COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **1**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Interactive ECE Degree Planner**

SME: Bill Plymale

Customer POC: Mary Brewer, Garrett Campbell, taylorm@vt.edu, campg3@vt.edu,

Create a tool that provides a centralized location for students to be able to access various degree planning services. The tool will allow stakeholders to view all of the available ECE courses, create and test plans of study through DARS/HokieGPS, access links to the ECE website, and more. In short, the tool will provide a central location where students can access the most important tools they need in order to make decisions regarding their studies here at Virginia Tech. In addition, the tool will allow for the advisors to easily add or update information as needed. Stakeholders in this project are potential ECE students, incoming ECE students, current ECE students, and ECE advisors.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **2**

Project Sponsor:

VPT, Inc., Blacksburg, VA

Project Title: **VPT - Magnetic Levitation 1**

SME: Campbell Lowe

Customer POC: Dan Sable, VPT, sable@vptpower.com,

The goal of this project is to design and demonstrate a magnetic suspension system whereby an object attached to a permanent magnet can be suspended vertically in air by controlling the current through an electro-magnet placed above the object. Multiple electro-magnets are to be employed in order to move the object horizontally while suspending it vertically.

This project is important to VPT because VPT requires engineers with skillsets in the following areas matched to this project:

* Analog circuit design and debug
* Design and analysis of Magnetic elements
* Control loop design and analysis
* Closed loop optimization and performance measurement using advanced test equipment
* Use of a microcontroller for digital feedback
* Printed Circuit Board design and construction
* Mechanical design and use of a 3D printer Creative design approach

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **3**

Project Sponsor:

VPT, Inc., Blacksburg, VA

Project Title: **VPT - Magnetic Levitation 2**

SME: Matthew Strehle

Customer POC: Dan Sable, VPT, sable@vptpower.com,

The goal of this project is to design and demonstrate a magnetic suspension system whereby an object attached to a permanent magnet can be suspended vertically in air by controlling the current through an electro-magnet placed above the object. Multiple electro-magnets are to be employed in order to move the object horizontally while suspending it vertically.

This project is important to VPT because VPT requires engineers with skillsets in the following areas matched to this project:

* Analog circuit design and debug
* Design and analysis of Magnetic elements
* Control loop design and analysis
* Closed loop optimization and performance measurement using advanced test equipment
* Use of a microcontroller for digital feedback
* Printed Circuit Board design and construction
* Mechanical design and use of a 3D printer Creative design approach

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **4**

Project Sponsor:

VPT, Inc., Blacksburg, VA

Project Title: **VPT - Magnetic Levitation 3**

SME: Robert Crnkovich

Customer POC: Dan Sable, VPT, sable@vptpower.com,

The goal of this project is to design and demonstrate a magnetic suspension system whereby an object attached to a permanent magnet can be suspended vertically in air by controlling the current through an electro-magnet placed above the object. Multiple electro-magnets are to be employed in order to move the object horizontally while suspending it vertically.

This project is important to VPT because VPT requires engineers with skillsets in the following areas matched to this project:

* Analog circuit design and debug
* Design and analysis of Magnetic elements
* Control loop design and analysis
* Closed loop optimization and performance measurement using advanced test equipment
* Use of a microcontroller for digital feedback
* Printed Circuit Board design and construction
* Mechanical design and use of a 3D printer Creative design approach

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **5**

Project Sponsor:

Lockheed Martin-Aeronautics, Ft. Worth, TX

Project Title: **LMCO - Automated Testing & Characterization - Aircraft Wiring (IEEE 1355 & Fiber Optics)**

SME: tbd

Customer POC: Tony Keith, tony.r.keith@lmco.com,

There have been many technical advances in the design and construction of aircraft over the years. However, there is one area where movement has been slow to develop. The use of fiber optic cabling for data communications has become a dominate technology in our homes and communities. However, this technology has been very slow to be adopted in aircraft flight critical systems despite readily apparent benefits in size, weight, and power reductions. Realize the historical mainstay of critical flight controls relied on hydraulics. Adoption to electrical interfaces was a challenge by itself let alone the use of fiber. The reason for this is that when hydraulics "fail" they tend to degrade rather than stop functioning altogether as an electrical interface would. The purpose of this project is to first design, build and characterize a classical aircraft wiring harness for IEEE 1553B, RE232, and even discrete signaling. The second part of the experiment is the replacement of the copper wiring with fiber and compare this characterization with the classical method. For the purposes of this project items to be characterized and compared are: (1) cable weight, (2) power requirements, (3) physical features such as bend limitations, (4) transmission distance, (5) error rate, and (6) reliability. Additionally, reliability is considered one of the major roadblocks to adoption of this technology for critical flight systems and this project seeks to suggest methods to increase the reliability to levels

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **6**

Project Sponsor:

Dominion Power, Richmond, VA

Project Title: **Dominion - Power Sys Planning & Ops Game**

SME: tbd

Customer POC: Matt Gardner, Dominion Energy, matthew.gardner@dominionenergy.com,

The purpose of this project is the development of an open source, scalable power systems planning and operations game. Like many other forms of simulation, this tool should be designed to be entertaining, educational, and useful in the synthesis of new power system design and operations concepts. This multiplayer game should broadly include two parties: a planning, construction, and operation team and a environmental, weather, customer, and critter team. The planning and operations team (PCO Team) is responsible for ensuring the appropriate scale, development, and configuration of power systems infrastructure. Additionally, considering operations, the PCO Team is responsible for balancing power generation and demand while managing more complex concepts such as contingency analysis, stability analysis, fault response. The opponent of the PCO Team would be the environmental, weather, customer, and critter team (EWCC Team). This team should have ability commensurate with the PCO Team to challenge the grid. For example, if the PCO Team incorporates a large measure of photovoltaic power generation, the EWCC Team may challenge the PCO Team with erratic weather patterns or perhaps even a solar eclipse. This game should be programmed in an open source language and scalable to allow other developers to add features to the game. The object of this game is to educate a broad spectrum of users at one level as well as being useful for power system

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **7**

Project Sponsor:

Dominion Power, Richmond, VA

Project Title: **Dominion - Interactive Power Sys Protection Demo**

SME: tbd

Customer POC: Matt Gardner, Dominion Energy, matthew.gardner@dominionenergy.com,

The purpose of this project is the development of a professional, commercial grade, portable, durable, and modular interactive recruiting tool to aid Dominion Virginia Power in demonstrating power system protection concepts to high school and college students. Power system operations concepts are often multilayered and complex – making it difficult to explain the various career opportunities that are available in the power and energy sector. The focus of this demonstration tool will be the demystification of power system protection principles. The tool will need to offer observers an overview of basic power system principles with a particular focus on power system protection. High level concepts such as dependability and security in power system protection should be clearly explained. Basic power system protection concepts should be clearly explained (e.g., over current protection, differential protection, impedance-based protection principals, communication based protection, etc.). In addition, users should have an interactive interface where the various protection principals can be demonstrated in a hands-on manner. Users should be provided with a "do it yourself" interface where basic protection settings can be adjusted and various fault scenarios explored.

Requirements:

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **8**

Project Sponsor:

Dominion Power, Richmond, VA

Project Title: **Dominion - Power Adaptive Dynamic Compute Nodes**

SME: tbd

Customer POC: , ,

Build a demo of distributed compute node system that migrates processes to the compute node with the best available power. Students will build a functioning, representative model with 4-5 compute nodes, each with its own solar power. As the nodes move in and out of light, programs in execution tasks will be moved among the nodes to ensure continued, correct operation and to leverage available power.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **9**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Coin Cherrypicker**

SME: Creed Jones

Customer POC: Luke Lester, lflester@vt.edu,

The objective of this project is to design, build and test a coin detector selection and selector grading device. Sets of coins will be presented on a flat surface. The system will contain suitableUsing existing lighting and imaging components, to produce good quality images of the coins will be captured. Using computer vision and machine learning techniques, the individual coins will be identified and checked for various conditions that may indicate high value. Output will be provided to a user to allow the coins of interest to be extracted. The value is to increase the throughput, accuracy and human factors acceptability of the task of checking a high volume of coins for numismatically significant pieces.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **10**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Sports Card Grader**

SME: Creed Jones

Customer POC: Luke Lester, lflester@vt.edu,

The objective of this project is to design, build and test a system for identifying and characterizing sports trading cards. Images of cards for various sports will be captured using a flatbed scanner. Using computer vision and machine learning techniques, the individual cards will be identified and checked for various conditions that may indicate high value. Output will be provided to a user to designate the cards of interest. The value is to increase the accuracy, repeatability and human factors acceptability of the task of checking collectible sports trading cards for significant pieces.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **11**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Fitness watch open sound control interface**

SME: Ben Knapp

Customer POC: Ben Knapp, benknapp@vt.edu,

tbd

NOTES:

BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **12**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Intelligent devices for future medical workspaces**

SME: Ben Knapp

Customer POC: Ben Knapp, benknapp@vt.edu,

The purpose of this project is to demonstrate possibilities for seamlessly integrating intelligent devices into medical workspaces to improve the performance of teams of clinicians. In healthcare, patient outcomes are dependent not only on the skills of individual practitioners, but their skills in working as a team. The environment in which a team functions can significantly influence their ability to communicate, coordinate actions and anticipate challenges and adapt their performance accordingly. In particular, this project will explore possibilities for designing medical workspaces that improve the performance of teams of clinicians, provide them with better situational awareness, give them feedback on their performance, and enable them to fluidly interact with other healthcare workers to support their decision making and patient interaction. The scope of this project does not include devices that are used to directly treat patients, e.g., surgical robots. While patient treatment devices may be sources of data for the proposed intelligent workspaces, they are not the focus of this project.
Deliverables:
1. Literature review of the performance of clinical teams and prior work conducted by Virginia Tech and Steelcase
2. Create storyboards for 4-5 scenarios around improving teamwork in medical workspaces by

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **13**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Electronic textiles for sensing human motion**

SME: Tom Martin

Customer POC: Tom Martin, tlmartin@vt.edu,

The purpose of this project is to develop ways to use soft textiles to sense human motion, in particular, measuring the angles of a person's elbow, shoulder, and other major joints. Electronic textiles (e-textiles) have sensing, computation, and actuation as an integral part of the fabric. Ideally, these intelligent components should look and feel like normal, everyday fabrics so that people can treat the fabric the same way they would a traditional one. For example, a person should be able to treat an e-textile coat the same way that they would treat a traditional coat. Previous work has used hard electronics such as inertial measurement units (IMUs) to measure joint angles. For this project, the team should develop a garment that has soft sensors for measuring the joint angles, with the sensors being indistinguishable in terms of look and feel from the rest of the garment. The garment should be self-contained, i.e., able to monitor joint angles without being connect to any other devices such as a phone or laptop. The sensors should be integrated into the garment using traditional garment construction techniques. Of particular interest is a garment that can be worn by children with limited mobility of their arms to as part of a soft exoskeleton that can provide support for their arms during everyday activities. It is also desirable to have a more general-purpose garment that can measure the joint angles of all of the major joints for the torso, arms, and legs to provide real-time measurement

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **14**

Project Sponsor:

Analog Devices, Greensboro, NC

Project Title: **ADI - Digital Beamforming Demo with Quad MxFE**

SME: Louis Beex

Customer POC: Michael Jones, Chas Frick, Michael.Jones@analog.com, Charles.frick@analog.com,,

The Quad-MxFE Platform from Analog Devices is a 16-channel transmit, 16-channel receive development platform being used for phased-array radar, electronic warfare, satellite communication (SATCOM), and 5G applications. Customers can presently use this platform to serve as the backbone digitizer for L/S/C-band applications. There is a desire within Analog Devices to promote this system-level platform as the backbone to increased frequency coverage into the Ku-band as well as to develop digital algorithms demonstrating calibration/beamforming/digital pre-distortion/etc. using this system.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **15**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - IPT Transformer Design**

SME: Minh Ngo, Bo Li

Customer POC: Khai Ngo, kdtn@vt.edu,

The designer should develop a method that quickly converts an IPT transformer design with identical transmitter (Tx) and receiver (Rx) sizes into one with scaled receiver size. This process starts with the study of IPT transformer design with identical transmitter and receiver sizes. Then the designer needs to design the transformer with reduced receiver size and change the transmitter size until the desired power and efficiency are realized. This requires literature review, FEA software simulation, and coding.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **16**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - Medium-Voltage Power Electronic Interrupter System**

SME: Jian Liu, Lakshmi Ravi

Customer POC: Dong Dong, dongd@vt.edu,

CPES currently is performing an ARPA-E sponsored project: “Ultra-Efficient Intelligent MVDC Hybrid Circuit Breaker”. In Fall 2021, the project will enter its third and also the final budget period. During the third budget period, to prepare for the final system integration and test, the project needs to rebuild CPES-designed 6 kV power electronics interrupter and high-frequency auxiliary power supply units as the back-up system, which includes the IGBT and GaN devices and their gate-drivers, passive snubber components, and other electronic circuits.

This task provides the undergraduate students ample opportunities to gain the basic skillsets like electronics components ordering and house-keeping, PCB circuit component soldering, circuit debugging and bench-level circuit testing. The undergraduate students will also reinforce their understanding and learning from the undergraduate classes like ECE4224: Power Electronics, ECE3204: Analog Electronics, and ECE 2024: Circuits and Devices.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **17**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - Condition Monitoring and Lifetime Prediction of Power Devices**

SME: Ming Xiao, Qihao Song

Customer POC: Yuhao Zhang, yhzhang@vt.edu,

The purpose of this project is to explore the condition monitoring and lifetime prediction of GaN power devices in switching circuits. The scope of this project spans from device physics and simulation to circuit design and control program development, and ultimately to data analysis and lifetime prediction. Test circuits will be designed to stress GaN devices and monitor the evolution of critical device parameters based on switching waveforms. Device simulations will be used to understand the mechanisms of device degradations and ultimate failures. Based on the degradation and failure physics, a lifetime model will be developed and then used to predict the device lifetime using the switching waveforms automatically collected in a real-time manner.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **18**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - EMI Test Hardware Development**

SME: Dong Dong

Customer POC: Qiang Li, lqvt@vt.edu,

CPES plans to develop a summer professional short-course: “EMI and Noise Reduction Techniques and Filter Design” The short-course will teach professionals and engineers the fundamental knowledge of EMI and EMC design techniques for electronic circuits and system. The propose MDE project will help develop several electronics circuit tools/hardware for the EMI noise measurement and analysis, including analog and digital circuits, switch-mode power supply, and filter components. The preparation of these test hardware provides the undergraduate students ample opportunities to gain the basic knowledge of switch-mode power supply and its EMI noise, and develop the skillsets of PCB circuit component soldering, PCB circuit designing and layout, as well as bench-level circuit testing. The undergraduate students will also reinforcement their understanding and learning from the undergraduate classes like ECE4224: Power Electronics, ECE3204: Analog Electronics, and ECE 2024: Circuits and Devices.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **19**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - Fabricating High-Voltage Power Electronics Modules**

SME: Mark Cairnie

Customer POC: Christina DiMarino, dimaricm@vt.edu,

This project will focus on developing an apparatus to apply a specified temperature and pressure profile to a power module while maintaining the alignment and planarity of the components. The fixture will be controlled by a PLC system which will control the programmable heating element and custom pneumatic system. The control system will be integrated with a computer interface for monitoring the apparatus during sintering.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **20**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - Energy Transfer Protocol for 5G-Operated Nanogrids**

SME: Kenneth Test

Customer POC: Igor Cvetkovic, igorc@vt.edu,

This project will utilize the electronic energy system testbed already put together by the current MDE project in which students can be sending set points and measurements to the inverter via 5G network (main energy management algorithm of the testbed runs on Linux at raspberry pi board that communicates with all system components via Ethernet). Students will also simulate and test some energy transfer protocol(s) and developing the basis for a proposal that can be submitted to CCI (or DOE) once initial results are obtained.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **21**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - Control Network for High-speed Multi-phase Drive Systems**

SME: Yu Rong, Vladimir Mitrović

Customer POC: Boran Fan, brianfan@vt.edu,

Tune the existing PESNet 3.0 communication system to be compatible with a 12-phase high-speed motor drive system. Key modifications include the communication topology adjustment, coding of Xilinx 7000 CPU and FPGA units. A distributed control architecture is required to link the main controller, the phase-leg controller, and the gate-drive controller. Communication and synchronization measurements should be performed to verify the control network.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **22**

Project Sponsor:

Virginia Tech CPES, Blacksburg, VA

Project Title: **VT CPES - A Unified Design Tool for High-Performance LLC Resonant Converter**

SME: Chunyang Zhao

Customer POC: Eric Hsieh, yhhsieh@vt.edu,

This project aims at providing a unified design tool for high-performance LLC converters, which integrates all the latest research. The key property of this tool is the versatility. In almost every design, there is no “best” solution. Each optimization is weighted based on various factors. A product with certain inputs and definitive outputs is not expected. Instead, each step in the complete design procedure should provide sufficient information such that the user is able to make an engineering trade-off, and the outcome of this trade-off is the input for the following step. Consequently, the end design result not only depends on the system specification, but also the decisions made among the design procedure.

The characterization for the latest power devices and magnetic components will be performed in the lab, and the resulting models will be entered into the tool. Having these models, the students should justify the decision in each design step. Some DC/DC power converters will be demonstrated using this tool. A 48V/12V 1kW power converter for data center application will be built based on the developed software if time allows. It is expected that students can gain real design experience, and that the design tool can facilitate both academic research and industry design.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **23**

Project Sponsor:

NAVAIR Cherry Point, NC

Project Title: **NAVAIR - Aircraft Acquisition Device**

SME: Adnan Sarker

Customer POC: Dario Hashemi, Dylan Gooch, Brittany, Cline, Dario.Hashemi.civ@us.navy.mil, Dylan.Gooch@navy.mil, brittany.b.cline.civ@us.navy.mil

Develop a hand-held aircraft data acquisition device that records real-time vibration, sound, humidity, component temperature, and component-environment temperature. Device must contain the following : touch screen, eight quick disconnects and interchangeable sensors, programable for different sensor arrays.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **24**

Project Sponsor:

Marsh & Mclennan

Project Title: **MMC - Diabetic Monitoring App**

SME: tbd

Customer POC: Zak Kornblum, zakkornblum@yahoo.com,

Create an analytic decision framework for incorporating and analyzing client data, including client attributes and pharmacy claims, with drug information and other internally and externally created data sources. Source data will be in multiple formats including: .TXT files, .XLSX files, APIs, and SQL Server databases. The customer will provide sample data formats for injestion. The initial challenge is organizing the external pharmacy claims data that is received from multiple sources and in multiple formats. This framework must be able to handle highly formatted data automatically and assist users in formatting and storing less structured data. Less structured data is typically an excel document with multiple tabs and header rows where data labels and indicators may vary from source to source. The next challenge is to create a simple process for collecting, organizing and storing client data. This input data may be provided in excel or text files, or be generated by raw user input. CLEANING: Once all the relevant data is collected the challenge of unified identifiers for clients and their data remains. Different sources likely have different names for a single client. Finally, end users must be able to interact with the data to extract summary statistics and other useful information. A GUI is the final challenge and must be simple enough for non-technical users to manipulate but professional enough to use in business situations. Our business does create standard templates for data input from internal

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **25**

Project Sponsor:

MITRE

Project Title: **MITRE - UAS lofted HFSWR Array**

SME: Mike Ruohoniemi

Customer POC: Dale W. Herdegen, Andy Thompson, Julia B Huynh, Dennis Milam, Dave Maples, dherdegen@mitre.org, athompson@mitre.org, jpacker@mitre.org, dmilam@mitre.org, dmaples@mitre.org

Conduct a study of a notional unmanned aircraft system (UAS) lofted time-staggered MIMO frequency modulated continuous wave High Frequency Surface Wave Radar (HFSWR) system. Perform modeling, simulation, and analysis to determine the feasibility of the system and identify potential performance envelope, operational and technical limitations, and initial design parameters.

NOTES: Project team members need to be US Citizens.

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **26**

Project Sponsor:

NAVAIR PAX

Project Title: **IEEE Robotic - Software**

SME: Arthur Ball

Customer POC: Andrian Jordan, Israel Jordan, Theresa Shafer, andrian.jordan@navy.mil, israel.jordan@navy.mil, theresa.shafer@navy.mil,

Design and implement the software, automation, and controls software and integrations to hardware to implement the functionality of the robotic solution. Assist in the design of the overall robot and develop solutions to the competition stages. You must collaborate with the other IEEE Robotics Team to design and integrate a complete robot. Details and Rules can be found at https://attend.ieee.org/southeastcon-2022/student-program/hardware-competition/

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **27**

Project Sponsor:

NAVAIR PAX

Project Title: **IEEE Robotic - Hardware**

SME: Arthur Ball

Customer POC: Andrian Jordan, Israel Jordan, Theresa Shafer, andrian.jordan@navy.mil, israel.jordan@navy.mil, theresa.shafer@navy.mil,

Design and implement an electrical subsystem to provide the various components of the robot with power. Assist in the design of the overall robot and develop solutions to the competition stages. You must collaborate with the other IEEE Robotics Team to design and integrate a complete robot. Details and Rules can be found at

https://attend.ieee.org/southeastcon-2022/student-program/hardware-competition/

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **28**

Project Sponsor:

SSAI/NASA, Langley, VA

Project Title: **NASA - Additive Manufacturing Circuit Design**

SME: tbd

Customer POC: Beth Paquette, NASA Goddard 5620; Christopher Green, NASA Goddard; Jonathan Kelly <jonathan.kelly@ssaihq.com>, chrostopher.m.green-1@nasa.gov, jonathan.kelly@ssaihq.com

Create software to translate existing circuit design to supported additive manufacturing circuit construction formats. Current AM circuit printing is a manual and labor intensive process to translate existing traditional circuit design formats (Gerber, DXF) to a 3D printable representation. This project will provide an existing circuit (arduino?) layout. Students will order components and will design, develop, and test an automated translation of the the existing circuit into a format (nominally DXF or DWG) that can be 3D printed and tested.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **29**

Project Sponsor:

SSAI/NASA, Langley, VA

Project Title: **NASA - VSAT MBD2M**

SME: Haibo Zeng

Customer POC: Carl Mills, NASA; Shelley Stover, SSAIHQ/NASA; Jeryl Hill, SSAIHQ, carl.s.mills@nasa.gov, shelley.k.stover@nasa.gov, jeryl.hill@ssaihq.com

In support of the Vertical Solar Array Technology (VSAT) project at NASA Langley Research Center (LaRC), Virginia Tech's Design Team (VT) shall provide a hardware design and working prototype for a Mast Assembly Controller (MAC) capable of deploying and actively controlling the VSAT mast assembly. As part of the controller work, VT will pursue the development of an emulator (or digital twin) of the VSAT mast assembly, enabling Hardware-in-the-Loop (HIL) testing to verify the MAC without having the mast assembly mechanical hardware available. Lastly, the VT Design Team will test the prototype MAC with the actual VSAT mast assembly on center at NASA LaRC (subject to travel and other restrictions).

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **30**

Project Sponsor:

Micron, Manassas, VA

Project Title: **Micron - Dynamics of electron tunneling**

SME: Mariusz Orlowski

Customer POC: Zuzana Steen, Megan Wallace, zsteen@micron.com,

Set up a new electric characterization system where the heat source cell and the neighboring cells are powered independently and the current evolution through the heat source cell and the neighboring cells are monitored concurrently.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **31**

Project Sponsor:

Wiley Wilson, Lynchburg, VA

Project Title: **Wiley Wilson - Battery Storage System**

SME: Minh Ngo

Customer POC: Steve Bowman, Mark Adkinson, Dan Morton,, sbowman@wileywilson.com, matkinson@wileywilson.com, dmorton@wileywilson.com

This project will explore battery storage technologies including Lithium Ion for data centers and other commercial applications. The students will research several battery technologies and determine when one technology should be used over the other with respect to electrical load, run-time, environment, safety, code requirements, and cost. The students will also apply their research by designing a battery storage system for a mission critical facility.

NOTES: Project team members need to be US Citizens.

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **32**

Project Sponsor:

NAVAIR Cherry Point, NC

Project Title: **NAVAIR - Magnetic Debris Accumulator**

SME: Peter Han

Customer POC: Brandon Krahn, Patrick Horney, Kevin Conner, Brittany Cline, Brandon.j.krahn.civ@us.navy.mil, Patrick.r.horney.civ@us.navy.mil, Kevin.a.conner6.civ@us.navy.mil, brittany.b.cline.civ@us.navy.mil

Currently, the magnetic field array consists of a single NdFeB disc magnet secured at the bottom of the magnet container, and NdFeB arc magnets surrounding the disc magnet. To optimize the design, various magnetic field array designs are to be tested to determine the best capture efficiency. The purpose of this project would be to analyze, design, and prototype 4-5 magnetic field arrays for testing in conjunction with the H-1 FST drives team. Upon selection of final design, engineering drawings will be required for manufacture of design.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **33**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Fault-Tolerant Power Electronic System**

SME: Marif Daula

Customer POC: Lai Zuo, leizuo@vt.edu,,

Design, analysis, and simulation of the new fault-tolerant converters for the wave energy system followed by a prototype design and implementation of the complete system.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **34**

Project Sponsor:

VT ECE, Blacksburg, VA

Project Title: **VT ECE - Communication System Design for Ocean wave powered autonomous robots**

SME: Yaling Yang

Customer POC: Lai Zuo, leizuo@vt.edu,,

The goal of this project is to develop the communication system for an ocean-powered autonomous robot, for applications like fish farm monitoring and maintenance, ocean observation and communication, underwater and surface vehicle charging

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **35**

Project Sponsor:

Aerospace Corp

Project Title: **Aero - Cislunar Space PNT**

SME: Scott Bailey

Customer POC: Jim Fishenden, Britany Chanberlain, james.c.fishenden@aero.org, britany.chamberlain@aero.org,,

Design an alternative Position, Navigation, and Timing (PNT) for satelites in Cislunar Space. Developing a Cislunar PNT solution will include the following: (1) Constellation which broadcasts a navigation signal, (2) Navigation signal for the constellation to transmit to cislunar users (3) Build a reciever for the navitation signal.

NOTES: Project team members need to be US Citizens.

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **36**

Project Sponsor:

TMIEC, Roanoke, VA

Project Title: **TMEIC - Vehicle Charging Case Study**

SME: Ryan Gerdes

Customer POC: Thomas Tainer, TMEIC, thomas.tainer@tmeic.com,

Complete engineering case studies for high capacity vehicle charging sites to determine the adaptability of TMEIC power electronics products in those markets. Case studies will include but not limited to Impact on power grid, Energy transfer requirements, Ratings of electrical equipment, energy storage efficiency, options for modularity, Equipment layout, Electrical Schematics showing equipment interface connections etc.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **37**

Project Sponsor:

VT TREC Lab, Blacksburg, VA

Project Title: **VT TREC - Haptic Gloves**

SME: Alex Leonessa

Customer POC: Alex Leonessa, leonessa@vt.edu,

Force Bot is a project currently pursued by the TREC lab with the intent of giving users an immersive full-body force feedback experience in virtual reality. The project will allow users to experience a variety of scenarios but will be especially useful in training professionals for their work. Firefighting and surgery are two of many examples. With Force Bot, these people will be able to immerse themselves in intense, hypothetical situations without the consequences brought by failure in the real world. Force Bot can also be used in teleoperation, where a user takes control of another physical robotic system and, through force feedback, is able to better understand how the robot they're controlling is interacting with the world. Half of the Force Bot project involves creating an upper-body grounded force feedback system. The TREC lab is looking for a team of students capable of designing, assembling, and programming a system to apply forces to a user's hands that mimic the forces they would be experiencing in virtual reality or through a teleoperated robot.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **38**

Project Sponsor:

Phase II Staffing & Contracting

Project Title: **Phase II - Automated Frequency Management**

SME: Tim Solie, P2sc

Customer POC: Ross Osbourne, ross.osborne@p2sc.net,,

To eliminate the need for manual spectrum management this project is to Identify, design and develop a mechanism to automatically sense frequencies in an area, characterize signals into groups of blue, red or grey frequencies. Utilize Artificial Intelligence to identify jamming, frequency bleed over, interference with protected frequencies and blue frequencies. Then utilizing digital means rapidly reprogram blue frequencies to alternate frequencies, within multiple radio capabilities, to automatically deconflict the signals and enable clear blue communications while enabling the close quarters jamming of red communications and protecting grey communications.

NOTES: Project team members need to be US Citizens.

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **39**

Project Sponsor:

VT Facilities, Blacksburg, VA

Project Title: **VT Facilities - Building Ladder Safety Locking System**

SME: tbd

Customer POC: Greg Winters, VT Facilities, wgreg@vt.edu,,

Key locks currently secure the hatches that provide roof access to the buildings at VT. Unlocking those latches creates a safety risk for a person on the ladder. Need to see if we can design an automated system that still ensures appropriate safeguards, but opens the hatch for authorized personnel.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **40**

Project Sponsor:

Benten Tech

Project Title: **Benten - MiniMi - Interactive Healthy Habit Doll**

SME: tbd

Customer POC: Tony Ma, ,

Research suggests that the onset of obesity among girls begins around age 6, and it is important to address obesity prevention in early childhood since it is a crucial period for developing taste preferences and healthy behaviors. A lack of healthy eating and active living (HEAL) is the leading contributor to childhood obesity and there are various barriers such as cultural norms, lack of knowledge, lack of role models and safety concerns of neighborhoods, that prevent AA girls from adopting HEAL practices. For this project, we are developing Mini-ME - an innovative and fun, early childhood obesity prevention program that will help AA girls aged 4-8 years adopt HEAL practices through observational learning and effective role modeling using a smart doll and an animated video series with reinforcement from primary caregivers. The specific goal of the project is to Develop a prototype of the Mini-ME program with a smart doll, animated video series, and a mobile app, initially for overweight/obese AA girls between the ages of 4-8 years old.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **41**

Project Sponsor:

VT Orlowski

Project Title: **tbd**

SME: Chakraborty

Customer POC: Mariusz Orlowski, ,

tbd

NOTES:

BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **42**

Project Sponsor:

VT Bright

Project Title: **tbd**

SME: Katey

Customer POC: , ,

tbd

NOTES:

BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

COLLEGE OF ENGINEERING
BRADLEY DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
VIRGINIA TECH

Project Number: **43**

Project Sponsor:

VT ITSO

Project Title: **VT ITSO - Cybersecurity Signal Collector/Analyzer**

SME: Tilley

Customer POC: Randy Marchany, marchany@vt.edu,

Build an inexpensive receiver/collector to monitor publicly available wireless signals for two common protocols, such as WiFi & Bluetooth. Analyze the data collected from the receiver to determine what intelligence you can gain. Consider layers of the OSI model to offer potential vectors where you might find vulnerabilities. Develop a users guide to identify different uses for your system in various operating conditions.

NOTES:

ece
BRADLEY DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING