hosted virtual STEM workshops for the high school students. These workshops covered the following items:

- ✓ Robotics Workshop - Robotics design & autonomous programming for the 2021 VEX U Robotics Competitions
- ✓ An informational session about the basics of drones and the design considerations
- ✓ Drone Autonomous Programming using Mission Planner software

These workshop sessions were conducted in both in-person and virtual zoom meetings.

- **Stackable Certificate Programs:** In the fall of 2020, the grant management team was able to complete and submit the UAS certificate program to NYSED for their review, and in January 2021 this certificate program received NYSED approval.
 - ✓ **UAS Certificate Programs:** In January 2021, the UAS certificate program received NYSED approval. This certificate program has 5 courses and 13 credits. The following courses are part of this certificate program:
 - UAS200 – Introduction to Unman Aerial Vehicles (Design, Operation, and system architecture for UAS), 3 Credits
 - UAS220 - **Drone Laws and Remote Pilot Certification**, 3 Credits
 - UAS231 - Introduction to Drone Aerodynamics, 3 credits (2 credits lecture & 1 credit Lab)
 - UAS241 - Drone Application – Lan Surveying , 2 Credits (1 credit Lecture & 1 credit lab)
 - UAS251 - Drones Rapid Prototyping and System Integration, 2 Credits (1 credit lecture & 1 credit lab)

In addition, during the academic years 2017-2018 and 2018-2019, the grant management team and the PD completed two certificate programs in **1) 3D Additive & Subtractive Manufacturing** **2) Composite Design & Manufacturing.** **3) CNC Machining and Manufacturing**, and all certificates received approval from the NY State Department of Education.

- **Laboratory Development:** With the support of the HSI-STEM grant, the Engineering and Technology Department established four new state-of-the-art facilities: 1) the Composite Manufacturing Center, 2) the CNC Machining Center, 3) the 3D Additive & subtractive manufacturing center, and 4) the UAS Center. During the academic year 2021-2022, HSI-STEM grant funding support allowed the department to make further enhancements to these manufacturing centers. In the 2021 academic year, the department completed the purchase of the following laboratory equipment:

1. **HASS Desktop Mill Trainer:** A HAAS Desktop Mill Trainer. The HAAS CNC Desktop Mill is an educational version of the popular HAAS VF2 SS CNC and

MCU control system. It allows instructors to teach the HAAS CNC MCU (Microcomputer / Machine Control Unit) interface to students in a lecture / lab classroom environment before moving on to the full-size industrial HASS VF2 SS milling machine (\$12,694.75).

2. **3D Scanner for Additive manufacturing Center:** This state-of-the-art metrology grade 3D scanner will be used for precision measuring alongside our CMM station to inspect production CNC parts and 3D scan parts for reverse engineering (\$18,849).
3. **Magics Additive Manufacturing Software Licenses:** the Magic Additive Manufacturing Software license is used in CDE375 and the 3D Printing Lab for manufacturing related courses and activities (\$3,154).
4. **PLC Lab Equipment:** These 20 units of SIMATIC S7-1200 PLC equipment will provide students with more relevant hands-on knowledge in how new PLC automation systems and programming are developed to facilitate engineering processes (\$10,175).
5. **Non-destructive Lab Equipment:** The Olympus Imaging Flaw Detector, Digital Ultrasonic Flaw Detector, and other Non-destructive equipment will provide students with more relevant hands-on knowledge in mechanical testing and evaluation (\$29,997.24).
6. **METAL X 3D Printer:** A METAL X 3D Printer will provide students with hands-on knowledge in additive and subtractive manufacturing (\$205,000),
7. **Vericut CNC Software:** Vericut CNC software is used in high end aerospace manufacturing as a safe method to debug and troubleshoot CNC programs. Most importantly Verticut is an important tool for safety in modern machine shops where program verification is used to prevent tool breakage, machine damage, or injury to machine operator (\$2000).

This laboratory equipment allows Vaughn to provide students with practical STEM hands-on training in CNC, Composite, UAS, and 3D additive and subtractive manufacturing on equipment current with today's manufacturing industry standards.

➤ **Students' accomplishments and success:** Below is a list of student accomplishments and successes that are a direct result of the current HSI STEM grant and its implementation process:

1. The Vaughn College robotics team participated in numerous local, state, and world championships events winning or placing high in all of them. Vaughn's robotics team has been a great outreach tool, as well as a great intervention to increase engineering student retention and success.
 - From June 26-27, the department chair and six members of Vaughn's Robotics club traveled to Greenville, Texas to participate in the 2021 VEX U Robotics World Championship. Forty one (41) national and international universities and colleges were invited to the 2021 World Robotics Championship. Invitation to the VEX U Robotics World championship was only granted to a team that is a tournament champion or excellence award recipient of a regional competition. The VEX U Robotics Championship was

an intense two day competition where our team continuously modified their robots and autonomous programming to be competitive with other top teams in this tournament. Vaughn's team finished 6th place overall and 3rd place in Robot Skills ranking, and they retained their standing as one of the top ranked competitors in the 2021 VEX U In-Person Robotics championship.

- On Sunday, January 30, 2022, Vaughn College's Robotics team participated at the WPI VEX U Tournament. Vaughn's team finished 1st in "Robot Skills." With this win, the team is currently ranked 3rd in the world in "Robot Skills." The team also won the Excellence Award which qualifies them to participate in the 2022 World VEX U Robotics Championship.
- On Sunday Feb 13, 2022, the PD and faculty along with Vaughn College Robotics team hosted its Eighth Annual VEX U College Regional Robotics Tournament. A total of nine teams participated in this regional robotics competition. Vaughn's team finished 1st in overall ranking and won the 2022 VEX U Skill Challenge, Tournament Finalist, and Excellence Awards, as well as qualification to participate in the 2022 World VEX U Robotics Championship.
- **Robotics Outreach Activities:**
 - ✓ On December 10th, 2021, seven members of Vaughn College engineering students with their faculty mentor traveled to Thomas A. Edison High School and presented several topics related to college experiences, competition experiences, robot experience, as well as a robot competition demo where the students were allowed to operate the robots under the team's supervision.
 - ✓ On Saturday, February 5th, 2022, Freeport High School hosted its regional state qualifier robotics completion, and more than twenty-four regional high schools and middle schools participated in this competition. Six members of Vaughn's robotics team, along with two faculty members, participated in assisting Freeport High School with this regional robotics tournament. Vaughn's faculty and students served as judges, referees, and announcers for this regional high school robotics competition
 - ✓ The PD, Faculty, and Vaughn Robotics team assisted Vaughn College in hosting its eight annual state qualifier high school robotics competition on Saturday February 12th, 2022. A total of 25 regional high schools from Queens, Brooklyn, Bronx, Nassau, and Suffolk and other NY counties attended the February VEX state qualifier at Vaughn College. Nine members of Vaughn's robotics team, along with three faculty members served as referees, event planner, announcers, and judges for this regional High School tournament.

- ✓ Vaughn's Robotics team hosted a robotics workshop for community college students during Vaughn's Annual STEM Day Workshop on Friday April 8, 2022.
 - ✓ On December 11th, 2021, Vaughn College hosted VEX Robotics High School VRC tournament in which 22 teams from Queens, Nassau, and Suffolk County, as well as others from Massachusetts participated. The teams competed in the tournament and skills competition, where the top competitor qualified for the state championship. Members of Vaughn's robotics team, along with two faculty members, served as referees, event planner, announcers, and judges for this VRC regional tournament.
2. Since 2016, the Vaughn College UAV team participated in the Micro Air Vehicle completion of the Vertical Flight Society (VFS) Conference and has won top place in the MAV student challenge and Design-Build-Vertical Flight competitions.
- Vaughn's UAV team project was selected as one of the finalists along with Penn State, Ohio State, Oregon State, University of Michigan, and University of Maryland for the Virtual Design-Build-Vertical Flight Competition on Friday April 16, 2021. Vaughn's UAV Team developed a drone to compete in both the manual and autonomous categories. The drone was designed to perform vertical takeoff & landing (VTOL) with onboard flight-stabilization and camera. Among all participating teams, Vaughn's UAV team was recognized by Boeing for having a compact design and being able to have a great lift capacity with the given design. Judges awarded Vaughn's UAV team with an **“Honorable mention with the *Most Manufacturable Award*”**. This is the fourth year in a row that Vaughn's UAV team has won the top award in the challenging VFS competition.
 - **UAV Outreach Activities:**
 - ✓ Since 2016, Vaughn's UAV team assisted the **Cradle of Aviation** Museum with drone awareness events, games, and workshops for middle school and high school students. On Saturday, February 27th, 2022, Vaughn's UAV team organized and hosted its third annual “Community Outreach Drone Awareness and Tiny Whoop Race” event at the Cradle of Aviation Museum. The event was free and open to the community. Many drone hobbyists and FPV pilots, as well as the locals from the area, attended this event.
 - ✓ Since 2015, Vaughn's UAV team hosted several STEM workshops for High School students on learning how to build a drone, along with a drone flying session in Vaughn's hangar during **Vaughn's Annual Manufacturing Day conference**. On October 29, 2021, Vaughn's UAV team hosted a Virtual drone workshop for High School students during the 7th annual Manufacturing Day conference.

- ✓ Since 2016, Vaughn's UAV team organized a day of drone workshops related to Arduino Programming, CAD Modeling of Quadcopters, and Learn to Build a Drone to celebrate **International Drone day**.
 - ✓ Vaughn's UAV team hosted a drone workshop for community colleges and high schools students during Vaughn's Annual STEM Day Workshop on Friday April 9, 2021.
3. **LACCEI 2021 International Conference:** From July 19-23, Vaughn's engineering and technology students, along with Dr. Hossein Rahemi, department chair and the PD of HSI-STEM, attended the LACCEI 2021 Virtual Conference. Two Vaughn student team research papers were accepted for presentation and publication in the LACCEI 2020 international conference. Both Vaughn student papers listed below were selected to compete among ten finalists for the student paper session as well as the student poster session of LACCEI 2021.
- ✓ **"Intelligent Robot Design for VEX U Skills Challenge"** by Misael Marquez
 - ✓ **"BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy"** by Tatiana Jaimes, Alina Santander Vinokurova, August Rodriguez.

From 11 am to 1 pm on Wednesday, July 21, two of the student team papers listed above were presented to the international conference audience during the student paper session of LACCEI 2021. Vaughn's student paper **"Intelligent Robot Design for VEX U Skills Challenge"** and presentation by Misael Marquez that covered the design, manufacturing, and development process of a robot as well as autonomous programming for VEX U skills challenge won **third place award of 2021 LACCEI student paper session competition**. Also, from 2:30 pm to 4:30 pm on Tuesday, July 20, both of Vaughn's student team projects were selected as finalists for the LACCEI 2021 Virtual poster session competition.

4. **2021 Southern Biomedical Engineering Conference:** From December 2-5, four Vaughn engineering students, Alina Santander, Tatiana Jaimes, Aaron Arana, and Mariah Villalon, along with Dr. Hossein Rahemi, engineering department chair, and engineering faculty, Drs. Mohammed Benalla, Shouling He, and Prof. Khalid Mouaouya participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA. Three Vaughn student team research papers were accepted for publication and presentation in this annual gathering. Vaughn's student papers, as listed below, were presented at the 37th Southern Biomedical Engineering conference on Saturday, December 4th from 2:15 AM to 2:45 AM

In addition to the above accomplishments, because of the HIS-STEM grant, many of Vaughn's students were able to participate in scholarly activities and student paper and poster sessions in regional, national and international conferences and competitions (ASEE, LACCEI, SWE, ASME, SHPE, and IEEE) and receive top ranking in those events. Also, the HSI STEM grant provided necessary funding support for clubs such as SWE, EWB, SHPE, and NSBE for students to be involved in professional development, activities, and STEM related workshops at Vaughn College. The Student engagement section of the VCJET journal provides more details regarding these activities, student successes, and accomplishments.

List of 2021 Placement Activity

The following table provides graduate career placement statistics within the Engineering and Technology Department for the 2021 calendar years. This can be used as an indicator to evaluate the effectiveness of the program in producing graduates who are sought by the general engineering industry and by graduate schools. During the academic year 2021, our students obtained internships and accepted employment at several corporations, including Boeing, GE, NASA, Raytheon, Tesla, Space X, Department of Defense, Daimler, Sikorsky Aircraft, Marotta Controls, Brookhaven National Lab, General Dynamics, Toyota, Siemens, Cummins, Northrop Grumman, Lockheed Martin, Easy Aerial, Pratt and Whiney, John Deere, Rolls-Royce, Volvo, Stryker, Magellan Aerospace, SciMax Technologies, Collins Aerospace, FAA, Safe Flight Instruments, CPI-Aero, Cox & Company, Cyient, and many others. These corporations have employed our graduates as mechanical engineers, design engineers, mechatronics engineers, control engineers, structural engineers, avionics engineers, and project engineers. The department of engineering and technology views such placements as a strong indicator of our students' value to the industry and of our programs' success in meeting our objectives.

Student Name	Program	Internship	Industry	Graduate School
Deno Jordan	Electrical Eng.		GE - Edison program, Summer 2021	MS, EE U. of Kuntucky
Jeffery Apau	Electrical Eng.		Air Force, Sum 2021	
Hassan Saleh	Electrical Eng.		Digatron Power Electronics, Inc, Fall 2020.	
Wole Barnarde	Electrical Eng.		Delta, Summer 2022	
Tika Tamang	Electrical Eng.		AT&T, Summer 2022	
Joan Crus	Mechanical Eng.		Space X, Spring 2021	
Peter Kalaitzidis	Mechanical Eng.		Easy Aerial, Inc.-2020 New York Power Authority, Sum 2021	
Rafacely Brito	Mechanical Eng.		ARUP, Spring 2022	
Olaitan Hammed	Mechanical Eng.		Turner Construction Company, Summer 2021	
Cesar Valle	Mechanical Eng.		Snake Tray, Spring 2022	
Kevin K. Osada	Mechanical Eng.		Nissan, Spring 2022	
Samia Oishi	Mechatronic Eng.	Kinetic Communities Consulting, Summer 2019,	Kinetic Communities Consulting,, Summer 2021	
Tatiana Jaimes	Mechatronic Eng.	NASA, Summer 2021		
Alina Santander	Mechatronic Eng.	InstaHub, Summer 2021		
Daniel Doscher	Mechatronic Eng.	Colins Aerospace, Summer 2021 and 2022		
Kang Jiang	Mechatronic Eng.		ArcBest Technologies, Sum 2022	
Kastronepaul Thevasahayam	Mechatronic Eng.	Pratt & Whitney, Sum 2020	Raytheon, June 2021	
Manolo Duenas Benavides	Mechatronic Eng.	KG Computech, Sum 2020	RevolutionNice-Spring 2022	
Samantha Vitez	Mechatronic Eng.	NASA propulsion Lab – Summer 2018	Department of Defense, Spring 2022	
Jason Becker	Mechatronic Eng.	EJ Electric - Sum 2017 Brookhaven National Lab-	Brookhaven National Laboratory, Feb, 2021	

		Sum 2019		
Norrin Abreu	Mechatronic Eng.		ArcBest Technologies, Fall 2021	
Fabian Lituma	Mechatronic Eng.	Eagle Technologies	Summer, 2021	
Timothy Tullio	Mechatronic Eng.		Marotta Controls, Summer 2021	
Atif Saeed	Mechatronic Eng.	Lockheed Martin, Sum 2019	Lockheed Martin, Sum 2020 Space X, Summer 2021	
Aaron Arana	Mechatronic Eng.		RCM Technology, October 2021	
Kenny Harris	Mechatronic Eng.	Northrop Grumman, Sum 2022		
Pablo Mauricio Guzman-Moumtzis	Mechatronic Eng.		Magellan Aerospace, Spring 2022	
Chasisty Melo	Mechatronic Eng.	Carrier, Summer 2022		
Misael Marquez	Mechatronic Eng.		ArcBest Technologies, Sum 2022	
Tiffany Zavala,	MET-CAD		Cyient, Summer 2021	
Arafat Ibrahim A Ali	MET-CAD		Misfat Consultant Services, Spring 2021	
Marino Rodriguez	MET-CAD		GE Healthcare, Summer 2021	
Shorfuddin Chisty	MET-Aero		Sensitron Semi-Conductor, Fall 2021	
Ahmed Farghaly	MET-Aero		CYIENT, Summer 2021	
Ousmane Thioune	MET-Aero		Material Handling Systems, Spring 2021	
Saminul Chowdhury	MET-Aero	General Dynamics Electric Boat, Sum 2019 & 2020	General Dynamics Electric Boat Feb 2021 – Structural Engineer	
Kastrinpaul Thevasahayam	MET-Aero	Precision Gears Inc., January 2021		
Maharshi Patel	MET	NASA-L'Space NPWEE Participant, Sum 2020	Mametuchen Fist Aid, Fall 2021 Stryker, June 2022	MS Biomedical Engineering, Cornell
Hugo Arias	BS EET		Engineering Services FAA, Spring 2022	
Jenfhy Diaz	AAS - Avionics		MTA, Summer 2021	
Ashley Nunez	BS EET-Avionics		Engineering Services FAA, Spring 2022	
Eben Rockwell	BS EET	L3Harris, Fall 2021	L3Harris, Summer 2022	
Wei Zhao	BS EET		Engineering Services FAA, Spring 2022	
Robert Silver	AAS - Animation and Digital Technologies		NavAir, Summer 2021	

SAD: Slice and Dice

Jack Sze

Mechatronic Engineering, Vaughn College, Flushing, NY | jack.sze@vaughn.edu

Kang Jiang

Mechatronic Engineering, Vaughn College, Flushing, NY | kang.jiang@vaughn.edu

Wiktor Harkot

Mechatronic Engineering, Vaughn College, Flushing, NY | wiktoria.harkot@vaughn.edu

Faculty Advisor: Shouling He

Engineering Department, Vaughn College, Flushing, NY | shouling.he@vaughn.edu

ABSTRACT

This project aims to apply mechanical and electrical engineering concepts to design a kitchen appliance named the Slice and Dice (SAD). SAD's design revolves around the application of acquired knowledge of engineering standards, constraints, and mathematics to try and draft a product capable of being a staple kitchen appliance that can cut ingredients in various patterns. This design process focuses on developing original engineering solutions with an emphasis on experimentation and rapid prototyping. Using a touchscreen LCD, users will be able to select blade patterns corresponding to how they want their ingredients sliced or diced. The process of blade swapping is otherwise an automated, internal system that minimizes user exposure to health hazards and expands the marketable consumer base.

1. INTRODUCTION

In engineering, an emphasis is placed on making life simpler through efficiency with new innovations. The backbone of engineering education orbits the physical and mathematical notions that enable this efficiency. SAD incorporates real-life production solutions by applying engineering automation ideas with tools available to everyday individuals.

1.1 OBJECTIVE

The central objective in SAD's conception is the gain of practical design experience through product construction and prototyping to ultimately create a product that benefits individuals through aiding in raw ingredient processing at a household or individual scale, while minimizing user interaction. This appliance seeks to meet all relevant engineering standards and safety requirements to create an automated slicer that employs a circular slicing disk, linear plunger, and automated blade swap process.

2. BACKGROUND STUDY

In brainstorming for SAD, research was conducted to ensure that SAD fills a marketable niche not yet occupied. This means a niche in which products service the needs of individual or household-minded consumers.

A common appliance similar to SAD is the Anescra meat slicer [1]. This appliance slices meat by utilizing a human operator. SAD distinguishes itself from Anescra in three ways. First, SAD

applies to produce as opposed to meat. Second, SAD does not require constant user interaction with bladed tools during operation. Third, SAD possesses an automated blade swapping mechanism that eliminates the need for Anescra's manual equivalent. These differences theoretically make SAD a safer product with better output consistency, which is relevant in recreating recipes.

Not only is the Slap Chop unable to slice lengthwise, but the size of the tool is highly limited and difficult to scale due to the grid mesh of blades creating an exponential gain in surface area with increases in tool size. This difficulty, coupled with its need for manual operation by force delivered through an individual's hand, limits its usable demographic. SAD, on the other hand, performs slicing tasks for the user by motor and is thus suitable for those otherwise physically disadvantaged.

2.1 MARKETPLACE REQUIREMENTS

To be a viable, competitive product, SAD must meet several requirements. SAD should be relatively cheap compared to similar products at around \$300 or less, although those products lack SAD's safety and automation considerations. SAD should be of a size and weight suitable for typical household countertops as a fixed appliance and operate in expected ambient conditions. Given the marketable demographic, control of SAD should be straightforward and intuitive, while operation itself should be efficient or comparable to a human operator.

2.2 ENGINEERING STANDARDS AND CONSTRAINTS

The first standard that was utilized was the *ASTM F1126 – 12 – Standard Specification for Food Cutters (Electric)*, which centers around food cutters that possess rotating blades and bowls for food collection [3]. Second was the *IEC 60335-2-14 – Household and similar electrical appliances – Particular Requirements for Kitchen Machines* which deals with the safety aspect of electrical kitchen machines for household purposes [4]. This standard encompasses all machines, with the exception of slicing machines with blades at an incline of 45 degrees or greater, noodle makers, and food disposers. Other restrictions revolve around additional locations where the appliance can be used, such as areas that have corrosive materials. If the design of the product does not meet any of these restrictions, this standard must be applied. Third was the *ASTM B479-19 – Standard Specification for Annealed Aluminum and Aluminum-Alloy Foil for Flexible Barrier, Food Contact, and Other Applications* as aluminum may be employed for structures such as the tray of the appliance. With ASTM B479-19, the standards for the types and ways that aluminum can be implemented with respect to being in contact with food were examined [6]. Lastly, the *NSF/ANSI 2 – Food Equipment*, *NSF/ANSI 8 – Commercial Powered Food Preparation Equipment*, and the *NSF/ANSI 51 – Food Equipment Materials* were considered as they dictate the types of materials that may be employed for food-based appliances [7].

2.3 HARDWARE AND ELECTRICAL STANDARDS AND REQUIREMENTS

Given average countertop space, a technical size constraint of 12"x15"x25" is present. Similarly, the device is limited to a technical maximum weight of 55lbs.

Using household outlets, the technical total amperage and voltage is 10A and 120V. This means a technical peak power draw of less than 1250W. Despite these technical maximums, the final

product should desirably have a peak draw of no more than 100W at 12V. The device is meant to be controlled by a microprocessor and have a user interface through an LCD screen. The internal logic was expected to require a relative abundance of space to store various device libraries and repeated safety checks but not much processing power. Thus, the ESP32 with 4 MB of memory compared to 256 kB on some Arduino models was preferred. The LCD screen is required for the prototyping phase user interface, as the amount of user controls can be varied by code as opposed to hard limited by buttons. Having a touch screen also makes user selection and control simpler, while making backend development more complex.

Lastly, the desirable speed of the device in completing its slicing task is under 5 minutes with an autonomous blade swap of under 30 seconds. Also, the hardness rating of the blade should be around 55 HRC to allow for safer operation.

3. HARDWARE DESIGN

3.1 ENCLOSURE DESIGN

Following the size constraints, the project was designed to fit within a 12"x15"x25" box, with the prototyping being approximately half the size. This resulted in the prototype box having a dimension of 7"x9"x13". The material chosen was ½" thick wood as that was a suitable thickness to maintain the shape of the design. Wood was found to have good prototyping compatibility with 3D-printing, as large-scale parts and adjustments can be made on wood and small-scale parts and adjustments made in prints. Furthermore, wood is a viscoelastic material which infers some degree of dampening capability. This would help in minimizing any vibration from operation due to low mating accuracy of homemade components.

3.2 GEAR DESIGN

The initial step in the computation of the gear design was to research prior studies conducted to determine the minimum necessary force and torque of cutting various foods such as vegetables as to get a basic idea of the requirements. Without this information, factors such as the type of motor or gears that would must be used could not be determined. The study that was employed to gather this information was *Energy requirements for cutting of selected vegetables: A review* [8].

The mentioned study provides information regarding the specific energy required to cut certain foods at an angle of 15 degrees. The angle that the blade in SAD operates at is 0 degrees. Thus, the 15-degree measurements from the study provided an excess of force and torque, ensuring that SAD will be able to cut the foods in the study without issue.

Table 1 displays the data that were analyzed for the force for cutting various vegetables with respect to the vegetables' intermediate diameter. The highest required force was that of an onion, at 28.182 Newtons. The equation utilized to complete the computation for Table 1 is Equation 1.

Table 1: Data for Force of Cutting Vegetables with an Intermediate Diameter

Food Item	Specific Energy ($\frac{N}{m}$)	Diameter (m)	Resulting Force (N)
Potato	558	0.047	26.226
Carrot	906	0.031	28.086
Radish	454	0.032	14.528
Bell Pepper	249	0.051	12.699
Onion	671	0.042	28.182

$$\left(\text{Specific Energy} \left(\frac{N}{m} \right) \right) (\text{Diameter} (m)) = \text{Force} (N) \quad (1)$$

Table 2 is the result of analyzing and computing the resulting torque that was required to cut through the vegetables. Equation 2 was the primary equation employed to compute the values listed in Table 2. As may be seen, the highest torque computed was approximately 0.16 Nm for a potato. This number was then utilized to compute the minimum motor parameters needed to ensure successful food cutting. Converting to watts, with a torque of 0.1599 Nm and a speed of 900 revolutions per minute, the minimum required power came to be approximately 20 W. This provided insight into the required motor as it has to operate with at least 20 W of power and 0.1599 Nm of torque.

Table 2: Data for Torque of Cutting Vegetables with an Intermediate Diameter and Angle of 15 degrees

Food Item	Force (N)	Radius (m)	Resulting Torque (Nm)
Potato	26.226	0.0235	0.1599
Carrot	28.086	0.0155	0.01127
Radish	14.528	0.0016	0.06
Bell Pepper	12.699	0.0255	0.0838
Onion	28.182	0.021	0.1533

$$(\text{Force} (N))(\text{Radius} (m))(\sin (\theta)) = \text{Torque} (Nm) \quad (2)$$

3.3.1 GEAR COMPUTATION

The gear configuration to lower the revolutions per minute from 3,000 RPM to around 200 RPM involved eight components. The eight components include two bevel gears five spur gears, and one worm gear. Figures 1 and 2 present the sample setup for the gear system with a top view and a back-left view, respectively, with the employment of Fusion 360. This arrangement of gears was selected in order to fit into the physical confines of SAD and meet all the necessities imposed by the mechanical and electrical requirements.

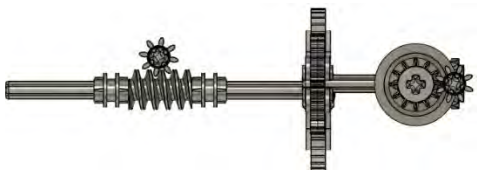


Figure 1: Gear Setup, Top View



Figure 2: Gear Setup, Back-Left View

Table 3 depicts the number of teeth on each gear as well as its respective angular velocity, and torque, while Table 4 displays the calculated gear ratios between each one of the gears. The gears were designed based off of the angular velocity and torque that the motor was able to give off during motor tests that were performed. Unlike the advertised torque, the tested torque was much

lower and measured to be 0.068Nm, thus the gears had to be redesigned in order to accommodate this fault. From this, the gears were constructed to ensure the output torque was more than 0.1599 Nm, the highest torque based off of the study utilized to compute cutting torques of various food items. Likewise, SAD had physical space limitations, so the gear teeth numbers were selected to ensure that no gear would physically interfere with any other components.

Equations 3 through 4 displays the formulas utilized with gear ratios with respect to gear teeth, velocity, and torque, respectively.

Table 3: Gear Type, Tooth Number, and Angular Velocity

Gear	Type of Gear	Teeth Number (T)	Angular Velocity (rpm)	Torque (Nm)
Gear A	Spur	8	3,000	0.068
Gear B	Spur	12	2,000	0.102
Gear C	Bevel	20	2,000	0.102
Gear D	Bevel	12	3,333	0.0612
Gear E	Spur	24	3,333	0.0612
Gear F	Spur	40	1,999	0.102
Gear G	Worm	1	1,999	0.102
Gear H	Spur	8	249.9	0.816

Table 4: Gear Ratios

Gears	Gear Ratio
A and B	3/2
C and D	3/5
E and F	5/3
G and H	8

$$\text{Gear Ratio} = \frac{\text{Output Gear Teeth}}{\text{Input Gear Teeth}} \quad (3)$$

$$\text{Gear Ratio} = \frac{\text{Input Velocity}}{\text{Output Velocity}} \quad (4)$$

$$\text{Gear Ratio} = \frac{\text{Output Gear Torque}}{\text{Input Gear Torque}} \quad (5)$$

One key necessity was to ensure that the material of the gears, ABS plastic, would be able to withstand both the contact and the bending stress that was occurring.

With the stress analysis computations with respect to the bending of Gears A and B, the worst-case scenario, the result was a factor of safety of 1.22. Equation 6 depicts the formula that was employed to compute the pitch line velocity whilst Equation 7 displays the formula that was employed to compute the tangential component of the force applied. The bending stress was then computed with Equation 8 as Equation 9 was used to find the stress cycle factor which was employed in Equation 10 to determine the factor of safety.

$$V = (w) \left(\frac{\text{teeth}}{P_D} \right) (\pi) \quad (6)$$

where,

V : pitch line velocity

w : revolutions per minute on driving gear

teeth : teeth on driving gear

P_D : diametral pitch

$$W^t = \frac{H}{V} \quad (7)$$

where,

W^t : tangential component of force applied to tip of tooth

H : horsepower from motor

V : pitch line velocity

$$\sigma = W^t K_O K_V K_S \left(\frac{P_D}{F} \right) \left(\frac{K_m K_b}{J} \right) \quad (8)$$

where,

σ : bending stress

W^t : tangential component of force applied to tip of tooth

K_O : overload factor

K_V : dynamic factor

K_S : size factor

P_D : diametral pitch

F : face width

K_m : load distribution factor

K_b : rim thickness factor

J : geometry factor

$$Y_N = 1.6831N^{-0.0323} \quad (9)$$

where,

Y_N : stress cycle factor

N : life cycles

$$\sigma_{all} = \left(\frac{S_T}{S_F} \right) \left(\frac{Y_N}{(K_T)(K_R)} \right) \quad (10)$$

where,

σ_{all} : allowable bending stress

S_T : allowable material stress

S_F : factor of safety

Y_N : stress cycle factor

K_T : temperature factor

K_R : reliability factor

As for the contact stress analysis with respect to Gears A and B, the factor of safety came out to be 1.26. Equation 11 depicts the formula for the contact stress whilst Equation 12 shows the formula to find the stress factor for a given amount of life cycles. Equation 13 then depicts the computation for the factor of safety with respect to the allowable contact stress. This indicates that for the revolutions per minute and the torque that the gears undergo, they will be able to withstand their required task with the material of ABS Plastic [9].

$$\sigma_c = C_p \sqrt{W^t K_O K_V K_S \left(\frac{K_m}{d_p F} \right) \left(\frac{C_f}{I} \right)} \quad (11)$$

where,

σ_c : contact stress
 C_p : elastic coefficient
 W^t : tangential component of force applied to tip of tooth
 K_O : overload factor
 K_V : dynamic factor
 K_S : size factor
 P_D : diametral pitch
 F : face width
 K_m : load distribution factor
 K_b : rim thickness factor
 I : geometry factor for pitting resistance
 C_f : surface condition factor
 d_p : pitch diameter

$$Z_N = 2.466N^{-0.056} \quad (12)$$

where,

Z_N : stress cycle factor
 N : life cycles

$$\sigma_{c,all} = \left(\frac{S_C}{S_H} \right) \left(\frac{Z_N C_H}{(K_T)(K_R)} \right) \quad (13)$$

where,

$\sigma_{c,all}$: allowable contact stress
 S_C : surface strength number
 S_H : factor of safety
 Z_N : stress cycle factor
 C_H : hardness ratio factor for pitting resistance
 K_T : temperature factor
 K_R : reliability factor

With more time and greater financing, the ideal scenario would consider the application and testing of other materials for gears. ABS Plastic gears were employed for this case, as they are food safe and they come in standard LEGO sets, available for purchase in vast quantities. This minimized cost and met the requirements of the torque and motor; however, for longer life capabilities, decreased failure, and increased factor of safety, it would be more beneficial to employ stainless steel gears as they are stronger with respect to their material and the capability to withstand heavier forces. Steel gears can also be manufactured to reduce backlash that was present with LEGO gears.

3.3.2 Gear Setup

Following the gear computations, the physical gears were obtained, and the gear housing was 3D modeled and printed. The DC motor selected was too big to be placed directly underneath the slicer. This meant that the motor and gears had to be placed in the back with a transmission shaft coming out and into the slicer. By having the gears and motor in the back, the gears were placed next to the plunger system (see Linear Rail System section below) and a casing for both the rail motor and gears was made as seen in Figure 3. The transmission shaft outwards from the gears were set at a predetermined height to match the location of the slicers center.

The second part of the gear setup was creating the DC motor holder and additional gear holders to connect Gear C to Gear D from Table 3, which may be seen in Figure 4. The connection along with the rotation were then tested in Experiment 3.



Figure 3: Rail and Gear Housing



Figure 4: Physical Gear Setup

3.4 Slicer and Slicer Base

The concept of slicing and potentially dicing raw ingredients was the starting point of the slicer. In order to achieve slices, three possible motions with the knife were considered. The first possible motion that was considered was the idea of blades slicing vertically, similar to that of a guillotine. The second option was for the blades to slice in a circular motion, similar to that of a blender. The last option was for the blades to be shaped like a grater. After creating a Pugh Decision Matrix, for the two sets of three options, represented in Tables 5 and 6, the circular blades cutting in a circular motion were selected as the optimal option. However, in reducing the scale of the prototype, the low scalability factor of circular blades was found to be a critical problem. As a result, the next best option of straight blades operating in a circular motion was selected.

Table 5: Pugh Decision Matrix for Blade Selection

Property	x(weight %)	Straight Blades	Circular Blades	Grating Blades
Vibration Susceptibility	0.2	25	50	75
Scalability	0.2	75	50	25
Manufacturability	0.3	75	50	25
Bulk Efficiency	0.3	25	75	50
Total	1.0	50	57.5	42.5

Straight Blade



Circular Blade



Grating Blade



Figure 5: Comparison of Blade Types

Table 6: Pugh Decision Matrix for Circular Blade Action

Property	x (weight %)	Spinning (rotation)	Chopping (x-y)	Rolling (x-rotation)
Simplicity of Motion	0.2	75	50	25
Internal Space Required	0.2	75	25	25
Manufacturability	0.3	25	50	75
Bulk Efficiency	0.3	75	50	25
Total	1.0	60	45	40

Spinning



Chopping



Rolling

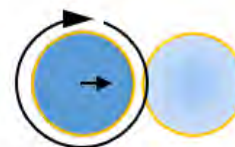


Figure 6: Comparison of Blade Actions with Circular Blade

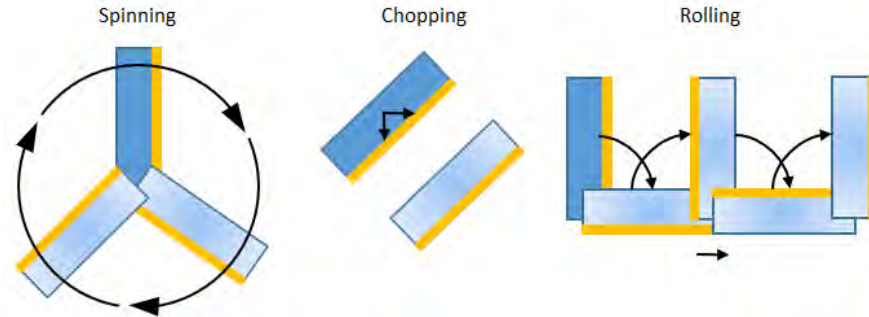


Figure 7: Comparison of Blade Actions with Straight Blade

3.4.1 Slicer Design

The design concept consists of a flat disk and a cylindrical blade holder. The blade holder is connected to the flat disk and spun by a DC motor, as is represented in Figure 8. The DC motor would spin both the cylindrical blade holder and the flat disk. The idea to spin the disk along with the blade was important because if the disk did not spin along with the blade, the sliced ingredients would only fall down at one location and pile up leaving the other areas empty.

The second part of the design was the blade holder and swapping mechanism. The intention of the project is to have different blade types allowing for different types of cuts. Rather than having the user switch blades manually for the type of cut they want, the design will have a selection screen and automatically switch between blades. This indicates that the blade holder must be easily inserted and removed when not in use and be locked securely when the device is running. The first idea was to use a wedge that was spring loaded. The wedge rests inside the slicer and will wedge into the blade holder at its starting and ending state, as may be seen in Figure 9. When switching blades, a protrusion in the plunger will push the wedge back, releasing the lock on the blade holder. This allows the blade to be easily removed from the slicer and for the next blade to be inserted. When the slicer is in motion, the wedge will be holding the blade holder in place securely.

The slicer was printed in sections allowing access to the spring-loaded wedge during assembly.

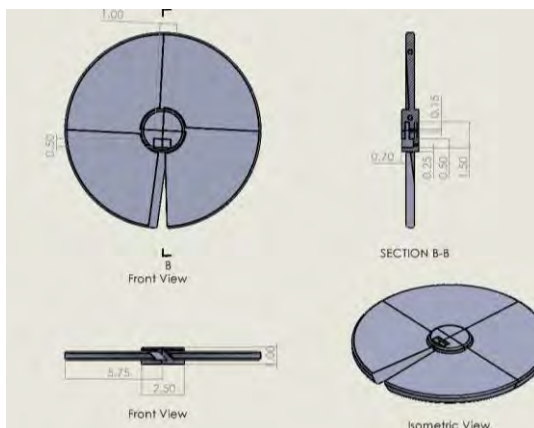


Figure 8: Wedge-Lock Slicer Design

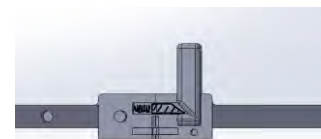


Figure 9: Spring Loaded Wedge-Lock Design

It was found that the unlocking protrusion could not sufficiently push the wedge back given this design before the plunger hit the face of the spinning disk. Therefore, the next iteration of the slicer utilizes a spring-loaded stopper that holds the blade and blade holder in place and is exposed from above, as may be seen in Figure 10. This allows for a simpler mechanism to lock the blade in place and a smaller plunger holder for the blade storage. Alongside this, a stress analysis was conducted, pictured in Figure 11, for the slicer on SolidWorks to ensure that the part wouldn't critically fail.

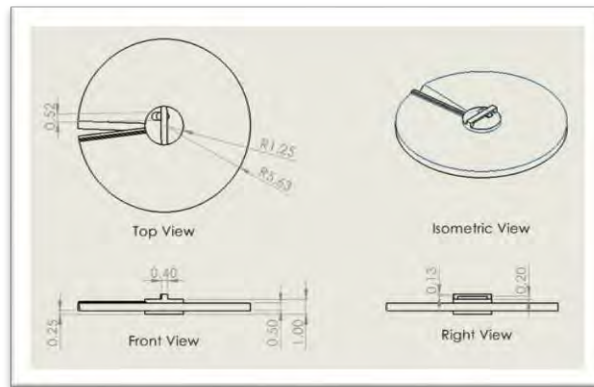


Figure 10: Stopper-Lock Slicer Design

3.4.2 Door Latch Design

The door lock concept consists of lever and latch. The rear of the latch is kept in tension to a high point through a rubber band. This forces the latch to a passive down position that locks the door as seen in Figure 11. A lever is then raised by the plunger to forcibly push the rear end of the latch down, which raises the fore end of the latch to unlock the door. This means that, by design, the door cannot be unlocked while the plunger system is performing its plunging task, because it is not present to overpower the locking tension.

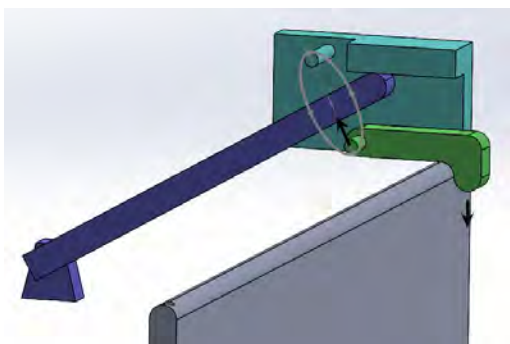


Figure 11: Door Latched

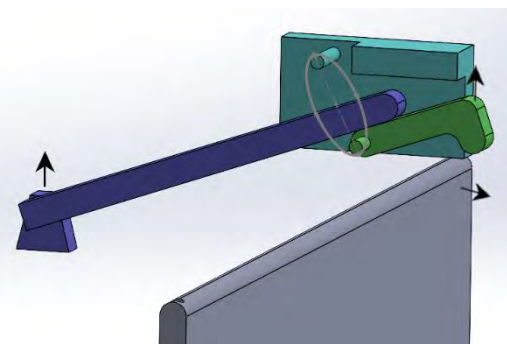


Figure 12: Door Unlatched

3.5 LINEAR RAIL SYSTEM

The next system was the linear rail system with a plunger mass attached. To hold the raw ingredients in place while the slicer is spinning along with holding unused blades, a plunger design was created to slowly move downwards when the device is active and to move down and up to swap blades. As this motion was intended only along the vertical axis, a linear rail system

was the best option. The V-Slot 20x40 Linear Rail allowed for a gantry plate with wheels to be connected to a timing belt system and an NEMA 17 stepper motor, depicted in Figure 13. The V-Slot 20x40 Linear Rail was chosen, as those had the smallest dimensions of the linear rails and met the size constraints on the prototype. The plunger to store blades and push ingredients down was then modeled, printed, and screwed onto the gantry plate. The plunger is depicted in Figure 14.



Figure 13: Linear Rail System

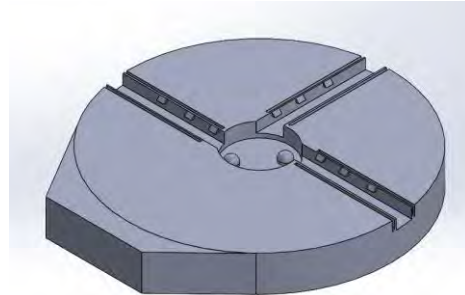


Figure 14: Plunger

3.6 SolidWorks Simulation and Analysis

To ensure that the slicer and plunger does not deform nor critically fail during operation, a SolidWorks simulation was completed for both parts.

3.6.1 Slicer FEA Analysis

The slicer will be subjected to the weight of the food items, the plunger force going downwards, and the reaction force from the blade slicing through the food items. An average potato weighs around 0.625lbs, or 2.78N. To simulate under extreme loading, the weight of the potato was doubled, and a total of 4 potatoes' weight was applied to the top of the slicer as shown in Figure 15. Alongside this, the force that the plunger would apply to hold the potatoes in place was considered to be around 5N, as the plunger does not need to force the potato down but rather, just hold the potato stationary. This results in the total distributed force applied to the top of the slicer to be 28N. The reaction force from the blade is applied to the cylinder within the center of the slicer. The force required for the knife to slice through the potato was found to be approximately 27N as seen in Table 1. The slicer also rotates at an approximate 300 rpm. This rotation is applied from the center of the base and affects the entire part. Lastly, the material of the slicer was 304 Stainless-steel with a yield strength of 215MPa and a modulus of elasticity of 200GPa [13].

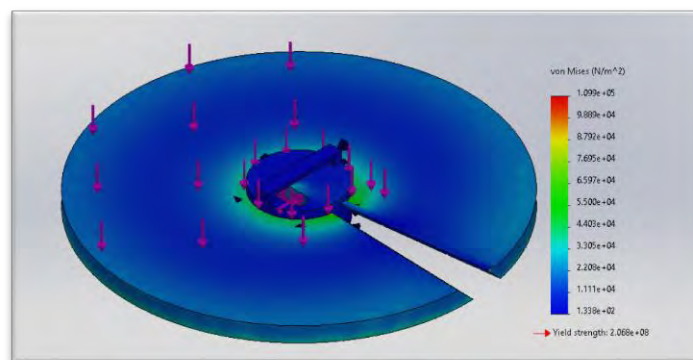


Figure 15: Stopper-Lock Slicer Stress Analysis

SolidWorks Simulation calculates the stress and strain of the part using von-Mises yield criterion as seen in Equation 14.

$$\sigma_{vm} = \sqrt{\frac{1}{2}(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2} \quad (14)$$

where,

σ_{vm} : Von-Mises Stress

σ_{1-3} : Normal Stress in the x, y, and z direction

This results in a maximum stress of 129.1kPa. Lastly, utilizing the factor of safety equation, or Equation 15, the factor of safety was calculated to be 1665. This factor of safety is well over the industry standard for turbine components of 2-3, as it is the closest motion to the slicer mechanism.

$$F.S. = \frac{\sigma_{yield}}{\sigma_{vm}} \quad (15)$$

where,

$F.S.$: Factor of Safety

σ_{yield} : Yield Strength

σ_{vm} : Von-mises Stress

3.6.2 Plunger FEA Analysis

For the plunger simulation, the reaction force of the potatoes and the weight of the plunger was applied. The reaction force of the potatoes was determined as the force the potatoes would apply back onto the plunger as the plunger moves downwards. This force was determined to be 5N from 3.6.1 Slicer Analysis, but for this simulation, the value was upped to 15N to account for extreme cases. The weight of the plunger was also taken into consideration. The density of 304 Stainless steel is around 0.283 lbs/in³ [14]. This resulted in the plunger having a weight of approximately 2lbs, or 9N. Applying a distributed force of 20N to the surface of the plunger resulted in the stress analysis shown in Figure 16. The forces applied here are strictly in the vertical axis. This simulation can be considered as a cantilever beam, as only one end is fixed to the gantry plate and the distributed forced are applied across.

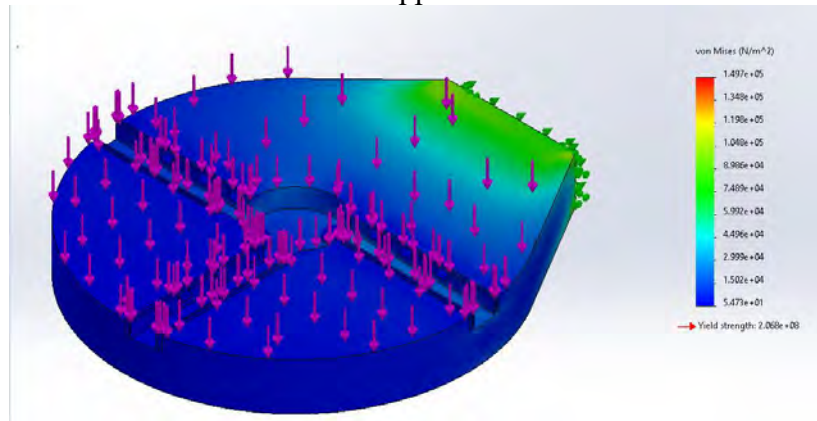


Figure 16: Plunger Stress Analysis

The maximum stress on the plunger was calculated to be 134.2kPa. Utilizing Equation 15, the factor of safety was calculated to be 1602. Similar to the slicer, the factor of safety for the plunger is well over any industry standard set. To take away from the two analyses done, the stainless-steel material and the shape design of the slicer and plunger is able to withstand the load applied.

3.7 COMBINED DESIGN

Figure 17 depicts the combined design with the initial components in their respective locations.



Figure 17: Combined Design

4. Electrical and Software Design

4.1 CIRCUIT SETUP

The circuit used to control the machine's actions consists of a ESP32 Microcontroller, ILI9341 LCD Module, DROK-200218 Power Supply, the BTS7650 DC motor controller with the XD-3420 DC motor, the DRV8825 motor driver with a NEMA 17 Stepper motor, and lastly, a limit switch. The power supply outputs 12V that runs through three parallel lines. Of the three, one goes to the motor controller, one to the stepper driver, and one to a breadboard power module that splits the 12V into a 5V and 3.3V lane. The breadboard power module then feeds to the microcontroller through the 5V lane and auxiliary components through a combination of 5V and 3.3V lanes. The LCD is connected to the microcontroller and powered through the 3.3V lane. The pins controlling the direction and PWM signals from the microcontroller are connected to their respective motor controller/driver. Lastly, the limit switch is connected directly to the microcontroller and 5V lane. These connections allow for the microcontroller to dictate the necessary voltage required for each action that the machine is supposed to complete. See Figure 18 for a reference wiring diagram and Figure 19 for the prototype circuit before their placement on the prototype combined assembly.

Table 7: SAD Parts List

1	ESP32 Microcontroller	Enabled logic and provides control
2	XD3420 DC Motor	Actuates spinner
3	BTS7960 Motor Driver	Controls spinner motor
4	NEMA 17 Stepper Motor	Actuates plunger

5	DRV8825 Motor Driver	Controls plunger stepper motor
6	DROK200218 AC to DC Power Supply	Provides power to main systems
7	Breadboard Power Supply Module	Provides power to low voltage systems (<5V)
8	ILI9341 Touchscreen LCD	Enables user input and provides feedback
9	LKB01 Micro Limit Switch	Detects if safety door is closed
10	608ZZ Bearings	Smooths spinner rotation
11	V-Slot 20x40 Linear Rail	Guides plunger movement

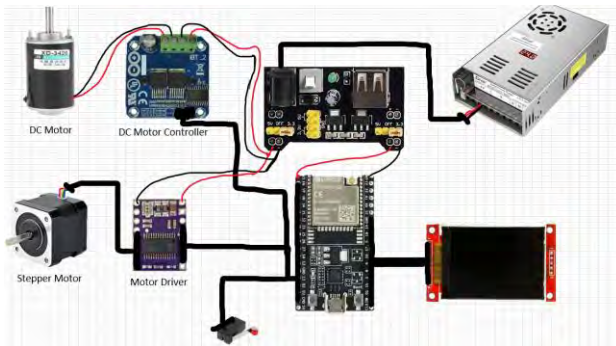
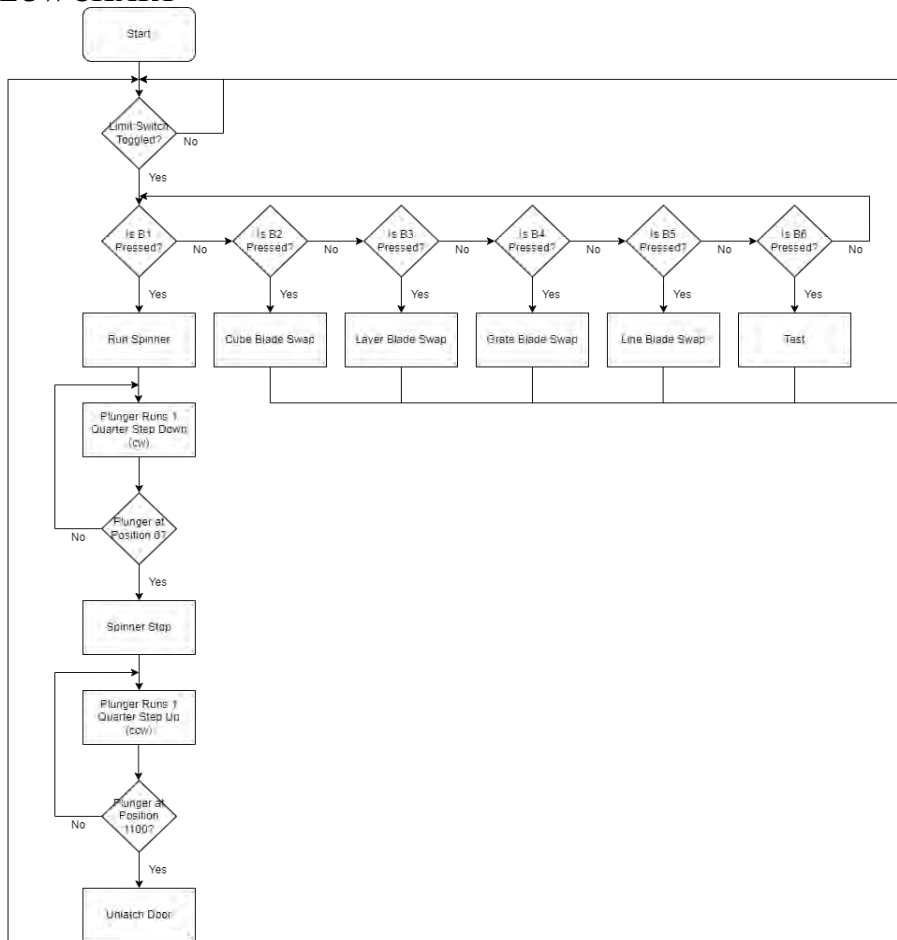


Figure 18: Pictorial Wiring Diagram



Figure 19: Physical Circuit

4.2 CODE FLOWCHART



5. IMPACTS

5.1 IMPACTS ON ECONOMY

Through the process of designing SAD, there have been many attempts, both successful and unsuccessful, to decrease the manufacturing price and design complexity while maintaining desired functionality. This ensures that the individual who could potentially employ SAD will not have to overspend on the product. Furthermore, studies have shown that eating food made at home, which SAD aims to promote, is more economically advantageous than eating out [15]. Thus, the core economic aim has been to make a product that is as economically efficient as it is safe, permitting individuals to buy whole foods and consume them at home, at a lower price than restaurant eating.

5.2 IMPACTS ON SOCIETY

Seldom do people want to waste hours on menial tasks. This is especially true before, during, and after workdays. Cooking for friends and family is an integral portion of many cultures and traditions, but, with a demanding lifestyle, traditions can sometimes be overlooked in favor of efficiency. SAD hopes to resolve this compromise by combining tradition along with efficiency. Various cultures around the world cook diverse meals that often require an abundance of vegetables. Instead of painstakingly cutting them meal after meal, SAD aids in this process, allowing families to enjoy spending more time together and to focus on more fulfilling tasks. Not only are hours saved in the long run, but family dynamics grow stronger.

Additionally, Earth is the only habitable planet humans know of, and every small way to aid in saving it should be utilized. SAD touches on the idea of helping the planet by encouraging one to cook at home with common groceries rather than to eat take-out with deliveries in plastic containers that go to waste after the meal.

5.3 IMPACTS ON HEALTH

SAD encourages individuals to cook at home using more fruits and vegetables as opposed to fried, greasy, and sugary alternatives. SAD's purpose inherently promotes considerations towards an individual's health in looking at what they eat. Whether through a sense of urgency or a sense of obligation, owning this device serves as a constant reminder of and aid in developing healthy eating habits. Studies have shown that increasing the intake of fruits and vegetables in the average person's diet can decrease cardiovascular diseases, certain types of cancers, and type 2 diabetes [16].

6. CONCLUSION

To recapitulate, the following project was an aim to employ foundational engineering knowledge acquired in college courses to real-life applications that may be beneficial to the public. The Slice and Dice could potentially be an opportune kitchen appliance that is proficient in the task of slicing food items with safe automation and the SAD design aims to inspire home cooking by reducing the time and energy involved with ingredient preparation. Through an LCD screen, individuals would select their desired pattern for sliced, diced, and even grated fruits and vegetables. SAD aims to perform all transitional steps in a safe and shielded workspace. SAD could also possess the ability to switch blades for various desired cuts in an automated manner to further minimize the need for user interaction with hazardous components. This type of

consideration makes SAD suitable for both busy individuals looking towards their health and the physically disadvantaged individual who wishes to expand his or her independent options.

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Robot Path-Planning and Decision-Making Subsystem for VEXU Competition

Nicholas Bentancur

Mechatronic Engineering, Vaughn College, Flushing, NY
Nicholas.Bentancur@vaughn.edu

Misael Marquez

Mechatronic Engineering, Vaughn College, Flushing, NY
Misael.Marquez@vaughn.edu

Faculty Advisors: Dr. Shouling He and Dr. Hossein Rahemi
Mechatronic Engineering Department, Vaughn College, Flushing, NY
Shouling.he@vaughn.edu

ABSTRACT

This report entails the development of a mobile robotic subsystem to assist the robot with path-planning and decision-making. This type of system is widely used in robots that work within warehouses and fulfillment centers. The robot subsystem is designed to determine its location and environment, so that it may follow the correct path while moving cargo. A new path may be created by the subsystem depending on the robot's surroundings or time limits. The developed subsystem will be applied to the autonomous robot competition and skills mode of the 2021-2022 VEXU robotics competition.

1 INTRODUCTION

The VEX robotics competition creates a constantly changing environment, due to the different play-styles introduced by opposing teams. The designed robot subsystem must be able to detect the opposing team's autonomous routines and develop the best strategy to counter their moves. To be able to accurately counter the opposing team's moves during the autonomous portion of the match, the robots will be able to move from point to point, correct their path, and allow a routine that was created by the subsystem without prior testing. The robots must move from point to point efficiently to complete their designated tasks before the opposing team can. It is possible that the robot will experience a collision from the opposing team, which could slow down or ruin the team's current autonomous routine. It is imperative that the robots are able to correct their paths and accurately arrive at their desired end location. Finally, a routine could be created, before a competition match, to combat the opposing team's routine by using information from scouts, or a person sent out ahead of time to gather information about the opponent's play-style and autonomous routine. This can save the team valuable time and help them to gain possession of important game elements early in the competition match, giving them an edge for the driver-controlled portion of the match.



Figure 1.0: VEXU Competition Stage

The objective of this project is to develop an easy-to-use robot subsystem that is able to assist in the movement of objects from one location to another, while also taking into account the obstacles in its desired path in order to avoid the obstacle and allow the object to reach its destination safely and efficiently. This will be done by using a path planning algorithm that will update as the robot moves along the planned-out path. If the robot is knocked off course by an obstacle or another robot, it can update its path and bring itself back to its originally planned destination.

The path planning algorithm will be assisted by the use of a set of “dead wheels,” which consist of wheels attached to shaft encoders that can measure the exact amount of wheel rotation, in order to determine directional movements by using a series of calculations. Other distance detection sensors will detect obstacles, so that the robot subsystem may recalculate a path to avoid these obstacles and reach the desired destination.

2 BACKGROUND RESEARCH

2.1 SIMILAR PRODUCTS

Amazon currently uses many different robots in their warehouses, such as the original Kiva, Hercules, and Pegasus [1]. Items at Amazon are placed on storage shelves called “pods” and are lifted by these robots. Once picked up, these shelves are moved to workers that pick out certain items. Afterwards, the robots place the shelves back in their storage areas. These robots use IR (InfraRed) sensors, pneumatic bumpers, and PIR (Passive InfraRed) sensors. The IR and pneumatic bumpers are used for collision detection and avoidance, while the PIR sensors are used to sense the movement of objects.



Figure 2.0: Amazon Delivery Robot

Starship creates delivery robots that move cargo, typically food, from the vendor to the customer [2]. The robots are loaded with the goods and are then on route to the delivery location. Afterward, the robot sends a notification to the customer that their delivery has arrived. These robots use ultrasonic sensors, ten cameras, radar, GPS (The Global Positioning System) sensor, alarm system, and TOF (Time of Flight) cameras during their operation. GPS sensors are used for the robot's localization, while the radar, TOF cameras, and ultrasonic sensors are used to map the robot's environment, so that it can navigate around obstacles. The alarm system is used when it is stuck or being broken into and also when it is necessary to warn people it is moving near them.



Figure 3.0: Starship Delivery Robot

2.2 PATH PLANNING ALGORITHMS

For path planning algorithms, the A* algorithm is an option. This algorithm determines the most efficient path between the start and end points by calculating a cost value. Using this cost value, a robot would move from one checkpoint to the next.

The D-Star(D*) algorithm works similarly to A*. Once A* selects a path, any information about other locations is thrown out. With D*, the information is kept which allows for quicker calculations from D*.

The bug algorithms are other algorithms used for path planning. These algorithms are simple and are used in dynamic local environments. The mobile robot first begins moving to its target location. Once an obstacle is found, the robot will turn to the left until it reaches a clear path. The robot will prevent itself from completing a 180 degree turn, as this would cause the robot to return to its previous location. This process repeats until the robot arrives to its location [3].

2.3 ROBOT LOCALIZATION

Robot localization determines where the robot is in its environment. Localization is a crucial part for a path planning and decision-making subsystem, as the system needs to always know where the robot is, to correctly alter its path to the fastest and most efficient one available.

For robot localization, the dead wheel odometry method [4] could be an option. Dead wheel odometry works by using tracking wheels, which are attached to shaft encoders, which then can allow the robot brain to determine the robot's position based on changes in the shaft encoder's values. These dead wheels are not powered by any motors and are forced down to the ground to provide maximum grip and accuracy for determining movements in the x and y axes.

For this application, two or three dead wheels are used. In the case where two dead wheels are used, one measures movement in the x direction, while the other is placed perpendicular to the first and measures movement in the y direction, and the change in heading is measured by a gyroscope. In the case where three dead wheels are used, two are placed in parallel to measure the movement in the x direction, and one is placed perpendicular to the rest and measures the y direction. The change in heading is determined using the two wheels placed in parallel.

Two dead wheel odometry is cheaper than three dead wheel odometry, has good accuracy, and tuning of the heading is unnecessary, because the gyroscope has that aspect covered. The main issue with two dead wheel odometry is that it is more likely to have more drift than the three dead wheel odometry method.

Three dead wheel odometry has the most accurate tracking, which is great for a 45-second autonomous mode. Although it is more accurate than two dead wheel odometry, it is more expensive, and heading tuning is particularly important.

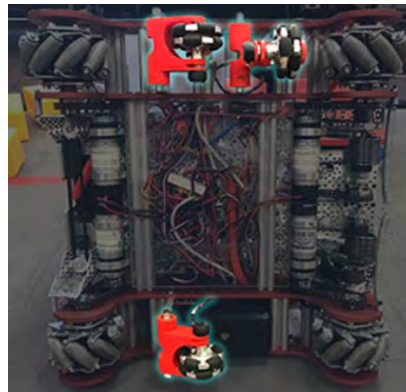


Figure 4.0: Three Dead Wheel Odometry Pods

Another localization method, which is based on LIDAR, or light detection and ranging, is called SLAM [5], which stands for simultaneous localization and mapping. This algorithm obtains a series of scattered point cloud data, along with angle and distance information collected by LIDAR, and calculates the distance and attitude change of the LIDAR relative motion by matching the point cloud data at contrasting times to localize the robot with respect to its environment.

Another form of SLAM, also known as vSLAM [6], or visual SLAM, uses images acquired from multiple cameras and sensors. This method is relatively low cost since it does not require expensive cameras. These cameras can provide a large amount of information and can also allow the system to detect landmarks or previously measured locations for the robot. Landmark detection can also be used in conjunction with graph-based optimization.

Although SLAM can be particularly useful in determining the robot's positioning, it comes with some challenges, one of which is localization errors. SLAM estimates movement and includes a slight margin of error. This margin of error accumulates over time and causes extreme deviations from the actual values. As the error accumulates, the robot's start and end point no longer match. This error accumulation is called a loop closure problem.

Another major issue with SLAM is its high computational costs. Computations are usually run on compact and low-energy embedded microprocessors with limited processing power. The issue with this is that to achieve accurate localization, image processing and point cloud matching must run at high frequency. This brings up a challenge on how to run computationally intensive processing on embedded microcomputers.

Another localization algorithm, named dead-reckoning, works by using a local process that simulates an object and temporarily sends a message with the current state to a remote process which extrapolates the state using a dynamics model. Dead-reckoning works in two parts, extrapolation, and convergence. Two extrapolation schemes are used in first-order models where each entity has a position and velocity. Two extrapolation schemes are also used for second-order models where each entity has a position, velocity, and acceleration.

With the use of a GPS, global positioning system, the sensor could allow the robot to travel longer distances with the use of waypoints. GPS works by having thirty-one active satellites in orbit, each inclined 55 degrees to the equator. These satellites orbit 20,000 km from the Earth's surface and make two orbits per day. The satellites' orbits allow for six satellites to be in view from most places on Earth [7].

The way the GPS receiver determines its location is by receiving a signal from each satellite, each of which transmits the exact time at which the signals were sent. By determining the time it takes for the signals to reach the receiver, the GPS receiver can determine its distance from that specific satellite, since it also knows the GPS satellite's exact position in the sky. Once the receiver collects this information from at least three satellites, it can triangulate its position in three dimensions, north, east, and altitude. Although GPS would be useful in determining the subsystem's position, it currently will not be used for this design, as GPS is not accurate while in an indoor location.



Figure 5.0: GPS Satellite in Orbit

3 ENGINEERING REQUIREMENTS

- VEX V5 Microcontroller: 128MB of RAM. One Cortex A9 processor at 667 MHz, Two Cortex M0 at 32 MHz, one FPGA is used for the VEXos. One Cortex A9 is used as the user processor with 1,333 million instructions per second. One 4.25" screen with 480 x 272 pixels. The microcontroller can connect via VEXnet3.0 and Bluetooth 4.2



Figure 6.0: VEX V5 Brain

- VEX V5 motors, stall torque of 2.1Nm, with 11 Watts of continuous and peak power



Figure 7.0: VEX V5 Motor

- Third party sensors are allowed
- ultrasonic sensors:
 - Vex Robotics: range of 1.5 inches to 115 inches, frequency of 40KHz, and a resolution of 1 inch.
- Shaft encoders:
 - Vex Robotics: standard one-eighth-inch shaft, continuous rotation, 90 slit encoder wheel with 1 degree of resolution.

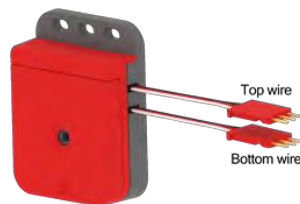


Figure 8.0: VEX Shaft Encoder

- Battery: only a specific battery can be used
 - VEX battery will be used
 - Battery will last between 5 and 10 minutes



Figure 9.0: VEX V5 Battery

- Weight and Size: under 5 pounds, and will fit within a robot with a maximum size of 15"x15"x15"

4 ENGINEERING CONSTRAINTS

Size: the robot must be able to fit within a 15x15x15 cubic volume for a small robot and a 24x24x24 cubic volume for the larger robot.

Parts limitation: Only Vex electronics for the main processing board, power distribution board, as well as their motors for movement.

Safety: A robot cannot harm the user or other robots. Every part of the robot must be thoroughly checked for sharp corners and edges and must also make sure that the materials used do not shatter after failure. Any action that occurs during the autonomous period including damage, entanglement, or the tipping of another robot could result in a disqualification of the autonomous period, match, or competition.

Autonomous: The robot must not traverse into the opposing alliance's zone as this would create a disqualification for the autonomous period of that match. Several instances of this could cause a disqualification overall. Any path created by this subsystem must not allow the robot to enter said zone.

Electronics: No vex sensors or electronics may be modified. Wires may be repaired by soldering or twisting. Sensors and electronics must be connected to the v5 robot brain via any of the externally accessible ports. A sensor may be connected to a processing unit which then connects to the v5 brain.

5 ENGINEERING STANDARDS

5.1 PROGRAMMING

Google C++ Style Guide: This is a standard created by google to correct format, keep a program manageable, and allows for the use of more features in programs [8].

ISO International Standard ISO/IEC 14882:2020(E) – Programming Language C++:

This standard was created so that people may create compilers and library implementations.

5.2 3d-printing

Three-dimensional printing is a process of creating a physical object from a 3D digital model by laying down a material layer by layer in succession. For this application, PLA will be used as the material type for the parts. PLA, which stands for polylactic acid, is the most common type of material used in the 3D printing community. 3D printing using PLA uses 65% less energy than conventional plastics and creates 68% less greenhouse gases and has no toxins [9]. PLA can also be infused with other materials to help strengthen it to be more resistant to fractures. The most common infusion is carbon fiber, which strengthens the layer bonds and allows for a more flexible final product. In terms of the 3D modeling, ISO/ASTM52910-18 is the standard for parts to be 3D printed, and for drawings of parts follows ISO 6322-1, ISO 6322-2, and ISO6322-3.

6 SYSTEM DESIGN

There were several options for the hardware to be used for this project. The hardware consisted of different sensors, such as encoders, LIDARs, ultrasonic sensors, infrared sensors, inertial

measurement units and a camera. From here, the pros and cons of each sensor were compared. The encoders must be placed on wheels that are on the ground. LIDARs require the opposite location on a robot. A LIDAR must be mounted on the highest part of the robot to see above any mechanisms when moving around. Any robot with an arm will cause issues as the arm can block the LIDAR's point of view. If the LIDAR is mounted even higher, the robot will not be able to detect obstacles. Ultrasonic Sensors are unable to detect various obstacles depending on size. Furthermore, an array of ultrasonic sensors is required to have a useful view around the robot, but items can still be found in between the ultrasonic sensor's view. Infrareds are like ultrasonic but have a smaller detection area. The inertial measurement unit can detect a change in movement by integrating the acceleration measured. Moreover, the inertial sensor can be mounted anywhere on the robot. However, the integrations may require some tuning. A camera can also be used to detect obstacles. Cameras use an exceptionally large amount of processing power along with image recognition. The need for power also creates a slow response to obstacle change. For this system, the encoders and inertial sensors were used as the main localization system for their ease of use. Furthermore, the ultrasonic, infrared, or cameras may be used to receive additional information in the path planning algorithms.

6.1 HARDWARE DESIGN

The first assembly of the odometry pod consisted of aluminum c-channels, a vex optical shaft encoder with 90 slits, and a 2.75" omni-directional wheel. The pod is used with two other pods to determine the translation in the X and Y directions. These wheels are separate from the ones used to create propulsion as driven wheels can slip and cause inconsistencies. Dead wheels (or non-driven wheels) are used instead as they will only move if the robot moves. The inertial measurement unit is included on the robot but is not used at this point. With the robot's size constraints being 15 inches cubed, the odometry pods took up far too much space. To rectify this issue, the c-channels were replaced by a part printed in PLA. The part was much thinner and is depicted in figure 12.

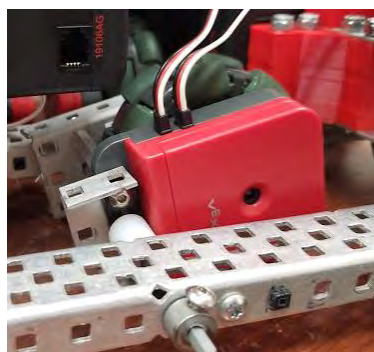


Figure 10.0: Odometry Pod V1 Placement

The below odometry pod assembly is the second iteration. The red printed part keeps the wheel and the encoder together while the black printed part allows the dead wheel to mount onto the base of the robot. While this design was thinner than the first, it was noticed that the wheels would be able to shift side to side. Their mounts were also able to translate about their mounting point. The pods were also only designed to support one side of the wheel. The shaft encoder would support the other side but caused friction. The mounts were designed around the pods rather than with the pods which allowed for greater play. The gaps that allowed the translation

and unwanted movements were filled in by spacers and washers but had negligible impacts. The wheels would also lock up when in use, due to the added friction from the shaft encoder.



Figure 11.0: Odometry Pod V2 Assembly

The problems stated before led to the next iteration of the odometry pod. The new part that was printed from PLA supports the wheels from both sides, as shown in figure 17. The design was meant to be exact, in the sense that only one specific spacer or washer was required to make the system functional, rather than the many used before in previous iterations. The mounts were also redesigned to bring the two mounting points closer together, thus reducing any side-to-side play or tilting caused by the wheels touching the ground. The shaft encoder is then mounted onto the outside of the pod and is no longer load bearing. This also reduces any inconsistencies in the localization calculations.



Figure 12.0: Odometry Pod V3 Mounted on Chassis

6.2 ALGORITHM DEVELOPMENT AND SOFTWARE DESIGNS

The localization algorithm was programmed onto a VEX V5 Brain. Afterwards, the program must be tuned to the system's pod locations. More specifically, the distance from the wheels on the pods to the tracking centers must be placed into the program. There must also be a constant that calculates the distance the wheels have traveled in inches. This is because the localization code must calculate the heading change and displacement in inches to then return a value in inches to the user or other programs. The unit can be replaced by another if necessary.

To tune the system, the robot with its mounted pods is moved in a known straight-line distance in the positive y (forward) direction. The robot will display the shaft encoder values to the Brain's screen for trouble shooting. From here a conversion ratio from rotations to inches can be created and applied. This process is repeated and tuned to get the constant that calculates the wheel traveled distance. While this value can be calculated, it will only give an approximation since the radius of the omnidirectional wheels is not constant. Afterwards, the distance from the tracking center to the pods is tuned by rotating the robot a specific number of degrees (a multiple of 360

degrees is preferred). The distance to the tracking center can be measured if known; however, this will also only give an approximation due to the shape of the omnidirectional wheels and their effect. From here, the robot's calculated change in heading is displayed on the screen. The actual and measured angle is compared and thus the distance can be tuned further. If the calculated heading is too large, the distance is increased, and if the heading is too small, the distance is increased. This should lead to the robot having an accurate position. Initially when the robot was moved from the origin to a location 2 feet forward, and 2 feet to the right, then back to the origin, the displayed position was incorrect. This can come from a tuning issue but primarily came from the use of the wrong conversion from degrees to radians and was promptly changed.

A movement function was created to have the robot move itself from one location to the next without the help of the user. It was unable to smoothly move around the field. This caused errors in the localization algorithm as well. One issue that came about was that the robot would curl towards the target upon a close approach. This came about from the robot not being able to move along the x or y axis to its target as it was missing a condition in the program. Another jumping issue came during the robot's movements. This was resolved by adjusting the gains applied to the straight-line and rotational errors. When applying power, the motors are controlled by mixing the outputs of two proportional controllers. The movement function was also adjusted to use an inertial measurement unit's gyroscope to make precise movements.

The robot moves smoothly to its next target most of the time. Sometimes the robot would stop abruptly and then continue along its path. While this does not affect localization to the point that it is noticeable, it could still affect how the robot carries items. Different tunings were given to the drivetrain's rotational and linear P gains. The lower P gain worked the best. A D gain may be included to speed up the robot's movement while also keeping the system stable, or the movement could be separated where the robot first turns to face its target, then moves in a straight line towards the target.

Another problem with the system is that if it is tipped too far to where the wheels leave the ground, the shaft encoders that are reading the robot's position do not have contact with the ground. This is crucial to the robot's localization. If the robot is moved while it is partially tipped, the dead wheels are not contacting the ground, and the robot cannot track its movements. This may be resolved by creating a heavier/steadier drive base or including other sensors to quickly determine its location.



Figure 13.0: Subsystem used in real world situation

The robot in the bottom right corner with the blue license plates was moved off course by an opposing robot. Once freed, the robot was able to continue along its preprogrammed route due to the on-board localization and movement system.

Rank	Score	Programming Skills	Driver Skills	Highest Programming Skills	Highest Driver Skills	Highest Programming Score Timestamp	Highest Driver Score Timestamp	Highest Programming Score Stop Time	Highest Driver Score Stop Time	Team Number
1	663	250	413	250	413	2022-02-12 18:55:51	2022-02-12 19:58:05	0	0	BLRS2
2	606	203	403	203	407	2022-02-12 13:35:31	2022-02-05 18:37:15	0	0	BLRS
3	589	243	346	243	346	2022-02-12 17:12:54	2022-02-12 19:45:57	0	0	NUKE
4	496	180	316	180	316	2022-02-13 14:41:42	2022-02-13 17:51:31	0	1	VCAT

Figure 14.0: World Ranking List

Moreover, the team used the localization and movement algorithms in their programming skills routines that were created the week of the competition. The score allowed the team to place 4th in the world as of 2/20/2022.

The localization algorithm was not functional due to several edits to the localization and robot definition programs to accommodate to a larger robot. Therefore, the motor names, motor ports, odometry pod ports, and inertial sensor port were all completely different and were replaced.

When implementing the path of the A-star algorithm using the moveToPos() function, the robot's coordinates were multiplied by eight. This is because the robot moved along 8-inch square cells. The center of the coordinates 1,1 should be at location 8,8. To prevent any errors, the movement algorithm's moveToPos() function multiplies the new coordinates by 8 to give the proper location. During its implementation, the robot would move around in an area of three inches around the origin. This was found to be where the multiplication of the 8 was placed.

```
int moveToPos(double xPosNew, double yPosNew)
{
    xPosNew *= 8;
    yPosNew *= 8;
    while(true)
    {
        xPosDelta = xPosNew - xPos;
        yPosDelta = yPosNew - yPos;
    }
}
```

Figure 15.0: Functional Position to Cell Multiplier

Above is the current functional location of the multiplier. Its previous location was on the xPosNew in the xPosDelta, $xPosDelta = (xPosNew * 8) - xPos$; and likewise, for the yPosDelta. The reasons behind this cause and error are uncertain, since xPosNew was never rewritten or updated in any lines in the movement algorithm.

The A*star algorithm was found online, modified, and was implemented onto the subsystem. The algorithm was given a field size of 18x18 with a cell size of an 8-inch square. Using the program's functions, the locations of obstacles were placed on the field based on the vex competition layout. A path was then generated with specific cell coordinates. The coordinates were then fed into the robot using the moveToPos functions. Finally, two paths were tested, one being a variant of the first, and worked phenomenally. The program was created by Daancode on GitHub[10].

The robot was too slow to complete the path. The robot moves from one cell to the other using a proportional feedback loop. Since the field has many cells, the robot starts and stops frequently. A better method of moving the robot from start to end would implement something like pure pursuit, where the robot aims for its next target and moves towards it. Once the robot is within a pre-defined range of the target, it moves onto the next. If there are no other targets, it will slow down before arriving to the last target. Another issue is that in order to have the robot follow the path, the path must be previously generated by users to move it to a specific location. Moreover, the A-star program has yet to be implemented to the main program running the robot. This is not optimal, since in a match, a robot could be moved, or an obstacle could be moved. Without the robot knowing this change, it is unable to correct its path and could cause a failure in the autonomous routine. Various sensors should be included around the robot to update certain cells. The A-star algorithm should be rewritten to interface with the robot's program.

After testing the A-star algorithm, it was decided that the Bug2 algorithm would be programmed, tested, and implemented next. This version of the Bug2 algorithm is designed to have a single input, the coordinates for the desired location. With this single input, the program can create a vector from the start position of the robot to the desired location. When the program runs, it has the robot move forward until an obstacle is detected by the front sensor. Once an obstacle is detected, the robot will turn left and follow the objects exterior using the right sensor until either the desired location is in sight and a straight path is available, or until the robot reaches the vector created at the beginning of the program. If the robot has a direct path to the desired location, the program will break out and create a straight path from the current location to the desired location. If the robot does not have a direct path, the program will remain in a while loop and repeat the circumnavigation of any objects in its direct path to the desired location.

At first, A* and D* path planning algorithms were considered for this robot subsystem. After further research, it was decided that the two algorithms would be too complicated to use for this specific application. The algorithms would take up too much processing power needed for creating a path. The Bug algorithms are simple to implement and are far more efficient and flexible for robot path planning. A* and D* would work best for larger paths with many obstacles. Since there are few obstacles in the competition field setting, the bug algorithms would work best.

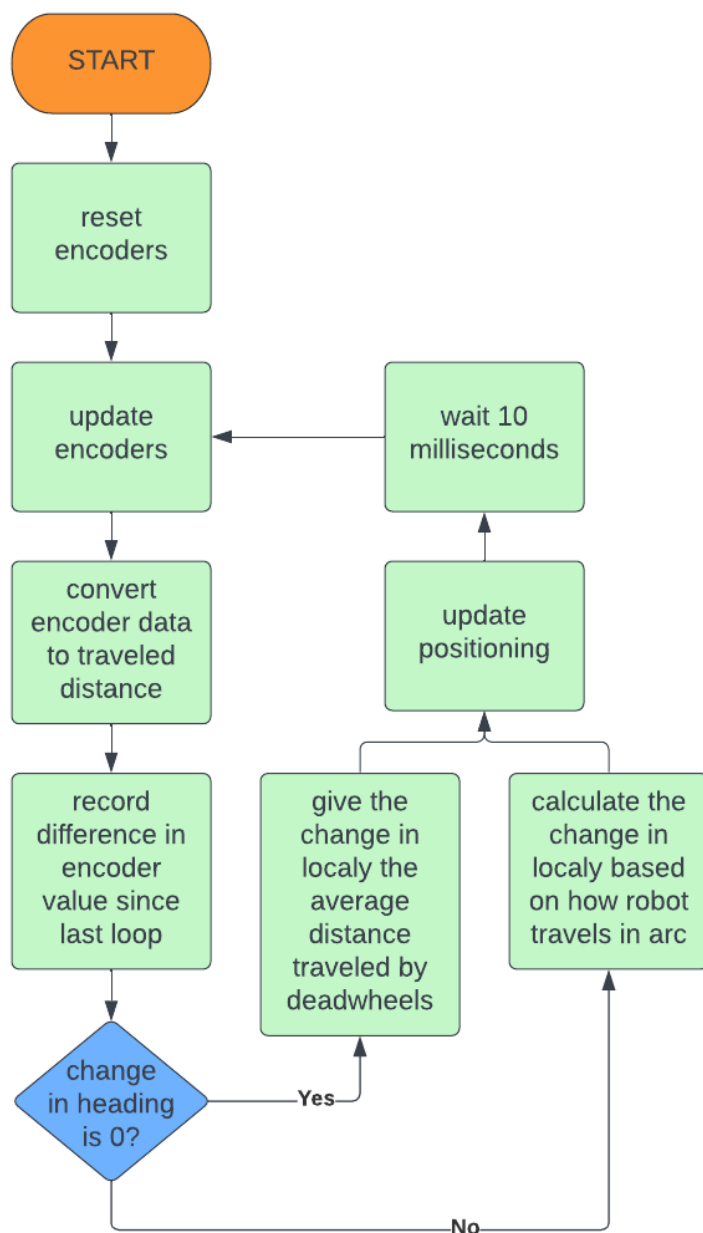


Figure 16.0: Localization Algorithm Flowchart

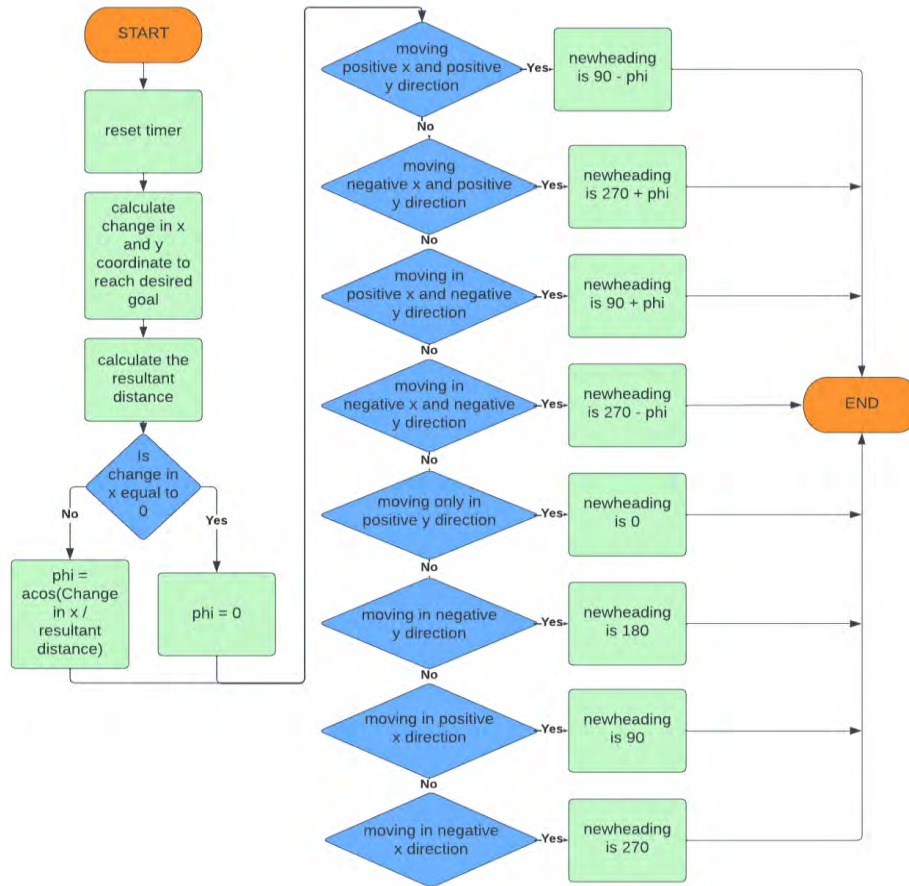


Figure 17.0: Movement Algorithm Flowchart

7 Robot’s Structural Safety Analysis - Analysis Due to Lift of Field Goals

7.1 Motor Safety Analysis

The robot through four moving bars and gear system is connected to the frame of the robot. The moving bars are designed to pick up a 3 lbs. goal and place it on the platform. A motor of 11 watt ($11 \times 8.851 = 97.36$ lb.in/s) power with a driver gear of 0.5 in diameter is capable to transmit a larger torque through driven gear of 2.5 in to the moving bar of the robot. The torque based on 100 rpm speed for the driver gear can be calculated as follow

$$T = P / (2 \cdot \pi \cdot f) = (97.36 \text{ lb.in/s}) / (2 \cdot \pi \cdot 100 / 60 \text{ 1/s}) = 9.3 \text{ lb-in} \quad (1)$$

The transmitted torque (T_T) through driven gear of 2.5 in diameter to the moving bar can be expressed as

$$T_T = (D/d)T = (2.5/0.5)(9.3) = 46.5 \text{ lb.in} \quad (2)$$

Knowing the length of each moving bar is 9.5 in, the applied tongue ($T_{Applied}$) that is produce by lifting 3 lbs. goal can be calculated as

$$T_{Applied} = F \cdot L = (3/4 \text{ lb}) \cdot 9.5 \text{ in} = 7.125 \text{ lb.in} \quad (3)$$

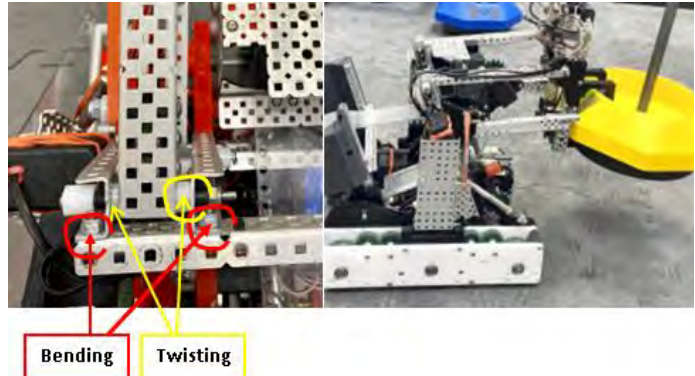
The factor of safety of motor against applied torque can be expressed as

$$(F.S.)_{\text{Motor}} = T_T / T_{\text{Applied}} = 46.5 / 7.125 = 6.53 \quad (4)$$

Hence the motor of 11 watt, safely supports the exerted torque that is produced by lifting 3 lbs. goal and placing it in platform.

7.2 Bending Stress Safety Analysis

The vertical frame is connected to horizontal moving bars through two screws of 0.16" diameter, hence the exerted bending stress to the frame of robot can be calculated as



$$\sigma_{\text{applied}} = M * C / I \quad (5)$$

Moment due to Smaller Robot weight at end of piston is

$$M = F * L = \left(\frac{3}{4} lb\right) * 9.5 in = 7.125 lb - in \quad (6)$$

The moment of inertia of two connecting screws to the vertical frame is

$$I = \frac{\pi}{64} (d^4) = 2 \left(\frac{\pi}{64}\right) (0.16^4) = 64.34 * 10^{-6} in^4 \quad (7)$$

Hence, applied bending stress exerted can be calculated as follow

$$(\sigma_{\text{Applied}}) = \frac{(7.125 lb-in) * (0.08 in)}{(64.34 * 10^{-6} in^4)} = 8.859 ksi$$

Factor of Safety of screw under applied stress can be expressed as

$$FS = \frac{\sigma_{\text{ultimate}}}{\sigma_{\text{applied}}} = \frac{66}{8.859} = 7.45 \quad (8)$$

This indicates that screw has a high factor of safety relative to ultimate strength and hence it can safely support lifting a field goal of 3 lbs.

7.3 Shearing Stress Safety Analysis

The moving bar through two screws of 0.16" diameter screws is connected to the frame of the robot. Hence, the applied shear stress to the connecting mechanism of robot can be expressed as

$$\tau = Tr / J \quad (9)$$

The polar moment of inertia for two connecting screws can be calculated as

$$J = 2(\pi/32) * (d)^4 = 2(\pi/32) * (0.16)^4 = 128.68.34 * 10^{-6} in^4 \quad (10)$$

Hence, the applied stress can be calculated as

$$\tau_{\text{applied}} = Tr / J = (7.125 lb.in) * (.08 in) / (128.68 * 10^{-6} m^4) = 4,429.6 psi = 4.43 ksi$$

Knowing that the material ultimate shearing stress is 40 ks, the factor of safety can be calculated as

$$(\text{F.S.}) = \tau_{\text{ultimate}} / \tau_{\text{applied}} = 40 / 4.43 = 9 \quad (11)$$

Hence, based on above calculation each supporting screw has a factor of safety of 9 relative to ultimate strength and it is safe enough to lift the goal and place it on the platform.

8 SOCIETAL IMPACTS

8.1 SOCIAL

Robotic networks comprised of multiple robot systems have become more prominent in the warehouse setting by bringing a higher standard of safety and quality of life to workers by reducing dangerous and repetitive tasks. The aim of this project is to create a robot subsystem which can increase the efficiency of a specific task by calculating the quickest path to target given the robots positioning with respect to its environment. This project also aims to produce an environment in which other team members can expand their knowledge on robotics subsystems.

8.2 ECONOMIC

The use of a path planning, and decision-making subsystem robot would help companies save money by preventing lawsuits from employees who become injured on the job. This will also help save money when it comes to broken or damaged products, as the robot would help prevent and avoid these mistakes altogether. By creating a safer work environment, the company will save money and the employees will feel safer while collaborating with these robots.

8.3 ENVIRONMENTAL

The use of a path planning, and decision-making subsystem robot would help reduce the emissions from gas powered forklifts being used in the warehouse environment. This can contribute to the reduction of greenhouse gas generation per year and help bring a cleaner and greener future for all.

8.4 Global Impacts

The development of a robot capable of carrying this path-planning and decision-making subsystem could bring together people from different countries in the design, creation, and electronic systems that go into making the robots.

9 CONCLUSION

The proposed project consists of a robotic subsystem with the ability to adjust its own path based on environmental variables which can cause the robot to deviate from its path, as well as being able to decide what path is the most efficient given the current situation. The subsystem could be used in many areas where a person would need to move cargo repetitively. An example of this is used in the Amazon fulfillment centers where items are moved from one part of the warehouse to another. For this project, we will be applying the path-planning and decision-making robotic subsystem to the VEXU competition robots. This robot must comply with the VEX rules and constraints. The robot must also be able to adjust its course if it is pushed away from the expected path by another robot or obstacle. This will be done by having dead wheel odometry running in the robot subsystem, allowing the robot to know its position at any given point in time. Using this information, it can calculate how far it was pushed off course and will be able to recalculate a path to its original target quickly and accurately.

10 ACKNOWLEDGEMENTS

The authors would like to thank the President of Vaughn College of Aeronautics and Technology, Dr. Sharon Devivo, and the Chair of the Engineering and Technology Department, Dr. Hossein Rahemi for allowing them to participate in this project. A special thanks to Dr. Shouling He for the feedback and guidance as the project advisor.

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The Braille Educational Tablet (BET)

August Rodriguez

Mechanical Engineering, Vaughn College of Aeronautics and Technology, Flushing, NY
august.rodriguez@vaughn.edu

Manpreet Anand

Mechanical Engineering, Vaughn College of Aeronautics and Technology, Flushing, NY
manpreet.anand@vaughn.edu

Bryan Gordillo

Mechanical Engineering, Vaughn College of Aeronautics and Technology, Flushing, NY
bryan.gordillo@vaughn.edu

Advisor: Amir Elzawawy

Professor at Vaughn College of Aeronautics and Technology, Flushing, NY
Amir.elzawawy@vaughn.edu

ABSTRACT

The present paper displays the design process and characteristics of the Pre-K Educational Braille Tablet. The tablet is a low-cost use tool for blind toddlers to teach the basic alphabet and simple four-letter words. The intention is to create an innovative teaching method that can stimulate the tactile and auditory senses. It is programmed using Arduino IDE code, and includes a DF player, 5-volt solenoids, and passive thin pressure sensors. The solenoids will act as braille dots to display words and letters, depending on their pattern. Finally, the speaker informs the users of the words that are currently being shown. The objective is to start the process of teaching blind toddlers basic literacy skills that are affordable for most families and schools. Along with the overall parts required, the mechanical, electrical, and coding will be shown to further evaluate which materials are preferred for the design. A case study will be conducted to show situations in which the tablet deals with different points of a concentrated load.

1. Introduction

1.1. Problem Statement

The history of Braille dates to the early 1800s, when Charles Barbier developed a unique system called “Night Writing”. The system was based on a 12-dot cell, two dots wide and six dots tall that would represent a letter or phonetic sound. Later, Louis Braille then created a reading method based on a six-dot cell for the fingertip to take-up the entire unit with one touch. In the present day, this system is utilized for touch reading and writing for the blind, in which raised dots contain equivalents for punctuation and symbols to show letter groupings and different words. [1]. According to the 2017 American Community Survey (ACS), approximately 568,000 children have vision difficulty and approximately 64,000 children, youth and adults' students are legally blind in an educational setting. Breaking this up, children in primary school who are blind compose 24.2 percent of this statistical portion. In our modern day, it is critical to have some form of literacy to navigate, whether in real life or in the virtual world, using personal computers or phones. Unlocking the ability to utilize the internet changes how one operates and how one

interacts with others. Although there are Braille educational tools to help the blind access the internet, these tools are very expensive. In 2016, a survey was conducted revealing there are approximately a million visually impaired Americans, and nearly one in five live in poverty [2]. This gives them less access to educational resources, leading to a lower educational level in the general population. There is limited access to educational Braille resources due to unreasonable prices that can run over \$1300 dollars [3]. The visually impaired and legally blind students have fewer materials with which to learn and review Braille, leaving them at a lower educational level. This project's objective is to close the literacy gap by introducing an innovative Braille block tablet that teaches children the alphabet and basic 4 letter words to ensure good pre-literacy fundamentals and that allows visually impaired and legally blind children equal access to educational products and methods at reasonable prices.

2. Social Impact

The objective of the project is to give back to the visually impaired community by providing an inexpensive Braille tool. The device will provide children, primarily in pre-k, access to learning the alphabet. This tool is designed to ensure these children will continue to learn braille so that they can communicate with the world onward into adult life [4].

3. Market Requirements

The customer's need for the Braille Tablet can be determined through the reading of the "Teaching Students with Visual Impairments" [5] as well as the "Paths to Literacy for students who are blind or visually impaired" [6]. The first site includes resources and strategies that enable children starting from Pre-K – 3rd grade to begin learning Braille. The second site is a place to allow for new creative strategies to be posted as well as events for the visual impaired. The device must be at a reasonable price as well for accessibility for a wider range of customers, especially children, who would benefit from learning how to read Braille.

4. Engineering Requirements

The engineering requirements are the results of the issue at hand as well as the technological advancements of the present time. The design will need to be compact to contain the components into the tablet size device. The device will need to be accessible as a carry-on and should be light enough that it does not cause discomfort carrying it all day. To create a device that is ergonomic, the ideal size of a tablet with the dimension of 12 inches by 8 inches is the target. The depth of the tablet should not be so large as to be uncomfortable, but just large enough to allow for the fitting of the electronics within the casing. The maximum dimensions here would become 12"x 8". After prototyping, the size of the tablet can be reduced from here. The tablet itself must be fully functional in the sense that it must be able to provide a tutorial on braille reading for a visually impaired individual as well having the capability to read regular documents in the English language and convert them into braille. The tablet must also be able to output audio in accordance with what the user is learning or reading on the tablet. For the reading functionality, this would give the user the option to turn off the sound as well. Since the device allows everything from basic learning to reading formal documents, these features would provide benefits to many different people, such as children learning during school, or adults reading in braille due to this newly affordable affordable option. The average power needed for a tablet is

2.0 A at 5.0 V. The design project does not have all the capabilities that a regular tablet has but will require a maximum of 1.2 A at 12.0 V due to the amount of power needed to supply multiple solenoids.

5. Design Concept

5.1. Mechanical Design

5.1.1. Prototype Idea 1:

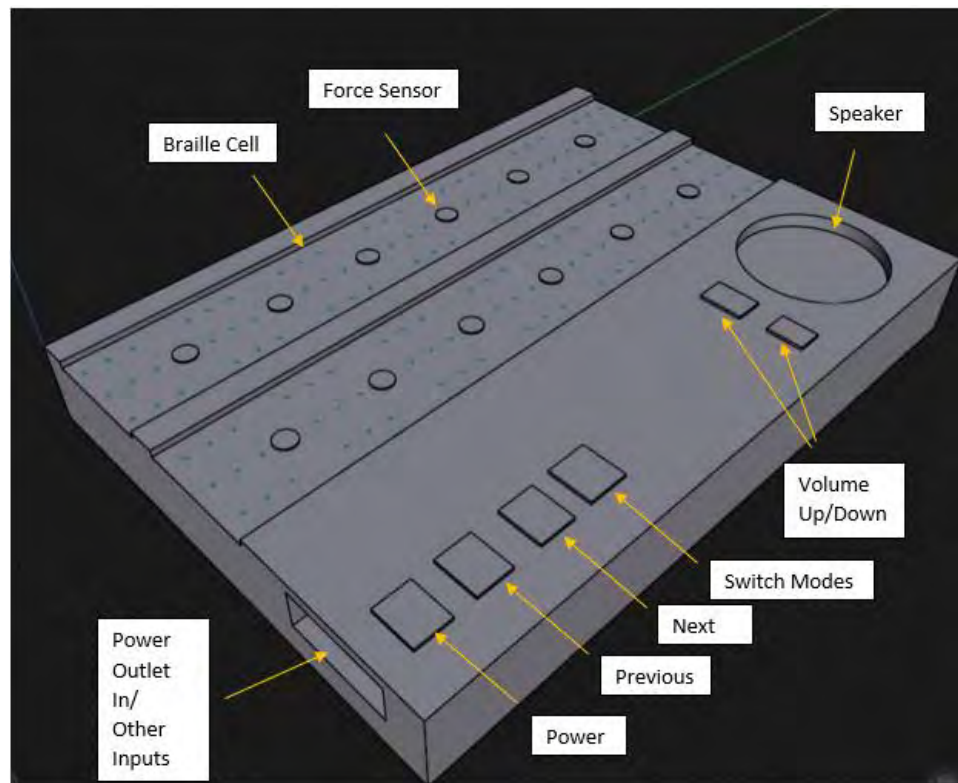


Figure 1: Prototype 1

This prototype allows the user to have two rows of cells, and 10 cells in each row. This improves the overall efficiency of reading braille on the tablet for users, compared to the last one where it was just one. After developing a method to incorporate education and interaction between the device and the user, the idea of installing pressure sensors on the device was created. Between each cell, there will be a sensor in which the device would be able to understand where the user has just read words. This would allow the device to output an auditory response as to what the user has read, thus incorporating the method in which our device becomes educational. Keeping it to a minimum of two rows allows for minimal mechanisms to be used. On the left side of the prototype, a cut out was made for where the USB-A breakout and the power in cord may charge the battery within the device. There are four buttons along the bottom left side of the device allowing for the user to Power On/Off the device, a begin button (to allow for the conversion of English to braille to begin, a Next button (allowing for the user to switch to the next two lines), and a Switch button (which allows the user to switch between educational feature and e-reader feature). The circular cut out on the right-hand side is for the speaker, alongside a volume up and down button.

5.1.2. Prototype Idea 2

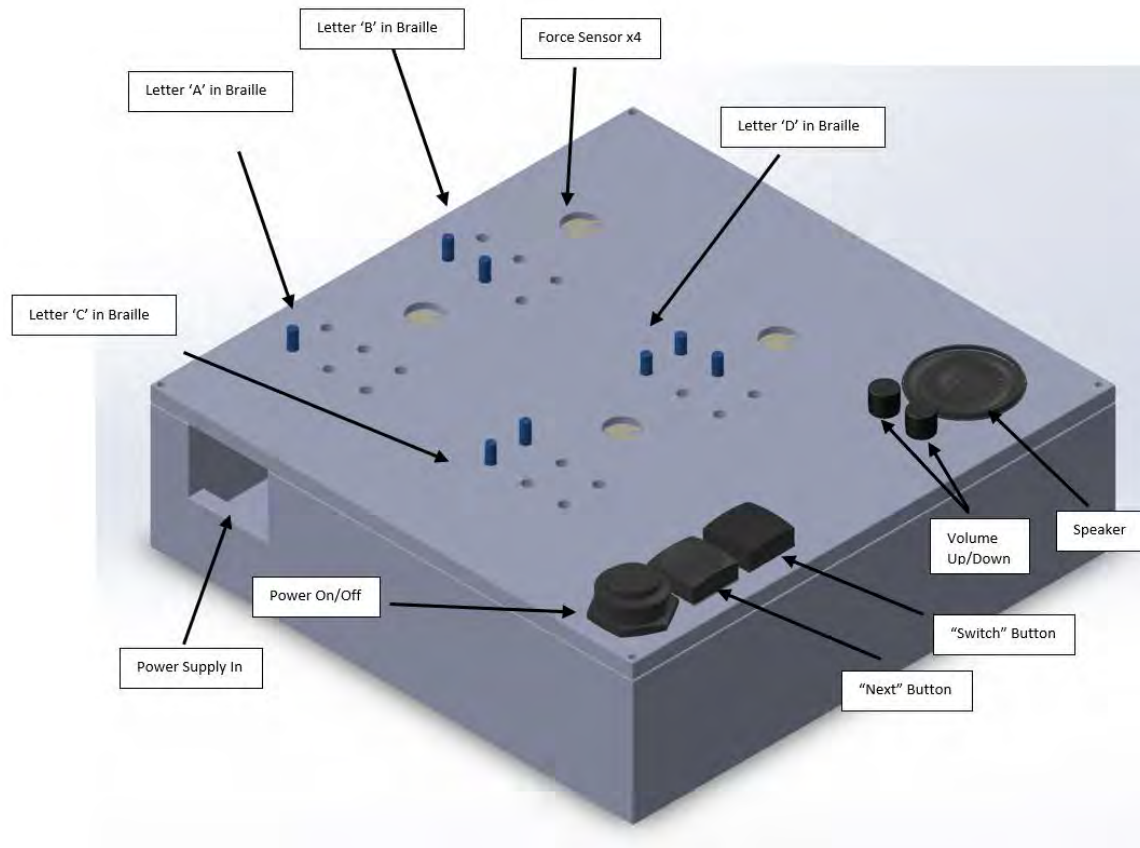


Figure 2: Prototype 2

The purpose of the third prototype was to create the concept in a physical design, all the while keeping in mind time and money restrictions. The goal was to create a smaller version of the prototype we had created by making a 2x2 cell setup. This would only allow for 2 letter words, or 2 words per row, but still allow the concept to be seen in person. This includes the usage of 24 solenoids, 4 force resistive sensors, 6 buttons, an Arduino UNO, external power source, and the speaker. This prototype is a smaller detail design and once it shows functionality can be expanded into the original larger prototype we had designed. The speaker on the bottom right corner outputs anything that has been read, by receiving a signal from the sensor into the Arduino. Its volume can be controlled by the two buttons adjacent to it. The Power button, allows the device to be turned on and goes into its default cell state as shown above, displaying the letters A, B, C, and D in Braille. The Next button allows for users to switch to the next 4 letters to be displayed. The Switch button allows for the user to switch between learning letters of the alphabet and smaller words that can be read from a single cell.

Within this prototype, the 6-solenoid cell will be held in place into the top layer by using casings we designed. The casing would be made with PLA and will use clips that attach themselves to the upper layer. The space below the casings would allow for other components to fit into place. The design of the clips involves the usage of deformation of plastic in the elastic region, allowing it to be clipped in and out of place whenever necessary (seen in Figure 15).

A 3-D printed plastic tip will be designed for the pin on each of the solenoids to account for the gap made within the cell casing, as well as for an aesthetic fit into the design. These will allow for a more comfortable use case for younger users.

The widespread use of the cell accounts for the idea that the younger age consumer will be using this product. Usually, Braille is written on paper as very tiny cells; to account for this detail, a future use case design was made.

5.2.Coding Structure:

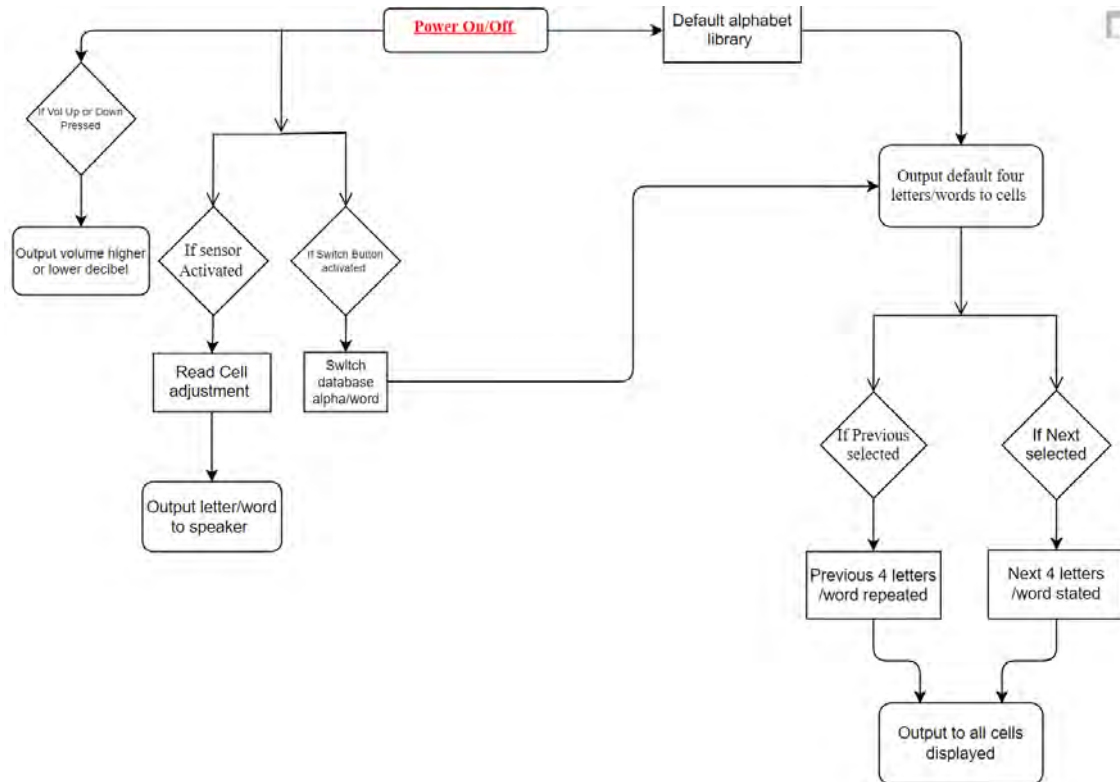


Figure 3: Braille Educational Tablet Coding Flow Chart

When writing the program for this project, the Arduino IDE software was used. The setup includes 24 output and four input pins. The 24 solenoids and DF plater are set as output pins, while the side switch and touch sensors are the inputs. When creating the code, there were two main goals: create an alphabet repository and a four-letter word generator. These required using six void functions to build the different programs and set the output pin patterns with the corresponding function. Once the device is turned on, the void loop, by default, is active. Here, the microcontroller waits for the state of the slide switch. Once it is specified to teach either the alphabet or the four letter word, the program is activated. The slide switch does not implement parameters, as its purpose is to recognize the state of the switch. The input of the switch is determined by a 0 or a 1. In the Arduino language that translates to LOW or HIGH state. If it has a low state, the program for the alphabet is triggered. The alphabet level operates with six solenoids and has a nested switch case in a for loop. The for loop allows the program to run from one case to another automatically if conditions are met. First a code was written that would connect specific pins in the Arduino to a solenoid. The aPO function, known as the active pin for

the alphabet code, is implemented to reduce the lines of code to activate the solenoid pins according to the letter. It has 6 integer parameters corresponding to the digitalWrite of solenoidPins 1 – 6 that communicate to the microcontroller. These give a HIGH or LOW voltage. Then the aPT function, active pin for the 4-letter word generator, is developed where the microcontroller operates with 24 solenoids at a time. The alphabet level operates with six solenoids and has a nested switch case in a for loop. The for loop allows the program to run from one case to another automatically if conditions are met. An array was created using the “const char” and the bank was called “words []”. When the user selects this section, the program will randomly select one of the 74 words that were used to fit within the curriculum of a pre-k to kindergarten student. Once a word is picked, it would display the word using the solenoids but wouldn’t use the audio function unless activated using the touch sensor. All the code is illustrated in a flow chart below.

5.3.Strength of Materials:

Table 2: Trade off study to select the tablet material using Pugh’s Method

Issue: Choose a Tablet material		ABS Plastic (score)	Carbon Fiber (score)	CNC Aluminum (score)	Aluminosilicate Glass (score)
Insulation	25	Strong (2)	Mid (1)	Weak (0)	Strong (2)
Durable	20	46 MPa (0)	3.0 GPa (2)	124 MPa (1)	180 MPa (1)
Cost	15	\$1.50/lb (2)	\$7.00/lb (0)	\$25/block (0)	\$2.50/piece (1)
Heat resistance	25	98 C (1)	2000 C (2)	66 C (1)	800 C (2)
Corrosive Resistance	15	Strong (2)	Strong (2)	Strong (2)	Strong (2)
	Total	7	7	4	8
	Weighted Total	67.5	72.5	37.5	82.5

After the design has been created, the Pugh’s Method will be used to determine the option with the most pros to cons. A comparison of four varied materials will be used to compare 5 key factors needed to take into consideration when inventing this tablet. The four materials that are common for tablets are ABS plastic, carbon fiber, CNC aluminum, and glass [13]. An analysis was conducted on the materials' properties and costs to determine the overall best material for the tablet [7,1,12,14]. Through Pugh's method it was determined that Aluminosilicate was the best material from which the tablet should be created. However, when creating the design, a combination of the materials will allow for a better tablet, as the pros of the materials can help to alleviate the disadvantages of the other materials. The glass provides a strong screen to prevent people from cutting their fingers when sliding across the sensors and braille cells. CNC aluminum is a great conductor to allow for current to flow properly through the electrical components. ABS plastic is a cheap material that will be useful to hold the interior of the tablet together, and carbon fiber will be used as the exterior with its high tensile strength.

The prototype itself was made from PLA plastic, just to have a physical reference to work with as we continued our work on the Braille tablet. There are two things that should be considered further for a proper analysis of the design. An understanding of how the solenoid casings would do if the solenoids were to run for a specific amount of time, as well as how the prototype can handle being dropped. PLA plastic has a glass transition temperature of around 50c – 80c.

Taking this into consideration alongside the temperature ranges, the other material may be better to avoid any failures. The material must also be durable to drops, as enough stress could cause failure in the system or the structure itself.

To get an accurate scaling of points for the advantages and disadvantages of the different materials, a set value must be obtained for the minimum requirement needed. To do this a stress analysis was conducted to analyze the shear and moment occurring on the tablet due to a concentrated load. The values found will be used to ensure that these materials meet the requirements and which materials exceed the requirements.

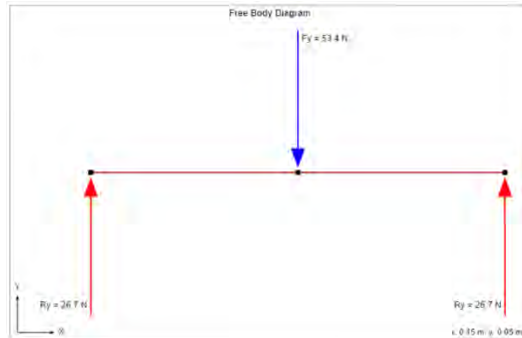


Figure 4: Simplified Free Body Diagram of tablet top shell

The results will then dictate that the maximum deformation to the top shell of the tablet is 11.82 nm. The forces and moments will then be used to obtain the von-mises stress on the top shelf as well as the stress occurring on the pins holding the tablet together. The von-mises stress or maximum distortion energy theory was used to find where theoretically the maximum stress would occur when a force is applied to the top shell of the tablet. This is crucial for the mechanical design of components; an engineer always will keep the Von Mises stress (σ_v) value less than the yield strength (σ_y) of that material to make the design safe.

A case study was then conducted to find the maximum von-mises stress and deformation occurring due to vertical loading at three different situations with two different sets of pin placements.

Table 2: Case Study 1

Case Study 1 (4 Pins)	Max Deformation	Max Von-Mises Stress	Factor of Safety= σ_{max}/σ_y (Must be > 2.0)	
Loading Point 1	1.43 mm	41.3 MPa	1.11	Not acceptable
Loading Point 2	1.46 mm	44.7 MPa	1.03	Not acceptable
Loading On Both	1.62 mm	53.1 MPa	0.87	Not acceptable

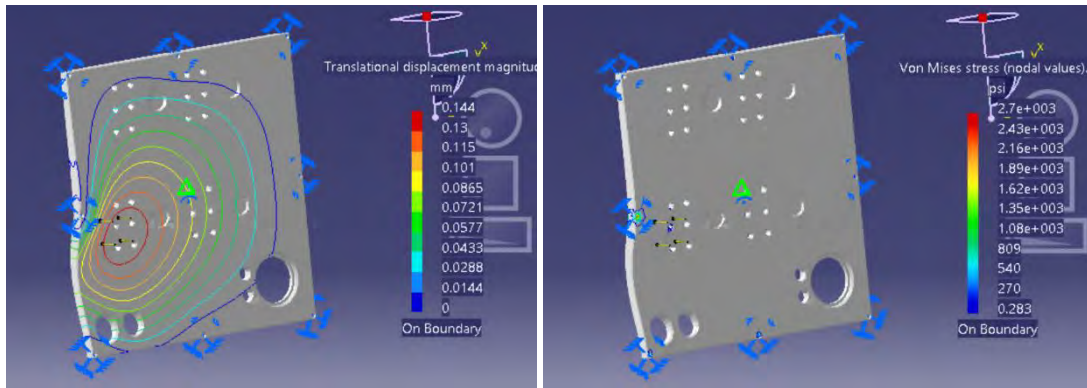


Figure 5: C.S. 1 Loading Point 1 Deformation and Von-mises Stress

Table 3: Case Study 2

Case Study 2 (8 Pins)	Max Deformation	Max Von-Mises Stress	Factor of Safety= σ_{max}/σ_y (Must be > 2.0)	
Loading Point 1	0.144 mm	18.6 MPa	2.48	Acceptable
Loading Point 2	0.151 mm	21.4 MPa	2.15	Acceptable
Loading On Both	0.107 mm	11.4 MPa	4.04	Acceptable

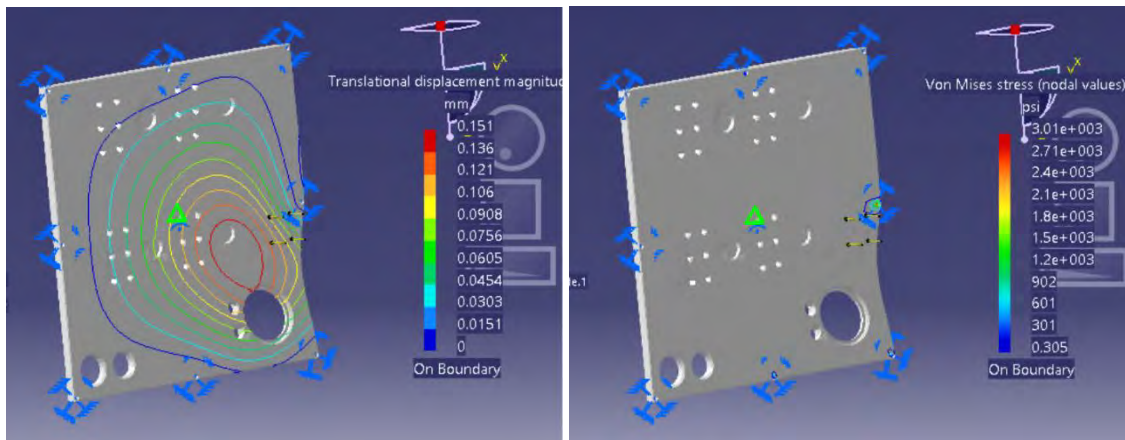


Figure 6: C.S. 2 Loading Point 2 Deformation and Von-mises Stress

The results from the case study show that to mitigate the maximum stress and deformation of the top shelf due to the vertical loading, 8 pins are recommended. The spread of the number of pins on the tablet edges allowed for the stress to be distributed evenly across the larger number of pins.

5.4. Electrical Layout

The Braille tablet consists of 24, 5-volts solenoids, TIP120 transistors, 1N4001 diodes, and 220-ohm resistors, large breadboards; one Mega Arduino, slide switch, USB, and Type C port. Initially, a subcircuit with the basic components to control the solenoid was tested (see Figure 10). The circuit would be powered by a 9V battery, followed by an 18V adapter that will be connected via a power outlet. An overview of the tablet's electrical design is viewed below.

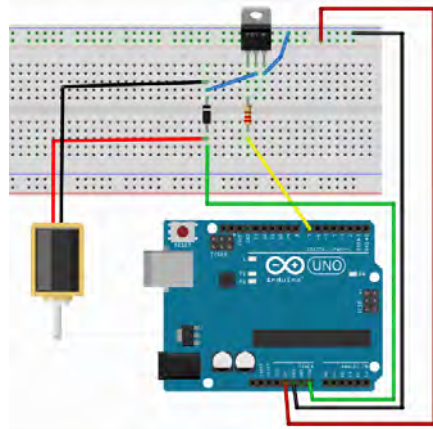


Figure 7: First subcircuit to control the solenoids

The electrical design is divided into two subcircuits. The first subcircuit, was developed in phase one of the project, which can be seen above in figure 10. A 220 Ohm resistor, TIP120 transistor and one 1N4001 diode would be needed to control each solenoid. This is to control the current and prevent it from flowing backwards when a pulse is sent from the Arduino to the solenoid. The resistor is connecting in series to the base of the digital pin in the Arduino. The diode is in series with the collector, voltage, and the positive and negative ends of the solenoid, with the emitter connected to the ground of the breadboard. The setup is repeated 6 times for the braille dots.

The second subcircuit consists of the input components – the slide switch and the touch sensor. The slide switch is connected to the breadboard to control the execution program. The switch has three terminals, one connected to ground, another to power, and the common terminal to a digital pin of the Arduino. The same concept is used for touch sensors. The same conceptual connection is valid for the sensor. These input components communicate to the microcontroller the user’s choice of program and detect the motion of the child’s hand above the braille cell to indicate if the program runs continuously or a letter must be looped.

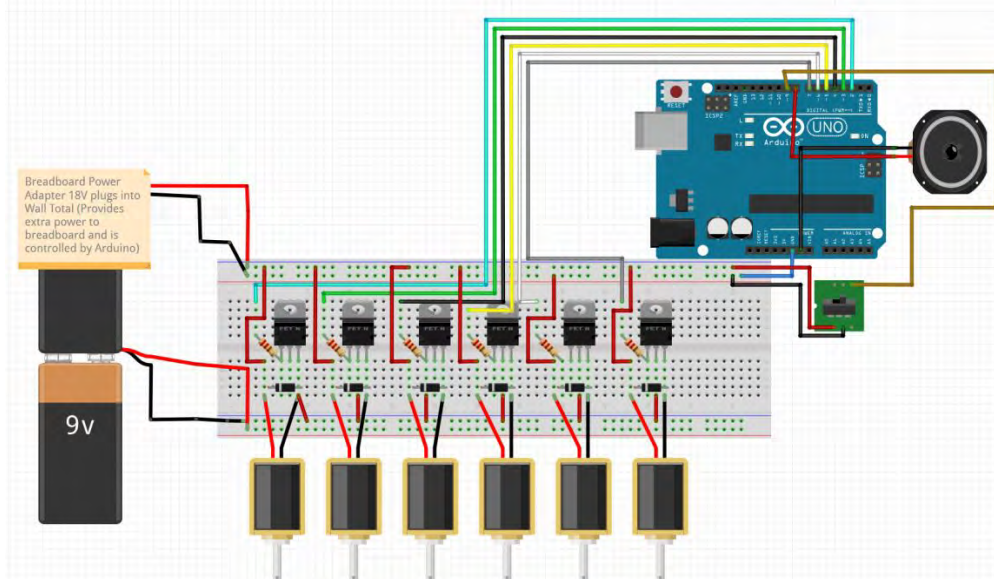


Figure 8: Full circuit to control one braille cell

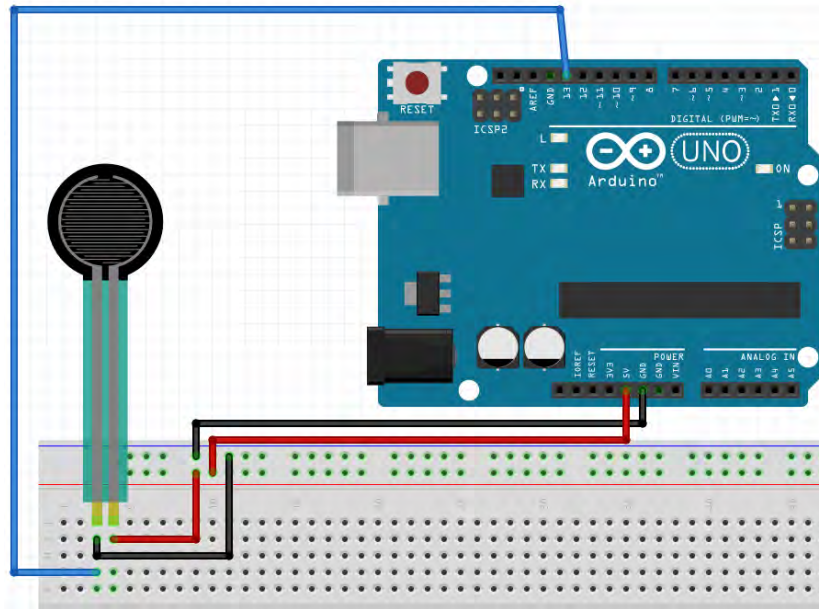


Figure 9: Touch Sensor circuit

6. Mathematical Analysis

a. Electrical Component

The input power of a Solenoid motor is the terminal voltage multiplied by the current:

$$P_{in} = V_{mot}I_{mot} \quad (1)$$

The breadboard implemented is connected in series ground to ground and power to power. The breadboard uses six solenoids, representing a Braille cell and one touch sensor. The resistors, diodes and transistors' values prevent the circuit from overheating or short circuiting. The main equation we used was Ohm's Law to ensure the safety of the circuit.

$$I = \frac{V}{R} \quad (2)$$

The variables in the equation represent V to the voltage source of the circuit, and R to the resistance used. The result is compared to 40 mA, which is the maximum current draw in DC current per input and output - I/O - pin of the Mega Arduino. As the voltage source is 18 volts and the resistor has a value of 220 Ω , the total current going through each pin is equivalent to 13.6 mA which is in a safe range.

b. Stress Analysis Component

The general equation for finding the stress of a structure would be used to find the maximum allowable stress.

$$\sigma = \frac{F}{A} \quad (3)$$

σ = Normal Stress, F = Force applied to structure, A = Area (m^2)

For industry standard, the factor of safety that we would use would be $N_{fs} = 2$

From the answers we got from Eq. (3) and taking the factor of safety of 2, allows us to find the maximum allowable stress on the system.

$$\sigma_{allow} = \frac{\sigma}{N_{fs}} \quad (4)$$

σ_{max} = Maximum Stress allowed

The bending stress would be applied to the cover of the braille tablet. This will give us the proper understanding of when we apply our force onto the beam how much deflection will occur.

$$\sigma_b = \frac{Mc}{I} \quad (5)$$

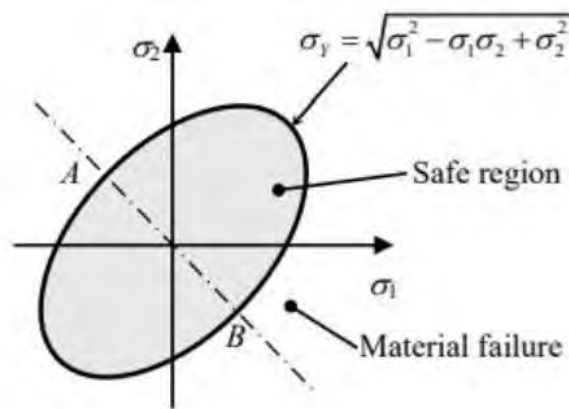
σ_b = Bending Stress, M = Moment of neutral axis, c = Perpendicular distance to neutral axis (m)

I = second moment area of neutral axis (m^4)

Von Mises stresses acting on the material are greater than the yield stress experienced by the material in a uniaxial tensile test. The direction and magnitude of stresses are different from point to point. Here Von Mises criterion is a formula for calculating the effect of these combined stresses at a point responsible for failure or not.

$$\sigma_{vm} = \sqrt{\sigma_x^2 - (\sigma_x \sigma_x) + \sigma_y^2 + 3\tau_{xy}^2} \quad (6)$$

σ_{vm} = Von Mises , τ_{xy} = Shear Stress



7. Electrical Testing

In the electrical testing stage, we ordered all the necessary parts to test out the project. We started with learning how to create a proper circuit for the project. Per 5V solenoid, we had used two 330 Ohm resistors, one TIP120G transistor, four cables and a 1N4006 diode all plugged into the breadboard. The main power source that was used was a 9V battery with the Arduino plugged in for importing the necessary code. Each test was successful up to beyond 4 solenoids, where our team realized that we would need to get more output from the microcontroller. For testing, we had written a simple forever loop on/off code to ensure that the solenoids would respond when given the appropriate amount of voltage upon activation.

The microcontroller can only output a regulated 5V stream of power; however, the solenoids all together would require more than 5V. To solve this problem, we discovered that we would require another controller to regulate extra power for the breadboard. The Arduino itself can only handle an output of 5V. By adding on this extra controller to supply power to the breadboard, the issue of not being able to power more than 4 solenoids at a time was solved.

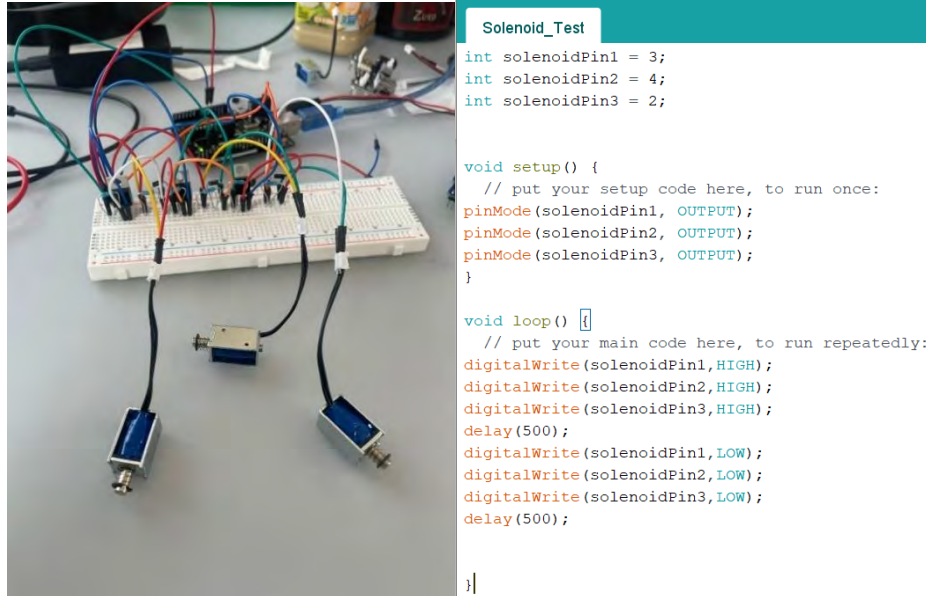


Figure 10: Solenoid Testing

Along with testing the solenoids, we had printed out the container needed to house the solenoids inside the Braille Educational Tablet. This was printed out using standard PLA 3D printed material, and clips were added to the side of the box to keep the solenoids in place while they were being operated.

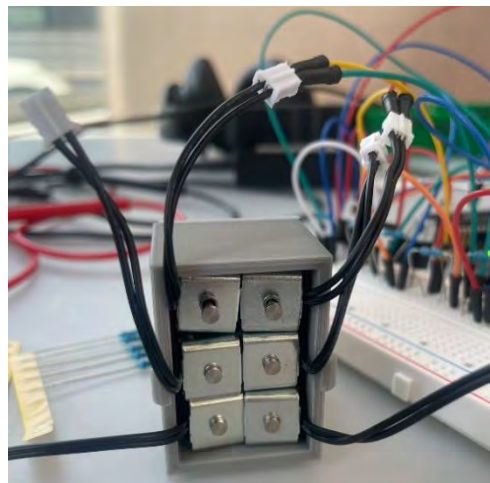


Figure 11: Solenoid Cell Casing

In Figure 13, the letter ‘C’ from the alphabet is being displayed in Braille. The 6 solenoids together are the formation of the cell, in which all letters can be displayed. The casing shown here was the original design printed to test fitment of the solenoids. After taking spacing considerations, as well as the fact that the solenoid wires come out the sides, a redesign was

completed as seen in Figure 15. This design accounted for the wires sticking out the sides of the casing while not interfering with how the casing plugs attach to the top shell of the prototype.

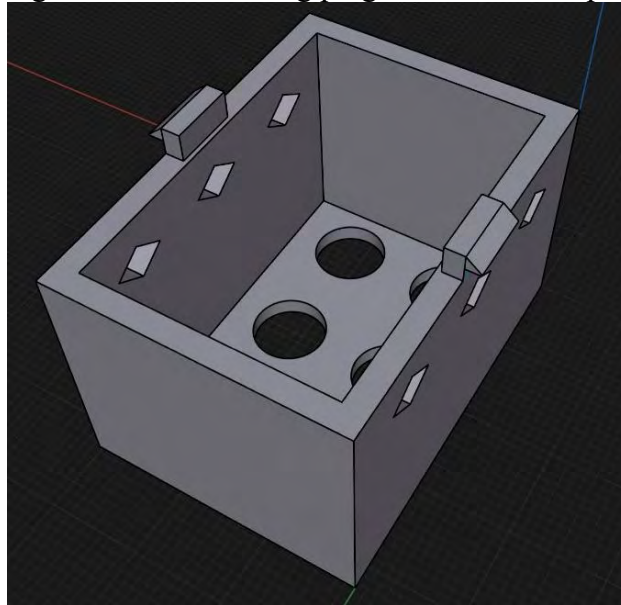


Figure 12: Updated Solenoid Casing

7. Project Management

A. Team Members and Responsibilities

August: Coding, Research, Electrical

Manpreet: Design Concept, Coding and Research

Bryan: Project Management, Design Concept (Requirements)

B. Project Budget

Table 4: Budget

COMPONENT	COST PER UNIT	QUANTITY	TOTAL
Arduino UNO Rev3	\$22.77	1	\$22.77
Breadboard	\$5.50	1	\$5.50
1N4001 Diode	\$0.15	24	\$3.60
Force Sensitive Resistors	\$5.54	4	\$22.16
TIP120 NPN BJT Darlington Transistor	\$1.00	24	\$24.00
Wiring Kit	\$19.95	1	\$19.95
Solenoid -5V	\$5.50	22	\$121.00
Speaker Unit	\$9.00	1	\$9.00
Resistor – 1K OHM	\$0.15	24	\$3.60
AC/DC Adaptor	\$16.99	1	\$16.99
Breadboard Power Supply	\$25.70	1	\$25.70
TOTAL COST			\$274.27

C. Project Timeline

Table 5: Activity Plan

PROJECT: BET (Braille Educational Tablet)

Project Manager: Bryan Gordillo



ACTIVITY PLAN				WEEK > 1																																					
#	Activity	Start	End	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35			
10	PROPOSAL	04/02/22	20/02/22	1	17																																				
20	PROTOTYPE DESIGN	20/02/22	05/05/22	17	91																																				
21	Change of design to Prototype #2	20/02/22	28/02/22	17	25																																				
22	Check compliance of all parts and their availability	28/02/22	03/03/22	25	28																																				
23	Change of design to Prototype #3	03/03/22	17/03/22	28	42																																				
24	Material Design	02/04/22	07/04/22	58	63																																				
25	Final Prototype Design	07/04/22	28/04/22	63	84																																				
26	Refurnish Design to Safety Standard	28/04/22	05/05/22	84	91																																				
30	ELECTRICAL WIRING AND COMPONENTS	07/03/22	19/04/22	32	75																																				
31	Creation of Flow Chart	10/03/22	14/03/22	35	39																																				
32	Acquiring Components	14/03/22	21/03/22	39	46																																				
33	Create a Complete Cell	21/03/22	30/03/22	46	55																																				
40	CODING	14/03/22	28/03/22	39	53																																				
50	TESTING	19/04/22	10/05/22	75	96																																				
51	Software Testing	21/04/22	28/04/22	77	84																																				
52	Hardware Testing	28/04/22	05/05/22	84	91																																				
60	COMPLETE PROJECT	20/02/22	20/05/22	17	106																																				
70	TECHNOLOGY DAY	20/05/22	20/05/22	106	106																																				

A budget was created to visually see the finances needed to build a single BET. The Project Timeline is used to demonstrate the progress needed for the group to complete the project on time.

8. Finalized Prototype Concept:

We discovered smaller solenoids that may be factored into a future design for which we use 3V 8mm solenoids allowing for the spacing within the cell to be much smaller.

By being able to make this design more compact, it will not only create a more realistic use case device, but also expand the audience for which we may use this product. Rather than just allowing only Pre-K students, it could expand upwards based on the device’s cell usage. If we increase the number of cells per row, it will allow for larger words and sentences to be read.

Prototype three was switched to an external power source, as the battery power that must be supplied involves a larger casing, in which we would be sacrificing the comfort of the tablet. However, if the tablet were made for a higher quantity of cells, it would also allow for enough space for a portable and rechargeable battery source to be included.

Prototype three also does not include the code for the functionality of being able to read external PDFs, as that would involve similar issues to the battery. To include this functionality alongside the original functionality of being able to educate students in Braille, it would require the Arduino UNO to be swapped for one of the more capable products. With better processing power and features, it could allow for a fully functional device meant for all ages. The code for this feature itself will be composed as a flow chart within this proposal.

When Arduino UNO is replaced one of the more capable products with better processing power and features, this could allow for a fully functional device meant for all ages. The code for this feature itself will be composed as a flow chart within this proposal.

9. Conclusion

The Braille Educational Tablet (BET) will be designed for educational purposes in helping Pre-k to 3rd grade students with visual impairments to be able to read. The completed project will utilize all aspects of Mechanical Engineering as well as a sufficient portion of Electrical Engineering. The use of flow charts, tables, 3-D designs, and analysis charts will be implemented to ensure a functional tablet is made.

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Smart Home Electrification

Wole Barnarde

Electrical Engineering, Vaughn College, Flushing, NY
wole.barnarde@vaughn.edu

Ankit Mistry

Electrical Engineering, Vaughn College, Flushing, NY,
ankit.mistry@vaughn.edu

Adem Bunardizu

Electrical Engineering, Vaughn College, Flushing, NY,
adem.bunardizu@vaughn.edu

Faculty Advisor: Dr. Mohammed Benalla

Electrical Engineering Department, Vaughn College, Flushing, NY
mohammed.benalla@vaughn.edu

ABSTRACT

For a number of years, the need for smart homes and smart home technologies has increased worldwide, including smart lights, smart thermostats, smart light bulbs, and an ongoing list of technologies. This smart technology provides homeowners with the ability to control, monitor and automate various devices around their home through one central point i.e., a smartphone, tablet or even a laptop. Smart homes can feature either wireless or hard-wired systems, or both. Security and efficiency are the main reasons behind the increase in smart home technology use. Hard-wired systems are considered more reliable and are typically more difficult to hack. Unfortunately, hard-wired systems are more expensive when compared to wireless systems, but wireless systems are often more cost friendly. A solution to this weakness in current smart home technology is to provide an easy way to both electrify the house in a ‘smart’ way as well as to provide several remotely operated home features. Installing this smart home electrification system will provide homeowners with convenience. Rather than controlling appliances, thermostats, lighting, and other features using different devices, homeowners can control them all using one device or several devices programmed to use the technology.

1 INTRODUCTION

Smart home refers to a home setup in which appliances and devices are controlled through internet connection. From smart doorbells to thermostats and light bulbs, smart home has grown popular all over the world. It was estimated that almost 37 percent of households in the United States owned a smart home device in 2020, the highest forecast smart home penetration rate worldwide [1]. As a consequence of the growing popularity for smart home devices in the United States, smart home revenues have also been on the rise with smart home sales in the United States projected to reach almost 47 billion U.S. dollars by 2025, which is approximately twice the amount of revenue in 2020 [2].

Tapping into the vast development in this market, our team has decided to design a ‘Smart Home Electrification System’ to better improve efficiency and provide remote access to several home features and appliances by the click of a button from anywhere, rather than the flick of a switch. These home features will be connected to each other and will be accessed through a ready-made application, the Blynk App, which will act as the centralized hub for remote control. There will be a code developed to operate these functions and sync them to the Blynk Application to enable this access. This smart home feature will provide power to the home, as well as automate light fixtures and control the temperature of the home/room. Once connected, services such as temperature control, remote control of light fixtures, and smart appliances are all part of the internet of things (IoT) technology, a network of physical objects that can gather and share electronic information.

2 BACKGROUND RESEARCH

Smart homes can improve residents’ quality of life by providing various services that assist their daily lives. Technology developers and researchers claim that advanced, applied knowledge will make our lives more comfortable. Their purpose is to support the daily lives of residents through technologies, such as those for energy management, security, monitoring, and incident detection [5,7]. Despite this broad range of potential and assumed benefits of technology adoption, if we focus only on technological features, the technology can disappear before they are even incorporated into our lives [7].



Figure 1 Smart Home Technology Concept

Research theories have been expanded as various variables affecting information technology have been newly identified in technology adoption theory studies, which report negative or positive effects of the perception of technology on usage intentions. In particular, Kim et al. (2007) reported that adoption of technology was made to maximize its value, and different values of technology recognized by the adopter affected behavior. They explained the adoption process of the technology based on the concept of perceived value that comprehensively considers both the sacrifices (e.g., technicality, perceived fee) and the benefits (e.g., usefulness, enjoyment) that accompany the use of the technology.

Thus, smart home research requires a sustained, systematic understanding of users because adopting smart technologies and incorporating these in everyday life are important for the success of smart homes [9]. The benefits of smart home technology are endless, and the technology is expected to improve even more during the coming years [10].

Whether it’s running your washing machine while you’re at work, turning down your thermostat on a cold, winter’s day, or being notified when someone rings your doorbell, smart technology comes with loads of advantages.

Having smart home technology installed allows homeowners to:

- **Decrease energy bills.** Much of the energy savings with home automation comes from the ability to control your home's lighting and heating and cooling system when one is not at home. If one is away from home for the weekend in the middle of the summer, one can change the temperature setting from 72 to 78 degrees to save money on one's energy bill. Smart home technology will, in many cases, lead to increased energy-efficiency and convenience.
- **Keep an eye on pets and family.** Through the use of motion detection, smart locks, and video monitoring, homeowners can keep tabs on their kids, elderly parents, or pets while they're at the house alone.
- **Have complete control of their devices.** Smart home technology gives homeowners complete control over their devices from the palm of their hand. Whether it's turning the lights on while one is driving home, turning on the coffee maker before one leaves the bedroom, or turning the thermostat up so as not to freeze when getting out of bed in the morning, the opportunities are endless. One can fully operate one's home even while one is away from this location.
- **Remote monitoring.** Monitoring one's systems remotely provides real-time monitoring of one's home. Whether it's through video feeds, alerts from your fire or carbon monoxide alarm, or notifications from the home alarm system, one will have peace of mind knowing the family and home are safe from dangers.
- **Motion detection.** Motion detection can alert one to suspicious activity around one's property. This technology also saves energy by only activating, or turning on, when someone is there.
- **Answer the door from anywhere.** With a smart doorbell, one is notified immediately when someone rings the bell. Some smart doorbells allow one to see the person and even speak directly to them. These types of systems deter thieves, because they know they are on video.

Although this system focuses on only a few of these benefits listed above, there is extensive research suggesting that the implementation of smart home technology is not only futuristic but also affords homeowners greater peace of mind.

3 ENGINEERING REQUIREMENTS/ SPECIFICATIONS

Each hardware component within this project was carefully selected, based on its size, functionality, and cost. These components were commercially available and were selected from a wide variety of options. The smart home electrification system consists of three basic applications of sensors: sensor signal processing, Internet of Things (IoT) and online monitoring through mobile apps. The components used along with their specifications are as follows:

1) *Arduino Microcontroller*

The brain of the system is the Arduino Nano which is based on ATmega328P which has the same functionality as an Arduino Uno, but on a smaller overall size. The Nano has a 5V VCC output, which has a limit of 200mA. This nano has a flash memory of 32 KB of which 2 KB used by bootloader



Figure 2 Arduino Nano Board

and an overall weight size of 7g. This will be used to program the WIFI chip to operate the circuit remotely as intended; see Figure 2.

2) ESP8266

Wireless connectivity was a requirement in the design of the smart home electrification system for it to connect to Wi-Fi network, which falls under the category of online monitoring of the device representing an IoT. One of the most common and readily available modules, for this purpose is the ESP8266. The model used in this project is the ESP-01 from the ESP8266 series developed by Expressif. It is a very low-cost Wi-Fi chip with 802.11 b/g/n connectivity which allows the Arduino to have full internet capability. The ESP8266-01 also includes a 32-bit microcontroller with a TCP/IP stack. It communicates with the Arduino through the serial pins D2 and D3 connected to RX and TX pins of the ESP. The ESP has been loaded with a custom firmware provided by Blynk which allows it to be connected to its server, Figure 3.



Figure 3 ESP8266-01 Board

3) 110V to 5V Converter

This system will utilize a NOYITO AC to DC precision buck power supply module AC 110V 100V-264V to 5V 3A 3000mA isolated step-down DC module (5V 3A). This gives an output voltage of $5v \pm 1\%$ which will allow us to step down the input voltage to a workable voltage that the ESP8266 can handle. This converter has an output current of 3A or 3000mA and has a ripple of less than 60mVp-p Figure 4.



Figure 4 110V to 5V DC Converter

4) 5V One Channel Relay

The module uses genuine quality relay, normally open interfaces, which have a maximum load of AC 250V/10A, DC 30V/10A. This relay uses SMD optocoupler isolation, strong driving capability, stable performance; trigger current 5mA. It is a fault-tolerant design, even if the control line is broken, the relay will not move. In the interface design of human nature, all interfaces are available through a convenient, direct connection terminal lead. The Module can be set by jumper high or low trigger. This we thought to be very convenient compared to other relays on the market, Figure 5.



Figure 3 5V One Channel Relay

5) Blynk App

This was the app used to remotely communicate with our circuit. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and perform many other remarkable procedures.

There are three major components in the platform:

- **Blynk App** - allows the user to create amazing interfaces for projects using various widgets.
- **Blynk Server** - responsible for all the communications between the smartphone and hardware. The Blynk Cloud can be used or a private Blynk server can be run locally. It's open source and could easily handle thousands of devices.
- **Blynk Libraries** - for all the popular hardware platforms, these enable communication with the server and process all the incoming and outgoing commands.

6) *Miscellaneous Parts*

This project will also utilize several other components. The ones listed above are the main components of this system. Components such as:

- A Tactile Button which will be used as a switch to manually turn the circuit on or off.
- LED's which are used only for demonstration purposes of actual light bulbs, which can be replaced during the implementation of this system to the customer.
- Fan with motor which will be used with the temperature control system and activate whenever the temperature of the room reaches a temperature preset by the user.
- Temperature sensor - this will be used to sense the room temperature, but for demonstration purposes we chose an affordable sensor.

The above are all included in the system, but they were all obtained from the cost-effective Arduino package and could be replaced for industry standard parts at the time of home installation.

4 ENGINEERING CONSTRAINTS

At the end of the Trump Administration, the bipartisan Internet of Things (IoT) Cybersecurity Improvement Act of 2020 ("the Act") was enacted after passing the House of Representatives on a suspension of the rules and the Senate by unanimous consent. The Act requires agencies to increase cybersecurity for IoT devices owned or controlled by the federal government. Despite its seemingly limited scope, the Act is anticipated to have a significant, wide-ranging impact on the general development and manufacturing of IoT devices.[11]

The Internet of Things is the "extension of internet connectivity into physical devices and everyday objects." [12] It covers devices — often labeled as "smart devices" — that have a network interface, function independently, and interact directly with the physical world." [13] While the Act's definition of IoT devices expressly excludes conventional information technology devices (for example, computers, laptops, tablets, and smartphones), it extends to a variety of sensors, actuators, and processors used by the federal government. [14] Agencies have reported using IoT devices for controlling or monitoring equipment, tracking physical assets, providing surveillance, collecting environmental data, monitoring health and biometrics, and many other purposes. This usage is likely to expand as over 85% of federal agencies either are currently employing IoT devices or plan to do so in the next five years, further elevating the significance of the Act.

Due to the overall length of the act please refer to the reference numbers to locate the laws by which implementation of such a system are governed.

5 SYSTEM DESIGN

5.1 ELECTRIC CIRCUIT DESIGN

The circuit diagram for the main system of the smart home electrification system is provided in Figure 6. This circuit was designed with all the main components listed above in the engineering requirements section. When designing the smart home electrification system, one of the main factors on which the team focused was the simplicity and cost effectiveness shown in the circuit design. This design is very simple and easy to follow, to allow implementation to

be very straightforward. The source current will be supplied from the already existing power from the house. It will then enter the converter where it will be converted to workable power for the esp8266 to handle without burning out. It will then leave the esp8266 to the relay switch and then out. The tactile switch displayed in the circuit drawing is a physical switch that will be used to turn the circuit on or off manually in the event of no internet access.

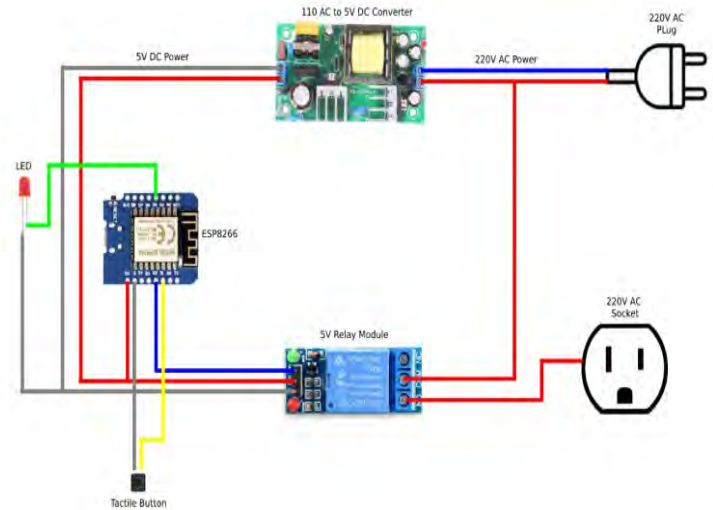


Figure 4 Circuit Diagram of the Main Smart Electrification System

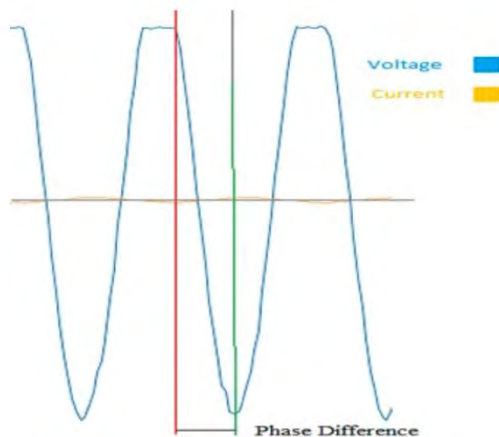


Figure 5 Graphical Representation of the Phase Difference

reproduces the Sine wave with a 2.5V DC offset; the raw output of the ACS712 current sensor can be seen in Figure 7.

The input signal is sampled at 10-bits. To measure the RMS current, we get the peak current by dividing the peak-to-peak value shown in Eq. (1).

$$I_{\max} = I_{pp}^2 \quad (1)$$

Several tests had to be carried out on the system to ensure that the system is functioning as intended. One component we used to test was an AC712 current sensor. The sensor used in this project can measure up to 30A using a Hall Effect sensor. It has a voltage resolution of 66mV/A which is suitable for high, as well as low current values. This is an invasive current sensor, which means that it must be set up in series with the circuit. The input of the current usage is a Sine wave. The Hall Effect sensor

After getting the peak current, we multiply it with 0.707 to get the RMS current as seen in (2).

$$I_{rms} = I_{max} / \sqrt{2} \quad (2)$$

Each ACS712 has a scale factor, depending on its maximum current reading capability. The module we used was the 30A module, which had a scale factor of 66mV/A. After multiplying the scale factor with the initial RMS current, we receive the actual RMS current in the system using Eq. (3).

$$I_{rms(actual)} = I_{rms} \times 66 \times \text{mV/A} \quad (3)$$

A voltage sensor was also used in the testing phase to ensure that everything was working as intended. The voltage sensor used to test in this project is based on ZMPT101b, working as a sensor signal processing unit. This consists of a voltage transformer with a turns ratio making it suitable for the module to handle mains voltage. The voltage sensor, like the ACS712, has a sine wave with a DC offset at 2.5V. This module is rated for 350V and must be calibrated beforehand. Measuring of the voltage and calculating the power and power factor was done by using the already available library developed by Open Energy Monitor programmed in the Arduino IDE. This library includes all the algorithms needed to sample the voltage and measure power factor using the peak-to-peak times of the current sine wave and voltage sine wave. The voltage measured is in RMS, and the power is simply calculated by using Eq. (4).

$$P = V_{rms} * I_{rms} (actual) \quad (4)$$

The power factor is a very important characteristic of a power system. It is the cosine of the phase difference in the voltage and current usage. The power factor can provide us the reactive power and the apparent power of a system since it is the ratio of true power to apparent power. The phase difference between the two inputs is calculated by using the zero crossings. The time of a zero crossing for a voltage signal and current signal is stored. The difference is a value in radians. The Cosine of this value gives us the power factor as seen in Eq. (5).

$$\text{Power factor} = \cos(\theta_v - \theta_i) \quad (5)$$

5.2 SOFTWARE DESIGN

All coding is done on the Arduino IDE. Since this project consists of several different modules, each had to be tested and programmed individually. The safety factors were included in the coding of the microcontroller. The coding was done to communicate with the components through the Blynk App. Blynk is an app designing platform supported by Android and iOS, which can control a microcontroller such as Raspberry Pi and Arduino wirelessly over the internet. The microcontroller can use either Wi-Fi or Ethernet connection methods. The basic working principle of the Blynk application is based on IoT (internet of things). The Blynk application can be used for



Figure 6 Visual Representation of Steps Taken to Develop Code

displaying values received from a microcontroller and send control commands to it. A very informative and easy to design UI is used for the control interface.

The flowchart here is a visual representation of the steps taken to interface the Blynk app with the circuit and how the code was designed for this system to enable the homeowner to remotely access this circuit. Although other programming environments, such as LabVIEW [15-19], are recommended to develop software for real time monitoring and control, the Blynk app was an inexpensive, user-friendly method requiring little to no presentation on how to use the application, because everything is self-explanatory.

6 IMPACTS

6.1 ENVIRONMENTAL

A smart home electrification system will benefit the environment in significant ways. Smart home automation reduces the overall energy consumption of one's home, making it greener and more environmentally friendly. Electricity has a huge impact on the environment, but implementation of a smart home electrification system is a proven eco-friendly solution.

6.2 ECONOMICAL

The economic benefits of a smart home electrification system go directly hand in hand with its environmental impact. Automating and remotely accessing household appliances and functions assist the homeowner in saving money on monthly energy bills. Although several studies suggest the implementation of smart home technologies within a home are expensive to set up, we have designed this system to be not only cost-effective to set up but also a cheaper option to maintain, thus providing economic assistance to the homeowner, in the long run.

6.3 SOCIAL

This smart home electrification system also provides social benefits for users. One of the biggest problems smart home technologies and this system solve is the assistance of seniors and people in need. This system will impact their lives in significant ways by simplifying all of their daily activities. Our team aimed to provide a user-friendly system that can be operated by even the less technically inclined members of a household. This system will also provide homeowners with peace of mind, knowing they have control of all of their household appliances and devices in the palm of their hands.

7 CONCLUSION

The objective of this project is to create a Smart Home Electrification system that will allow homeowners a cheaper and more user-friendly way to automate several house functions. This system will allow homeowners the ability to connect light bulbs to the smart socket designed or a to remotely access the switch and control the circuit of any other appliance. By extension, this system will also provide a unique feature that will allow homeowners an automated cooling system in which a fan will turn on to cool the room until it reaches a pre-set temperature. This

project grants the homeowner both economic and environmental benefits, as it will save homeowners money on their electric bill and provide an eco-friendly environment.

8 ACKNOWLEDGEMENTS

The researchers would like to thank Dr. Sharon DeVivo, President of Vaughn College of Aeronautics and Technology and Dr. Hossein Rahemi, Chair of the Engineering and Technology for providing the opportunity to conduct such a project. A special thanks to Dr. Mohammed Benalla, project advisor for the continuous guidance, support, and motivation throughout the project.

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Small Size Thermal Electric Generators to Convert Heat Flux into Electricity Built for Camping and Recreational Activities

TEG Pipe

Rafacely Brito

Mechanical Engineering Technology, Vaughn College, Flushing, NY,
Rafacely.Brito@vaughn.edu

Cesar Valle

Mechatronic Engineering, Vaughn College, Flushing, NY,
Cesar.Valle@vaughn.edu

Advisor: Dr. Elzawawy Amir

Professor at Vaughn College of Aeronautics and Technology, Flushing, NY
Amir.elzawawy@vaughn.edu

ABSTRACT

Fueling the future means designing with efficiency and sustainability. Thermoelectric power generating modules produce significant amounts of electricity from a small temperature difference. The purpose of the present device is to extract the most amount of energy from a simple heat transfer into a battery pack. This will allow for a more opportune and cost-effective way to harvest power. An aluminum double barrel pipe with an inner and outer diameter of 1 inch and 3 inches, respectively, was designed. The inner pipe is used to mount TEG modules along the top and heat sinks will be arranged among the TEG modules with steel reinforced epoxy putty. Both ends of the pipe will be exposed to the atmosphere. The plan is to start a small fire in the inner pipe and wrap it with insulation. The theory is that this will help prevent heat from escaping the system and will directly help maintain the temperature difference needed to power the TEG modules. The intent is to use the battery pack to power a smartphone later. The power output of the TEGs depends on the average temperature difference between the opposite sides of the TEG module and will determine the time it will take to charge the battery pack completely. With the world constantly evolving and technology on the rise, we believe that our device would be able to reuse excessive wasted heat and generate it into electricity.

1. INTRODUCTION

TEG is short for Thermoelectric Generator, and it is a device that converts a temperature difference into electricity. Thermocouples maintained at different temperatures develop thermoelectric EMF, and the current through the circuit is called thermoelectric current. In 1821, Thomas Johann Seebeck discovered a phenomenon when he placed a magnetic compass near a circuit of two dissimilar metals. He noticed the needle deflected as the two places where the two metals connected were held at different temperatures. Thermoelectric generation is not a

common power source, though the principle has been in industrial use for decades. Both batteries and thermoelectric generators were discovered in the 1800s, by Alessandro Volta in 1800 and Jonathan Seebeck in 1821. But replacing batteries with TEGs is a longer lasting alternative and it is also better for the environment. The use of TEGs is a suitable solution for the maintenance of changing batteries which can be costly and very time-consuming. This innovative approach will indirectly help the problem of batteries and landfill depletion. The application of The Seebeck Effect is seen in thermoelectric generators that help convert waste heat into electricity for power plants, and we've also seen the use of TEGs applied in the automotive industry.

2. Social Impact

Due to the nature of our project, the use of this device can provide a small amount of power to places in remote settings and in natural disaster situations. Some thoughts were taken into consideration over conducting a broad survey on the desirability of having the TEG device pre-installed on our pipe rather than having the consumer make it themselves. Another way to further advance the use of our product is to work with companies and organizations which bring power to the entire world.

3. Environmental Impact

The device's key purpose is to maximize energy efficiency, especially if natural disasters are to occur. The use of this product will reduce the amount of heat wasted from the wood put inside of it. Energy is produced when heat transfer occurs to generate electricity. As a result, low cost power in common appliances and electrical equipment can be powered using our device. Using renewable sources of energy could impact the world by recovering heat waste to produce electricity.

4. Economic Impact

With this goal in mind, it is our intention to use products that are easily produced and readily obtainable. Overall, the highest cost for our device are the TEGs, priced at approximately \$17, with the need to use 6 or 7 of them. All the other products are easier to obtain compared to existing products available today. With the use of fewer materials, we hope that our device becomes easier to produce, especially if any natural disaster is to occur.

5. Engineering Standards

There are important practical considerations that should be made before attempting to use TEGs. Perhaps the most important consideration is the question of survivability of the module at the anticipated maximum temperature. Our TEG will be experiencing 330°C continuously or 400°C intermittently. But in any case, consideration should be given for the operational lifetime of a TEG exposed to high temperature. Another important factor to consider are the high temperatures required for the shrink tubing around the soldered TEGs in series. Contaminants or parts of the shrink tubing can diffuse and can degrade the performance or failure of the TEG modules. To operate a TEG module in power generation mode, quality testing should be done to ensure long-term operation at the maximum expected operating temperature. Thermal energy is one of the abundantly available energies that could be found in many sectors, such as operating electronic devices (integrated circuits, phones, computers, etc.), running vehicles, indoor

buildings, and even in the human body. Thermoelectric generators are active devices that consist of converting thermal energy into electrical energy. TEGs are widely used in many fields due to their attractive features, such as energy efficiency, free maintenance, and long lifetime. Throughout the last few years, they have become an area of interest in the field of energy harvesting for large and even small types of applications, depending on size, delivered power, and used materials.

6. DESIGN CONCEPT

6.1 FIRST ITERATION

The original idea for the project was to create a small fire in an aluminum can. By connecting two common household cans horizontally, we measured the length of 9 inches and diameter of 3 inches. This established the first dimensioning criteria of the design. Next, we considered how to simultaneously heat and cool the TEG modules in these cans to power them. We immediately concluded fire would be the source of energy, and natural ventilation would be the cooling attempt. The temperature differential needed for the TEG modules to operate is vital and so the use of fans is clear and found on the commercial market. However, by not using fans to help dissipate the heat, this decision immediately sets us apart from existing devices. Leaving the ends exposed to the external temperature and implementing heat sinks would serve as the first method of eliminating heat quickly. The technique of mounting the TEG modules with the heat sinks onto the cans would follow. We considered clamping them onto a thin plate where the TEG module would be sandwiched with the heat sinks directly on top.

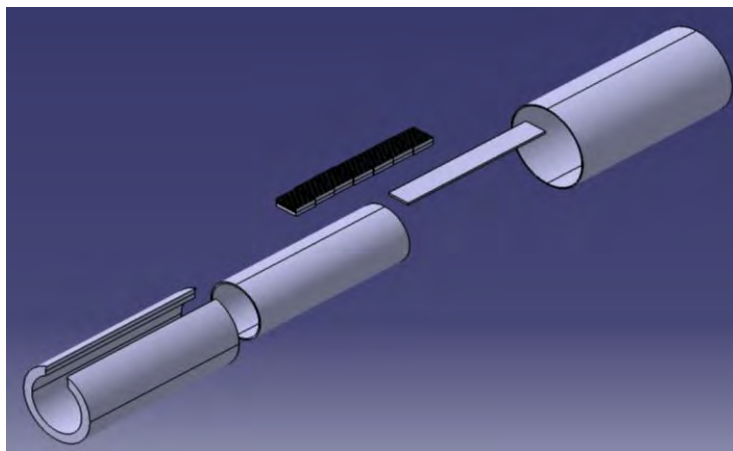


Figure 1: Expanded Initial Design

6.2 SECOND ITERATION

First, we'd like to eliminate the outer pipe entirely due to the limitation of oxygen supply needed for the combustion. Once the inner pipe mounted with the TEGs and the heat sinks proves to be successful, we can then consider reincorporating the outer pipe as a holding mechanism again. By solely focusing on the inner pipe, we would be providing maximum attention to the core of this product. The approach would be to strategically place air pockets, like the ones seen on the outer pipe, onto the inner pipe to create more directions of air flow. Encasing the TEG module wiring was another key take-away. Allowing the wires to be exposed to the fire would clearly

damage them, and so finding a way to encase the electrical wiring would be optimal. The first test was conducted without the use of insulation. Although with the help of COMSOL simulation, we were able to confirm the impact on this device, we are not able to conclude the insulation would be a great tool to use at this moment. The implementations on prototype 1 would require more assistance from the CNC lab and further testing to provide prototype 2.

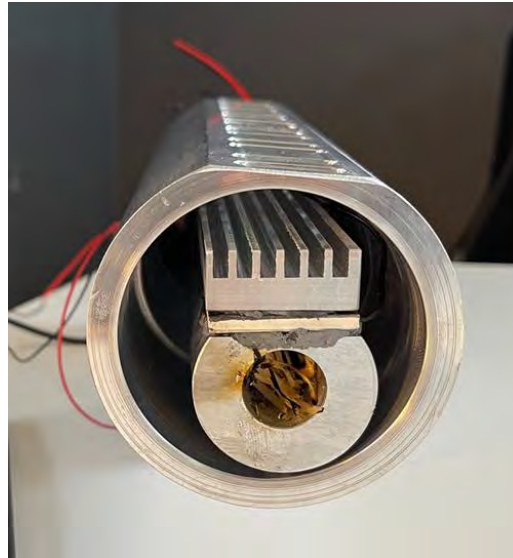


Figure 2: Expanded Initial Design

7. Heat Simulation Using COMSOL Multiphysics

To gain a better understanding of the temperature distribution inside of the TEG Pipe, a COMSOL heat transfer analysis was conducted. From the specification sheet of the TEG module we purchased, the continuous temperature the TEG modules are to be exposed to is 330°C continuously, and 400°C intermittently. Using these temperatures as a guide, three cases were studied to further understand if the need for insulation was necessary as we proposed this for our prototype. The first and second cases were studied to understand and confirm the temperature compared to the heat flux throughout the material. The TEGs and the other components of the TEG Pipe were not considered in this heat transfer, only the inner pipe made of aluminum alloy 6061. The properties of the material were imported into COMSOL and applied to the solid. The inner pipe was set to the following boundary conditions in the first case. The internal temperature of the inner pipe was set to 603.15 K; the outside of it was not insulated but subjected to a very low speed of external forced convection, 0.1 m/s. From this, we used the surface integration tool to find the convective heat flux around the entire surface area of the inner pipe. We also found the heat flux per unit area around the entire surface area of the inner pipe by using the measure tool on COMSOL. The absolute value measured 21.496 W and 773.1 W/m^2 , respectively. The second case we studied was subjected to similar boundary conditions, as mentioned before, to confirm the temperature versus the heat flux. The external convection forces were set to the same, 0.1 m/s, and there was no insulation added. Instead of setting a temperature for the internal area of the inner pipe, we set a general inward heat flux value. We inserted the value of the convective heat flux found in case one and divided that by the internal area of the pipe. We used

the measure feature and the surface integration tool once again to find these. The absolute value of the convective heat flux and the heat flux per unit area on the surface area of the inner pipe was found for case two. The heat flux measured 21.569 W and per unit area 775.7 W/m². The convective heat flux per unit area found in case one and case two were almost the same, which proves that the application of heat flux and temperature can be said to be the same throughout this material. The temperature distribution can be seen in the figures following. This accurately describes the properties of the aluminum material we are using. The third case studied was a combination of both case one and case two, but with insulation, and is the case that most accurately represents our system. The third case most resembles the boundary conditions of our project, which would indicate the need for insulation or redundancy. The general inward heat flux found in case one was used and the external forced convection speed was set to low again, 0.1 m/s. The surface area of the inner pipe was insulated, except the top where the TEGs would be mounted. This is where we are determining the convective heat flux in this case, because this is where the anticipated heat would be reaching to charge our TEGs. If the temperature was determined to be too high across the top of the inner pipe, it would signify that we would either need to ventilate by placing more air pockets on the outer pipe, or completely remove the insulation.

$$q_o = h \cdot (T_{ext} - T)$$

Where,

q_o : convective heat flux

h : heat transfer coefficient

T_{ext} : temperature of external fluid far from boundary

T : temperature of the inner pipe

Equation 1: Average heat transfer coefficient in correlation to external forced convection

$$q_o = h(T_{ext} - T) \quad (1)$$

$$h = \begin{cases} 2 \frac{k}{L} \frac{0.3387 Pr^{1/3} Re_L^{1/2}}{\left(1 + \left(\frac{0.0468}{Pr}\right)^{2/3}\right)^{1/4}} & \text{if } Re_L \leq 5 \cdot 10^5 \\ 2 \frac{k}{L} Pr^{1/3} (0.037 Re_L^{4/5} - 871) & \text{if } Re_L > 5 \cdot 10^5 \end{cases}$$

h : heat transfer coefficient

L : characteristic length

k : thermal conductivity of the fluid

Pr : Prandtl number

Re_L : Reynolds number

Equation 2: Prandtl Number

$$Pr = \frac{\mu C_p}{k} \quad (2)$$

μ : dynamic viscosity

C_p : heat capacity at constant pressure of fluid

Equation 3: Reynolds Number

$$Re_L = \frac{\rho UL}{\mu} \quad (3)$$

ρ : fluid density

U : bulk velocity

k : thermal conductivity of fluid

Table 1: Inner Pipe Heat Transfer

	Input				Output			
	Temperature Applied (K)	General Inward Heat Flux Applied – Per Unit Area (W/m ²)	Surface Area Applied To	Insulation Added Around	Convective Heat Flux Settings Applied	Surface Area Applied To	Convective Heat Flux – Absolute Value (W)	Convective Heat Flux – Per Unit Area (W/m ²)
Case 1	603.15	No	Internal Area: 0.01139	No	Plate Length: 0.2286 m Velocity, fluid:	Entire Surface Area Around: 0.027805	21.496	773.1
Case 2	No	Yes	Internal Area: 0.01139	No	0.1 m/s Fluid: Air Absolute Pressure:	Entire Surface Area Around: 0.027805	21.569	775.7
Case 3	No	Yes	Internal Area: 0.01139	Yes	1 atm External Temp: 293.15 K	Top Surface Only: 0.0069677	5.3923	773.9

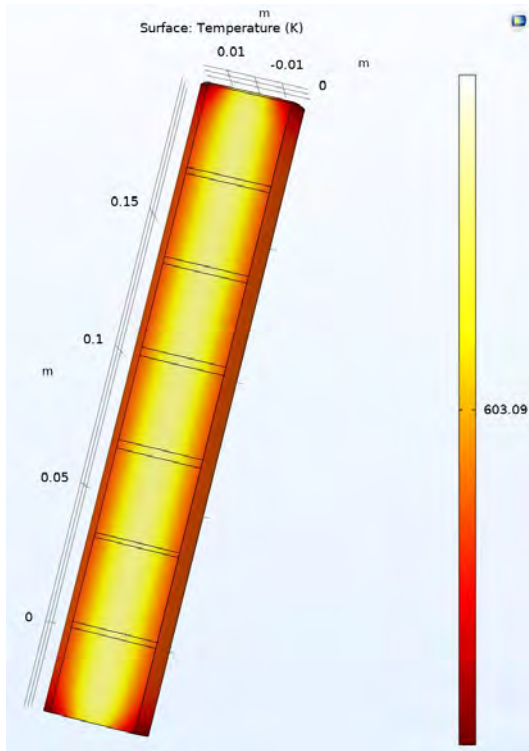


Figure 3: COMSOL– Case 1 temperature distribution

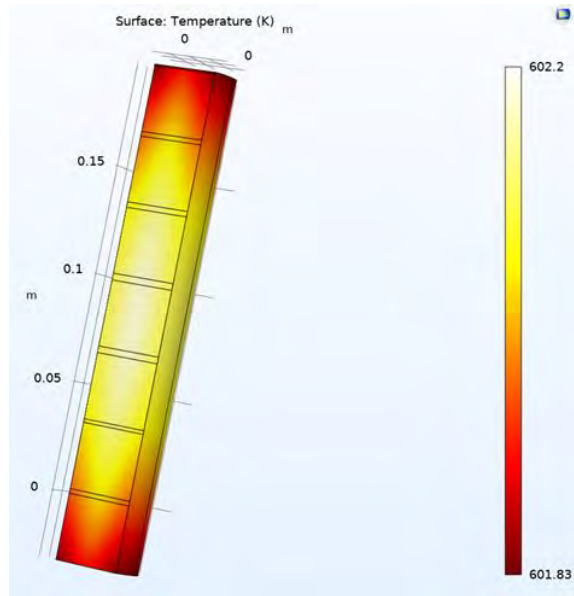


Figure 4: COMSOL – Case 2 temperature distribution

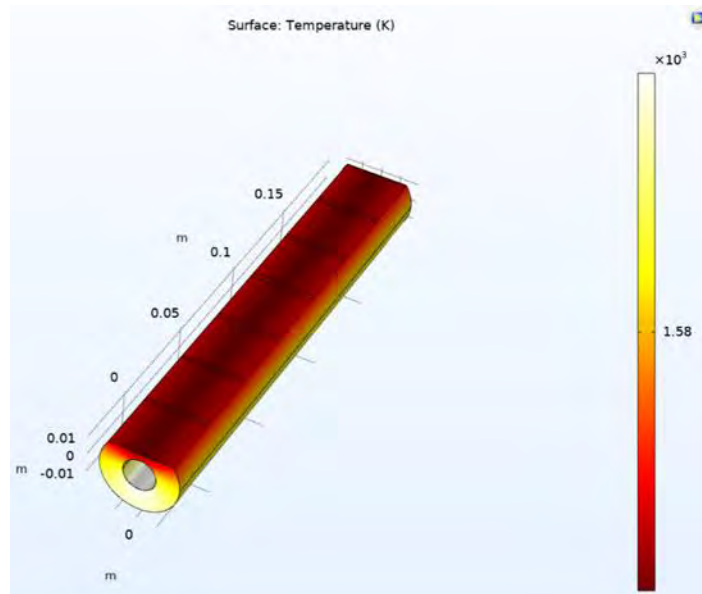


Figure 5: COMSOL – Case 3 temperature distribution

8. Estimated Costs

Table 2: Overall Budget

Item	Size	Quantity	Cost Per Item	Total
TEG Modules	30mm x 30mm x 6mm	6	\$16.99	\$101.94
Inner Pipe Material (Aluminum 6061)	1-1/2 Inch Diameter	1	\$13.77	\$13.77
Outer Pipe Material (Aluminum 6061)	3 Inch Diameter	1	\$55.85	\$55.85
Heat Sink Material (Aluminum 6061)	1.250 in x 1.250 in x 12 in	1	\$22.76	\$22.76
Insulation Material		1	\$21.50	\$21.50
Battery Pack		1	\$27.95	\$27.95
SteelStik Epoxy Putty		1	\$6.28	\$6.28
				\$249.78

9. Conclusion

In the quest for efficiency, we want to become the household item for extended power outage emergencies, by converting heat into electricity via thermoelectric generating modules at an affordable price. Emergencies are time-sensitive and the responsiveness of being prepared by having a device that can charge a battery pack for later use is an ultimate resource. Thermoelectric generators are great for recovering wasted heat. The device does offer the opportunity to use this renewable energy resource for power generation, but we must also consider the effects fire has on the environment. Wildfires emit carbon dioxide and other greenhouse gases that pollute the air. The intention is to fully educate those about capitalizing from an existing tool of survival. By investigating our initial methodologies and testing them, we hope to seek the most efficient TEG pipe on the market, if not the first. Finding the gap between the disparities in the world helps propel the next generations that come after us. We understand that trial and error is essential throughout this whole process. We look forward to looking at the pioneering work that has come before us, as well as the evidence we produce, to conquer this conceptual feat.

10. Future Improvements

As the development process continues, there are different approaches we would like to take to obtain the maximum efficiency of this device. Implementing fans may be the first modification

to the design. Fans will drastically improve the cooling conditions for greater output. The TEG pipe we are proposing today has one row of embedded TEGs and heat sinks. By incorporating more rows of these components along the cylindrical surface we can increase the power which then decreases the time it takes to fully charge a battery pack. Safety is always a major concern and given the opportunity to do so, we would like to add another feature by connecting a compartment with fire extinguishing chemicals for fire protection. Finally, the way to determine the maximum efficiency of a thermoelectric generator is to expose it to two extremes. If this TEG pipe were to be tailored to work in cold remote areas, the natural freezing temperatures would allow for a more drastic increase in temperature differential.

11. 3D Modeling and CNC Manufacturing

There are many advantages of having 3D printing technology easily accessible. Production is quicker than conventional manufacturing at the CNC lab. The process duration totaled approximately 10 hours and 38 minutes, as opposed to the weeks of manufacturing with raw materials. The difference is significantly huge which allows for multiple iterations of printing before accepting a final product. For the purposes of this project, we used the 3D printed model for presentation purposes only, not for testing purposes. Therefore, the strength and the material used in this prototype were not a high priority. We would have liked to increase the tessellation of the 3D model to have produced a more cylindrical shape. Nonetheless, this experience allowed for a creative design to come to fruition quickly and cheaply. The first step in the manufacturing process at the CNC (Computer Numerical Control) lab was to mill the aluminum rods down to our desired length. We purchased a 3-inch diameter x 12-inch-long aluminum round rod made from Alloy 6061 for the outer pipe. The rod was milled and hollowed to 1-inch thickness and 9-inch length. For the inner pipe, a rod with 1.5-inch diameter x 12-inch-long made with the same alloy was purchased. The inner pipe was shaved along the top for better placement of the TEG Modules and heat sinks once mounted. A 6061 T6 square aluminum rod, 1.25-inch x 1.25-inch x 12-inch, was purchased for the heat sink. Instead of cutting the 12-inch bar into 7 pieces for each corresponding TEG module, we chose to cut the square rod into two 4.5-inches pieces to be mounted along top of them. We do not consider this decision to change the efficiency of the model. The time at the CNC lab gives us a first-hand experience of what the manufacturing process would be like once our product is put into production. We hope to have lower manufacturing and production costs than our competitors in the market and to improve the quality of our products over time. From this experience we also learned about how to increase accuracy in predicting and meeting project plans and timelines. The device was manufactured in 13 days. Regarding the manufacturing for the outer tube, we used the 4axis Haas VF-2 with a 4th axis capability to drill and bore both sides of the rod and to remove maximum material. Then we used Okuma Genos 4 axis capability to finish the bore process through both ends. For the inner tube, we drilled both side of the part using Haas and then milled the flat feature using Haas milling machine. The heat sink was milled using the Haas machine, deburring, or removing sharp edges using the belt sander and the deburr wipe. Then we finished it off by sanding and polishing to clean the parts.

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Excellence Award 2022 World Champions



**“Tell me and I forget. Teach me and I remember. Involve me and I learn.”
Benjamin Franklin**

Vaughn College of Aeronautics & Technology
Industry Advisory Council Meeting and
Fourteenth Annual Technology Day Conference, May 20, 2022

Vaughn students, faculty, alumni, and industry professionals convened on May 20, 2022 for the Fourteenth Annual Industry Advisory Meeting and Technology Day Conference. Advisory Council members were given updates on recent developments in the Engineering and Technology Department such as EAC-ABET final accreditation statement for Vaughn's Mechanical Engineering and Electrical engineering programs, HSI-STEM grant activities including development process of stackable manufacturing certificate programs in CNC machining, Composite, and 3D additive and subtractive manufacturing and UAS design, application and operation as well as establishment of manufacturing centers (CNC machining, composite, additive manufacturing, and PLC & automation, and UAS) to support courses within these certificate programs. Dr. Rahemi, project director of title III HSI-STEM grant **“Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students“**, updated advisory members with the development process of a BS degree program in computer science as well as provided an update on grant-supported STEM activities, student engagement, and STEM outreach. Also, he talked about implementation process of recently NYSED-approved computer engineering program that is supported by Title V HSI grant. Each technical club (Robotics and UAV) and Vaughn's student chapter of professional societies (SWE, SHPE, and NSBE) provided their annual activities and accomplishment to the audiences of 2022 Technology Day Conference. In the afternoon session, capstone design presenters talked about their innovative design projects. The top 2 capstone design papers were selected by our Industry Advisory members as the recipients of the Best Student Paper awards of this session. Also, the work-in-progress capstone design projects and CSTEP undergraduate projects presented during afternoon poster session of this annual gathering. The following council members, faculty, and staff were in attendance:

Carlo Asaro - Lockheed Martin/Sikorsky Corp.
Max Gross, SciMax Technologies LLC
Rajdeep Singh, Lockheed Martin/Sikorsky Corp.
Jeff Hull, Tech Ed Systems
Dr. Aparicio Carranza – NY College of Technology (City Tech.), CUNY
Terry Jack – Lockheed Martin/Sikorsky Corp.
Ivan Stamatovski, Easy Aerial
Muhammad Noman – Lockheed Martin/Sikorsky Corp.
Manny Santana, Naval Sea (NAVSEA)
Beant Singh – Siemens
Mustafa Aboali – Pratt & Whitney
Felipe I. Munoz - Lockheed Martin/Sikorsky Corp.
Jason Becker – Brookhaven National Lab
Diogenes A. Ramos – FAA
Chaundra Daniels– Director of Vaughn's Career Service Dept.
Dr. Sharon DeVivo - President
Dr. Hossein Rahemi - Chair, Engineering and Technology Dept.
Dr. Amir Elzawawy – Associate Professor, Engineering and Technology Dept.
Dr. Shouling He - Associate Professor, Engineering and Technology Dept.

Dr. Douglas Jahnke – Assistant Professor, Engineering and Technology Dept.
Dr. Mohammed Benalla – Assistant Professor, Engineering and Technology Dept.
Dr. Miguel Bustamante - Assistant Professor, Engineering and Technology Dept.
Dr. Ghania Benbelkacem - Assistant Professor, Engineering and Technology Dept.
Dr. Amar Khoukhi - Assistant Professor, Engineering and Technology Dept.
Dr. Oluwaseyi Ajayi - Assistant Professor, Engineering and Technology Dept.
Prof. Khalid Mouaouya - Associate Professor, Engineering and Technology Dept.
Prof. Manuel Jesus – Associate Professor, Engineering and Technology Dept.
Gerard Sedlak –Engineering and Technology Dept (Retired Faculty).
Prof. Jonathan Sypeck – Assistant Professor, Engineering and Technology Dept.
Ryan Bobby Tang Dan – Vaughn’s FAA Drone Training Faculty
Francesca Marricco - Assistant, Public Affairs
Donald Jimmo – Vaughn’s writing center Faculty
Debbie Bari – Engineering Technology Senior Administrative Assistant

Prof. Manuel Jesus hosted this event and introduced all presenters as well as served as moderator for the clubs and capstone presentation sessions of this annual gathering.

Vaughn College’s President, Dr. Sharon DeVivo, welcomed the guests and thanked our advisory members and alumni for their active participation and support of the institution, student’s success and their involvement as advisory board of Engineering and Technology department.

Dr. Hossein Rahemi, Chair of Engineering and Technology Department, thanked the advisory members for their continuous support and valuable feedback in every aspect of the department’s programs and students’ success. He updated the advisory members about the 2021 EAC-ABET final accreditation statement for both Mechanical Engineering and Electrical Engineering programs, and ABET found both programs are in full compliance with all ABET criteria requirements.

Dr. Rahemi updated advisory members about the Department of Education title III HSI-STEM grant funded activities including the establishment of four manufacturing centers (PLC & Automation, 3D additive manufacturing, composite, and CNC machining), completion of four stackable certificate programs in Computer Aided Design & Additive Manufacturing, Composite Manufacturing, CNC machining, UAS design, application & operation and their current approval by New York State Education Department (NYSED). He added in spring 2021, institution developed and submitted a proposal for a new Title III HSI-STEM grant “Developing Guided Articulated Completion Pathways in Leading Edge Aeronautics and Aviation Careers for Hispanic and Low-Income Students“ to develop a BS degree in computer science program, and in fall 2021 the Federal Department of Education approved funding support for this project. In fall 2021, Project Director conducted several meetings with the curriculum committee to research and proposes a new BS in computer science. This committee solicited advice from related industry partners in development process of this program. In spring 2022, PD with input from both curriculum committee and advisory board, completed NYSED application for a BS degree with a total of 128 credits in computer science. In March 2022, with approval of NYSED, Dr. Impagliazzo has been appointed as an external reviewer to review this program and we expect by the mid-summer to submit Vaughn’s BS in computer science program with external reviewer feedback and all other supporting documents to NYSED for their review and approval.

Dr. Rahemi, presentation provided an insight about implementation process of new NYSED-approved computer engineering program, development process of BS in computer science program, students' professional and scholarly activities including the success of the Vaughn College Robotics team as the "Excellence Award" recipient of **2022 VEX U Robotics World Championship**, and invitation of Vaughn's UAV team as finalists for the virtual Design-Build-Vertical Flight competition of the 2022 Vertical Flight Society. Also, he talked about students' involvement and successes in scholarly activities including participation, presentation, and publication in technical conferences such as SWE, LACCEI, NSBE, SHPE, and Southern Biomedical Engineering.



Engineering Department's Annual Activities Presentation

Dr. Rahemi's presentation covered student participation and success in Robotics and UAV competitions as well as their involvement and accomplishments in scholarly activities and student chapter of professional societies (SHPE, NSBE, and SWE). Below is a list of students' accomplishments during academic year 2021-2022

- ✓ **2022 VEX U Robotics World Championship** - Vaughn's Robotics team received qualification to participate in the 2022 VEX U Robotic World Championship in Dallas Convention Center. This is nine years in a row, Vaughn's robotics team advanced to the world robotics championship. Invitation to the VEX U Robotics World championship is

granted only to a team that is a tournament Champion or “Excellence” award recipient of a regional competition as well as top place in “Robot Skills”. Vaughn’s Robotics team won **“Robot Skills Award”** and **“Excellence Award”** of both WPI and Vaughn College VEX U Robotics Regional Qualifier Competitions. This intense three days competition were challenging and Vaughn’s team wins 9 out of 10 matches of qualifying round and advanced to the top 16 playoff round. Vaughn’s team eliminated their competitors during top 16 and quarter final matches and advanced to the Semifinal (final four) of the World Championship. In an intense exciting semifinal game of tournament, team Wisconsin (WISCO) defeated Vaughn’s team and advanced to world tournament championship matches and wins 2022 World tournament championship. Vaughn College Robotics team wins the highest award **“Excellence Award” of 2022 VEX U Robotics World Championship**. Vaughn’s team wins this award for “best exemplifies, the best overall robotics program” and that judges “want the team be emulated by other teams” a team has to do well at pretty much everything during an event to win Excellence Award.



2022 VEX U Robotics World Championship “Excellence Award”

- ✓ **LACCEI 2021 International Conference, Virtual Edition:** From July 19-23, Vaughn’s engineering and technology students, along with Dr. Hossein Rahemi, department chair and PD of HSI-STEM, attended the LACCEI 2021 Virtual Conference. Two Vaughn’s student team research papers were accepted for presentation and publication in the LACCEI 2020 international conference; Both Vaughn’s student papers as listed below were selected to compete among ten finalists for the student paper session as well as student poster session of LACCEI 2021.
 - **“Intelligent Robot Design for VEX U Skills Challenge”** by Misael Marquez
 - **“BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy”** by Tatiana Jaimes, Alina Santander Vinokurova, August Rodriguez.
- ✓ **2021 Society of Hispanic Professional Engineers (SHPE) National Conference -** From Nov 10 – 14, a group of thirteen engineering students from Vaughn College attended the 2021 Society of Hispanic Professional Engineers (SHPE) in-person Conference at Orlando, Florida. Vaughn’s students participated in innovation, Nissan Design, and Extreme Engineering challenges as well as various professional development workshops that aimed to promote leadership, unity, and expose them to the diverse career opportunities in the STEM fields. Also, Vaughn’s participated in the career fair session of SHPE national conference and Vaughn’s SHPE chapter received a total of 11 interviews for both internship and full-time position with companies such as DuPont, Lockheed Martin, Rockwell Automation, Cummins, Tesla, Honeywell, Amazon, and Raytheon. Seven of which resulted in pending Internships and two internship offers. Also, Several of the

Vaughn HSI-STEM grant-supported students had the opportunity to participate in Innovation Challenge, Cybersecurity Challenge, and the Nissan Design Challenge. Vaughn's student, **Kevin Kenta Osada**, won **second place in the Nissan Design Challenge** and **Kirill Sokolov** won **third place in the Innovation Challenge** of the SHPE national Conference

- ✓ **Women Engineers Conference, October 21 to 23, 2021** - The Vaughn College chapter of the Society of Women Engineers (SWE) attended the 2021 Women Engineers Conference in Indianapolis, Indiana from October 21st through October 23rd, 2021. During the conference, nine members of the chapter had the opportunity to attend leadership seminars and technology talks. In addition to attending those, SWE students attended the in-person and virtual career fairs, where some interviewed with industry-leading companies such as Honeywell, Carrier, Raytheon Technologies, Accenture, and EBI. The conference was successful as 7 internship positions were offered on-site, interview opportunities were given both on-site and during the remote career fair.
- ✓ **2021 Southern Biomedical Conference** - From December 2-5, 2021, four Vaughn's engineering students, Alina Santander, Tatiana Jaimes, Aaron Arana, and Mariah Villalon, along with Dr. Hossein Rahemi, engineering department chair, and engineering faculty, Drs. Mohammed Benalla, Shouling He, and Prof. Khalid Mouaouya participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA. Three Vaughn's student team research papers were accepted for publication and presentation in this annual gathering. Vaughn's student papers as listed below were presented in 37th Southern Biomedical Engineering conference on Saturday December 4th from 2:15 to 2:45 PM.
 - "Electromechanical Device for Inceptive Braille Learning" by Alina Santander, Tatiana Jaimes, and August Rodriguez.
 - "Non-Invasive Glucose Monitoring System with Server Link" by Mariah Villalon, Isa Al-Maktoum, and Rebeca Snyder.
 - "Assistive Partial Limb Exoskeleton (APLE)" by Aaron Arana.

**Latin American and Caribbean Consortium of Engineering Institutions,
LACCEI2021 Virtual Conference, July 19-23, 2021**



Finalist for LACCEI Paper Session

1. "Intelligent Robot Design for VEX U Skills Challenge", by Misael Marquez
2. "BrailleBud - Transitional Learning Tool from Pre-Literacy to Braille Literacy", by Tatiana Jaimes, Alina Santander Vinokurova, August Rodriguez.

Vaughn's Student paper by Take Misael Marquez received Third Place Award at LACCEI 2021 Paper session Competition



2021 LACCEI Virtual Conference

2021 Women Engineers Conference, October 21-23, 2021

9 Vaughn's chapter of SWE students attended 2021 Society of Woman Engineers annual conference in Indianapolis, Indiana. Vaughn's SWE team attended STEM workshops and poster session competition, and career fairs of this annual gathering.

2021 Society of Hispanic Professional Engineers (SHPE) National Conference, Nov 10-14, 2021

13 Vaughn's chapter of Society of Hispanic Professional Engineers participated in 2021 SHPE annual conference, in Orlando, Florida. Vaughn College students participated in Innovation, Cybersecurity, and the Nissan Design Challenges. Vaughn's students won **2nd place in Nissan Design Challenge** and **3rd place in Innovation challenge**.

2021 SWE and SHPE Conferences



2022 National Society of Black Engineers (NSBE) Conference, March 23-27, 2022

8 Vaughn's chapter of NSBE students attended 2022 National Society of Black Engineers Conference in Anaheim, California. Vaughn's BSBE team attended educational and certification workshops and seminars, and career fairs of this annual gathering.



2021 Southern Biomedical Engineering Conference, 37th Annual meeting, New Orleans LA, December 2-5, 2021

4 Vaughn's Engineering students and 3 faculty participated in the 37th Southern Biomedical Engineering Conference in New Orleans, LA. Three Vaughn student team research papers were accepted for publication and presentation in this annual gathering



2021 NSBE and SBME Conferences

Robotics, UAV, SWE, NSBE, and SHPE Clubs' presentation
11:00 am to 12:00 pm

Each technical club and student chapter of professional society provided 10 minutes presentation of their annual activities that includes their involvement in technical competitions, organizing and hosting STEM workshops, community outreach activities, assisting Vaughn College in hosting regional High Schools and College Robotics competitions, hosting Robotics and Drone workshops during Vaughn's Annual Manufacturing Day and Annual STEM Day, hosting STEM workshops during SWE and SHPE annual conferences, participating in extreme engineering, Nissan design, and Engineering Innovation challenges of SHPE annual conference as well as other activities that helped them with internship and career opportunities. Also, they talked about their involvement in scholarly activities including participation, presentations, and publications in technical conferences. Each club after their presentation received "Excellence Award" for their active involvement and participation in STEM related activities including STEM workshops, technical competitions, and conference participation and presentation. .

TIPPING POINT ACCOMPLISHMENTS

- WPI Competition "Excellence Award"
- Vaughn Competition "Excellence Award"
- Vaughn Competition "Tournament Finalist"
- RIT Competition "Excellence Award"
- RIT Competition "Tournament Champion"
- World's "Excellence Award"
- World's "3rd Place Robot Skills"
- World's "1st Place Autonomous"
- World's Technology Division "Semi-finalist"

STEM OUTREACH

- Mentor NYC and Long Island High School Teams
- Volunteer at Local High School and IQ Regional events
- Co-Hosted the Southern New York State Competition for High School, Middle School, and Elementary Schools

Club Overview

Activities

- + Research and Design sUAS
- + Autonomous code development
- + Fixed Wings
- + Test flying

Professional Development:

- + Attend Conferences
- + Publish Engineering papers
- + Participate in numerous recognized competitions

UAV VAUGHN

LACCEI

STUDENT UNMANNED SYSTEMS (SUAS) COMPETITION

Vertical Flight Society

Annual Activities Presentation by Robotics and UAV Clubs

Member Center



swe

Society of Women Engineers

VCAT Chapter

2021-22 Activities



VCAT NSBE
NATIONAL SOCIETY OF BLACK ENGINEERS



Presented by:
Vaughn College National Society of Black Engineers Chapter



STEM Workshops





One of Vaughn's NSBE's chapters roles includes STEM outreach workshops, this includes workshops with the colleges Upperbound and STEP division as well as NSBE Jr. collaborations

- 'Cool It' Workshops
- Radio Kit Workshop
- Wind Tunnel Workshop
- Quantum Levitation Workshop
- C++ Foundations Workshops Series



SHPE PROFESSIONAL DEVELOPMENT WORKSHOPS



SHPE Vaughn College
RESUME BUILDING WORKSHOP



SHPE COMPETITION OPPORTUNITIES
Nissan Design, Extreme Engineering Competition & Innovation Challenge



**A Presentation by Vaughn's Student Chapter of Professional Societies
SWE, NSBE, and SHPE Annual Activities Presentation**



Robotics, UAV, SWE, NSBE, SHPE "Excellence Award" Recipients

Student Technical Paper Presentation, 1:00 pm to 3:30 pm

A total of five capstone degree projects as listed below were selected for publication in 2022 VCJET Journal and among those a total of three design degree projects were selected by our industry advisory members as finalists for the **Best Paper and Presentation Award** of 2022 Vaughn College Annual Technology Day Conference. In addition two CSTEP posters were selected as finalist for the **Best Poster presentation Award** during this annual gathering.

Capstone Degree Projects

1. SAD: Slice and Dice

Finalist for the Best Paper and Presentation Award

Authors: Jack Sze, Kang Jiang, Wiktorina Harkot

Program: Mechatronic Engineering

Advisor: Dr. Shouling He

2. Robot Path Planning and Decision-Making Subsystem for VEXU Competition

Finalist for the Best Paper and Presentation Award

Author: Nicholas Bentancur, and Misael Marquez

Program: Mechatronic Engineering

Advisors: Drs. Shouling He and Hosein Rahemi

3. The Braille Educational Tablet (BET)

Finalist for the Best Paper and Presentation Award

Authors: August Rodriguez, Manpreet Anand, Bryan Gordillo

Program: Mechanical Engineering

Advisor: Dr. Amir Elzawawy

4. Smart Home Electrification

Authors: Wole Barnarde, Ankit Mistry, Adem Bunardizu

Program: Electrical Engineering

Advisor: Dr. Mohammed Benalla

5. Solar Energy for Smart House

Authors: Tika Tamang, Matteo Salamone

Program: Electrical Engineering

Advisor: Dr. Mohammed Benalla

CSTEP Poster Presentation

1. Virtual Reality and Augmented Reality in Academia

Finalist for the Best Poster Presentation Award

Authors: Amanda Camacho, Jacky Chang, Kang Jiang,

Advisor: Prof. Manuel Jesus

2. Autonomous Drone Package Delivery System for Urban Environment

Finalist for the Best Poster Presentation Award

Authors: Jairo Andrew Ramos, Kevin Tsang

Advisor: Prof. Bobby Tang and Dr. Amir Elzawawy

3. Scavenging Energy to Measure and Transmit Water Temperature

Authors: Daniel Garcia

Advisor: Dr Douglas Jahnke

4. Scavenging Energy to Measure and Transmit Water Temperature

Authors: C. Sorto, J. Sze, J. Rosa

Advisor: Dr. Ghania Benbelkacem



Students' Capstone Design Papers Presentation





Students' Poster Session Presentation

Best Paper and Presentation Award Recipients

The top two research papers were selected by our Industry Advisory members as the recipients of the Best Student Paper and presentation awards of this session. The winning papers included: **First place Design Paper and Presentation winner**, “Robot Path Planning and Decision-Making Subsystem for VEXU Competition” by Misael Marquez and Nicholas Bentancur, and there were two **Second Place Design Paper and Presentation winner**, “Slice and Dice” by Jack Sze, Kang Jiang, and Wiktor Harkot; and “The Braille Educational Tablet (BET)” by August Rodriguez, Manpreet Anand, Bryan Gordillo, and **First Place Best Poster presentation winner**, “Virtual Reality and Augmented Reality in Academia” by Amanda Camacho, Jacky Chang, Kang Jiang





Best Student Paper, Poster, and Presentation Awards

In conclusion, Dr. Rahemi, congratulates all capstone design paper, poster, and technical clubs presenters and he added we as Vaughn community are very proud of your accomplishments. He extended his gratitude to the federal department of education Title III HSI-STEM and Title V HSI funding support for all STEM activities and students' engagements in hands-on technical clubs, competitions, and scholarly activities. He thanked industry advisory board and alumni for their participation, feedbacks and continuous support in every aspect of the department and student's success. Finally, he expressed his sincere gratitude to those advisory members who served as judges to evaluate student's capstone design projects as well as those who served as reviewers for Vaughn's new computer science program.