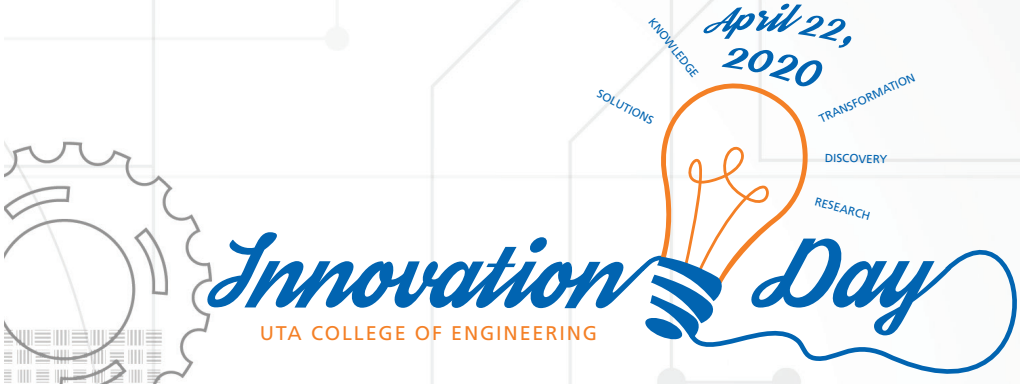

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Table of Contents

Click on a project to go directly to its abstract

Graduate

Research Experiences for Undergraduates

Senior Design

Graduate

1 – American Sign Language Recognition Using Deep Learning

Ashiq Imran
Advisor: Vassillis Athitsos
Computer Science and Engineering Department

Sign language is the major communication method for the deaf-mute community and people with hearing or speech damage. The signs actually have an internal structure in the same way as spoken words. They are combinations of hand shape, orientation and movement with mouth gestures and eye gaze. A single change in one of these components can result in another sign that has a very different meaning. Most early works on sign language recognition focus on ISLR with multi-modal features, such as depth maps, skeletons, and trajectories. We will present a deep learning-based approach to recognize American Sign Language.

2 – HandReha: Dynamic Hand Gesture Recognition for Game-Based Wrist Rehabilitation

Farnaz Farahanipad, Ashish Jaiswal, Harish Ram Nambiappan
Advisors: Vasillis Athitsos and Fillia Makedon
Computer Science and Engineering Department

Hand-gesture recognition systems have recently gained more popularity. Moreover, there is a growing interest in building games for other purposes apart from entertainment, such as education and rehabilitation. This research focuses on developing a novel game-based system for wrist rehabilitation, called HandReha. The idea is to automatically recognize pre-defined hand gestures using a web camera to control an avatar in a three-dimensional maze run game. The pre-defined gestures are picked from a pool of well-defined gestures suitable for wrist rehabilitation. Deep learning techniques were utilized to perform real-time hand gesture recognition from the images. To evaluate the performance of the developed wrist rehabilitation system, a study with 12 healthy participants was conducted. The results showed that the developed wrist rehabilitation system is intuitive, comfortable for the user, easy to understand and keeps the user engaged.

3 – Design, Optimization, Fabrication and Characterization for a MEMS-Scale Triboelectric Energy Harvester with High Operating Frequency and Wide Bandwidth

HM Ashfiqul Hamid
Advisor: Zeynep Çelik-Butler
Electrical Engineering Department

A novel triboelectric vibrational energy harvester with MEMS scale dimensions is presented in this work. The triboelectric energy harvester is designed to harvest energy from high frequency mechanical vibrations of machineries such as the skin of an aircraft. The electromechanical system is structurally optimized to achieve the maximum output power and power density. Novel fabrication approaches are implemented to fabricate the complex structure of the device in traditional cleanroom environment. Detailed characterization of the fabricated system demonstrates that the device can generate 0.18 uW average power and 0.6 uW peak power at optimum operating condition with 9.33g external acceleration at 1150 Hz frequency maintaining 920 Hz operating bandwidth. The system can be also operated as an accelerometer with 43 mV/g sensitivity. The triboelectric energy harvester design can have a significant impact in expanding the applications of the nano-sensors in wireless sensor nodes, in automobile and aircraft industry, in space exploration programs, in micro-robotics and in prosthetic systems.

4 – Comparative Calcium Responses of b-cells to Electric Field Stimulation and Photobiomodulation

Caleb Liebman
Advisor: Michael Cho
Bioengineering Department

Physical cues play an important role in a cell's response to its environment. These stimuli are polymodal, with commonly researched areas including mechano-transduction, electro-transduction, and photo-transduction. Of interest here, both electric field stimulation (EFS) and photobiomodulation (PBM) have been shown to influence intracellular calcium, which plays a critical role in signal transduction by amplifying or attenuating biological signals. From a bioengineering perspective, the ability to directly modulate calcium signaling could be a beneficial tool for cellular therapies. Utilizing these modalities for a particular response is clearly complex, including innumerous engineering parameters to consider. In addition, the particular response is highly dependent on the cellular phenotype. While insulin producing β-cells have very strong calcium activity, little research has been done on how these two modalities can influence the physiology of this cell type. Unlike other methods to modulate intracellular calcium, EFS and PBM are non-invasive and easy to apply. Herein, we aim to explore the extent that intracellular calcium in these cells can be influenced by EFS and PBM, thereby opening potential avenues for diabetic cellular therapeutics.

5 – Photobiomodulatory Effect of 1064 nm Laser Light on Stem Cell Differentiation

Andrew McColloch
Advisor: Michael Cho
Bioengineering Department

Photobiomodulation describes the influence of light irradiation on biological tissues. The cellular mechanism that mediates PBM's effects is generally accepted to be at the site of the mitochondria, leading to an increased flux through the electron transport chain. The aim of the study is to determine whether PBM-induced effects modulate stem cell differentiation to the

adipogenic lineage. To determine the effects of 1064 nm laser light on human mesenchymal stem cells undergoing adipogenic differentiation, ATP and ROS levels, lipid content, and adipogenic gene production were quantified. Cells were irradiated with three different fluences over the course of the experiments. At a low fluence the ATP increase was negligible, whereas higher fluences induced a significant increase. In the laser-stimulated cells, PBM over time decreased the ROS level compared to the non-treated control group and significantly reduced the extent of adipogenesis. In summary, we characterized the use of NIR light to modulate hMSC differentiation. Both the ATP and ROS levels responded to different energy densities. The current study is expected to contribute to the growing field of PBM as well as stem cell tissue engineering by demonstrating the wavelength-dependent responses of hMSC differentiation.

6 – Big Data Analysis for Signal Reconstruction

Jees Augustine
Advisor: Gautam Das
Computer Science and Engineering Department

Signal reconstruction problem is an important optimization problem where the objective is to identify a solution to an underdetermined system of linear equations that is closest to a given prior. The observable properties of the system are infrastructurally limited and inferring the complete state of the complete system from partial information impossible. It has a substantial number of applications in diverse areas including network traffic engineering, medical image reconstruction, acoustics, astronomy and many more. Most common approaches for SRP do not scale to large problem sizes. We propose a dual formulation of this problem and show how adapting database techniques developed for scalable similarity joins provides a significant speedup. Extensive experiments on real-world and synthetic data show that our approach produces a significant speedup of up to 20x over competing approaches.

7 – Anti-Abduction Application

Gokulraj Jayakumar
Advisor: Vamsikrishna Gopikrishna
Computer Science and Engineering Department

The application focuses on tracking the transit of women and children and reports sudden deviation in route using regression algorithm associated with machine learning.

8 – Multifunctional Hard Disk Drive

Aadithya Kumaran Gunasekaran, Srirram Iyer, Niharika Khamkar, Rakshith Sridhar
Advisor: Narayanan Janakiraman (College of Business)
Industrial, Manufacturing and Systems Engineering Department

Laptops which were heavy, big, slow and ordinary are now slim, extremely fast, compact and customizable. Almost all aspects of the laptop which had limitations in the past have a solution now except battery life. Longer battery life is one attribute everybody looks for in a laptop. The problem with portable laptop charger is size. Almost half the size of the small laptop is cumbersome to carry. The whole point of a laptop is its portability and compactness; Carrying multiple devices negates it. Our product idea is very simple: Major attributes of laptops are internet, storage and power, so our product is a combination of external hard drive, internet dongle and portable charger. Bigger and flatter in size, it sits on bottom of the laptop. Once connected, it can charge the battery, provide internet and act as external hard disk if necessary. The multipurpose portable hard disk will be good for customers as it will cater to multiple needs.

9 – Construction Workers' Health and Safety Challenges in Post-Disaster Reconstruction Projects

Thahomina Jahan Nipa
Advisor: Sharareh Kermanshachi
Civil Engineering Department

Reconstruction after a disaster comes with its own risks and adds them to already existing risks of construction activities. However, even though there are multiple studies in the literature of workers' safety in construction, studies related to safety and health hazards for reconstruction workers have been rarely conducted. Therefore, this study aims to investigate workers' safety issues in post-disaster reconstruction activities and develop appropriate strategies to overcome identified issues. Initial data were gathered through interviews of experts in the field of PDR and also by collecting actual case studies related to PDR. It was found that lack of personal protective equipment, language barrier and lack of risk perception of local workers, foreign workers, and supervisors respectively are the major factors contributing to safety hazards during PDR. Ensuring the availability of PPE along with the instruction manual will encourage workers to use them. Considering the cultural difference while preparing manuals for foreign workers will reduce workplace language barriers. Also, a safety training program focusing on increasing hazards identification skills of supervisors can reduce the health and safety issues during PDR. This study helps practitioners and employers by providing guidelines to increase safety and health hazards for reconstruction workers.

10 – Evaluation and Assessment of Disaster Preparedness, Awareness, and Education of Vulnerable Communities in Extreme Events

Ronik Patel
Advisor: Sharareh Kermanshachi
Civil Engineering Department

Disasters, either natural or manmade, can be extremely disruptive to campus life and affect college students both mentally and physically. When it comes to disasters, students are generally one of the most overlooked sub-group among the community. Hence, the primary aim of this study is to investigate the disaster awareness and preparedness of university students during pre- and post-disaster activities. A thorough literature review was conducted on disaster education indicators. Next, data was collected by distribution of a structured

survey among university students to assess their perception and awareness of disaster-related education requirements and needs. After performing several statistical analyses, it was concluded that the graduate students are significantly more aware of the university's emergency procedures and communication systems compared to undergraduate students, while undergraduate students are more aware of the medical supplies provided by the university in extreme events. It was also observed that students with disaster-preparedness education believe that it is important for local communities to help educational systems implement Disaster Risk Reduction courses. The findings of this study contributes to U.S. educational systems to effectively develop and implement DRR courses. In addition, this study guides policymakers to effectively assess universities' existing emergency preparedness policies.

11 – DC Arc Flash Estimation

Anusha Papasani, Kaynat Zia
Advisor: Wei-Jen Lee
Electrical Engineering Department

Renewable energy and energy storage systems are integrated into modern power systems to mitigate concerns about climate change and improve system reliability. This along with the increasing use of DC busses for DC systems have made the study of hazards and risks associated with DC arc flash very important. Arc flash between two conducting bodies can be attributed to aging equipment, environmental factors, human errors, or overheating. While arcing current, incident energy, and arc flash boundary of the AC system can be estimated using IEEE std. 1584-2018, the standard for similar estimation on the DC systems is not available. This research attempts to compare DC arc parameters with AC arc parameters from published literature with the intention of exploring the relationships between AC and DC arc flash phenomena.

12 – WheelTrip – FAA Smart Airport Challenge

Shannon Abolmaali, Justine Batongmalaki, Nikolai Drigalenko, Joanna Glover, Isabella Reyna, Elio Salloum
Advisor: Jay Rosenberger
Civil Engineering, Computer Science and Engineering, and Industrial, Manufacturing and Systems Engineering Departments and School of Social Work

The objective of this competition is to develop solutions to transportation technology challenges while addressing the human factors aspects of the traveler's experience. Our goal in this case is to assist air travelers requiring special assistance. Through our mobile application, WheelTrip, users will be able to primarily track their journey and flights, with added features for wheelchair users. In addition, our system will gather information on expected demand for wheelchair assistance and communicate that data to special assistance staffing agencies. By working with both users and these agencies in mind, we aim to increase the quality of service and minimize costs for staffing agencies, thereby improving the experience of users.

13 – Anaerobic Digestion of Food Waste Components: A Study of Biogas and Fertilizer Production and Composition

Opeyemi Adelegan
Advisor: Melanie Sattler
Civil Engineering Department

Currently most of the food waste in the United States is being placed into landfills. The abundance of food waste in United States, along with the rapid utilization of landfills available without the approval of counties to create new landfills poses a threat and a blessing if well utilized. In 2018, the EPA alerted the public about its growing concerns regarding this issue. Six states (not Texas) have already enacted strict bans on landfilling of food waste many other localities have ongoing organic-waste diversion programs. During a life-cycle assessment carried out by Levis and Barlaz, they found that anaerobic digestion is the most environmentally-friendly way of addressing commercial food waste. Due to high potential for bio-methanation, food waste is a reliable and promising substrate for AD. However, longer duration of digestion may sometimes lead to inhibition because of imbalanced nutrients. Thus, the overall goal of this study is to develop models to predict biogas quantity and composition, as well as digestate/fertilizer quantity and composition, for co-digestion of food and other wastes in AD. The models will be developed as functions of food waste category percentages, co-digestion waste percentages, moisture content, and temperature.

14 – Assessment of Factors That Affect Microbially Induced Concrete Corrosion of Manholes

Sunakshi Hada, Ankita Sinha, Ketan Shah
Advisor: Melanie Sattler
Civil Engineering Department

Manhole shafts in sewers are prone to deterioration due to microbially induced concrete corrosion, which can reduce their life from 100 years to 30-50 years. MICC is facilitated by sulfuric acid formed by generation and volatilization of hydrogen sulfide. Corrosion of manholes on roads can create safety hazards. Accordingly, this project sponsored by the City of Arlington aims to identify factors that contribute to hydrogen sulfide corrosion of manholes, so that these factors can be mitigated, or so that manholes most vulnerable to corrosion can be lined with protective coatings. The initial phase of the project involved collection of data from 350 manholes in the city, including liquid- and gas-phase parameters that influence corrosion, as well as corrosion depth. The manholes were divided into five categories based on their characteristics: presence of drop, pipe diameter, type of flow, inlets and bends, and control. Our results showed that manholes with a greater-than-2-foot drop or a hydraulic jump had the highest H_2S concentrations, and lowest was observed in manholes with subcritical flow. This indicates that turbulent flow increases rates of corrosion. Based on field data, a multiple linear regression equation was developed to predict corrosion rates.

15 – Multi-Sorbent Mixtures From Waste Materials: A Low-Cost Approach to Removal of Multiple Metals and Organics From Leachate

Mithila Chakraborty
Advisors: Melanie Sattler
Civil Engineering Department

Landfills, as a reservoir of various types of wastes, are designed with liners and gas collection systems to minimize the escape of water and air pollutants. Potential pollution from landfill leachate, however, remains a concern due to heavy metals and organic contaminants. These contaminants limit the potential for reuse of leachate water. To reduce the pollutant load from leachate, different treatment methods have been developed; adsorption is one of the lower-cost methods among them. Rice husk and sewage sludge have great adsorptive capacities and are naturally available waste byproducts. The principal goal of this study is to reduce the heavy metal and organics content from landfill leachate so that it can be reused for other purposes like irrigation water for agriculture or safely released into natural ecosystems. Following physical (steam) and chemical activation, the adsorption ability of these waste byproducts and their several forms is being assessed through batch and column tests for heavy metals (Cd, Cr, Cu, Pb, Zn) and organic compounds (PFOA, PFOS, humic and fulvic acid). EPA-approved leaching tests (LEAF) already conducted on these wastes found that the release of metals and organics was within national and international standards.

16 – Implementation of Forward Error Correcting Codes in UTA Coherent Optical Communication Testbed

Kamanashis Saha
Advisor: Michael Vasilyev
Electrical Engineering Department

Our approach is to incorporate a forward error correction algorithm into our LeCroy coherent optical modulation analyzer system. We have applied a low-density-parity-check (LDPC) based error correcting codes with a 7% and 25% overhead rate to minimize the bit error rate after decoding at the receiver.

17 – Noise Figure Measurement for the 3-stage S-band Amplifier

Cheng Guo
Advisor: Michael Vasilyev
Electrical Engineering Department

We measure the noise figure of an S-band optical amplifier based on a combination of two parametric wavelength converters and a C-band EDFA. The noises of three stages are measured separately and used to calculate the total noise figure by the cascaded optical amplifier formula.

18 – Nonlinear/Quantum Optics in Few-Mode-Fibers

Afshin Shamsshooli
Advisor: Michael Vasilyev
Electrical Engineering Department

Multiplexing and demultiplexing of spatial modes is important for both classical and quantum communications, in which mode-division multiplexing is considered a promising way of increasing the channel capacity. In quantum key distribution, switching between mutually unbiased mode bases could increase the dimension of the Hilbert space used for encoding. Also, entangled states are essential for quantum communication, computing, and information processing. Here, we discuss a novel scheme for generation of spatial-mode-entangled photon pairs directly in a few-mode fiber and report first steps toward its experimental realization, confirming the spatial-mode properties of the underlying IM-FWM processes with classical seed signals. And we present a scheme for spatial-mode-selective frequency conversion in a few-mode fiber and experimentally demonstrate upconversion of either of two signal modes as a solution to decode quantum spatial states.

19 – Deep Learning Modeling of Voxel-Level Response Prediction for Radiation Therapy Treatment of Lung Cancer

Jie Han, Rushank Arunkumar
Advisor: Shouyi Wang
Industrial, Manufacturing and Systems Engineering Department

Prognostic prediction of treatment response can be critical to achieve adaptive personalize treatment planning and improve cancer treatment outcomes for precision oncology. Traditionally, only a patient's clinical parameters are used to determine treatment type and to predict outcome and does not take into account tumor spatial radiomic heterogeneity in response. In collaboration with the University of Washington School of Medicine, this project is proposed to involve an undergraduate student team to investigate PET/CT imaging data for patients with lung cancer, and develop a voxel forecast model to predict spatially variant tumor response using deep learning and multiscale patient data analysis. Temperature distribution data is collected using an infrared camera and the theory proposed is used to calculate thermal conductivity. Materials of known thermal conductivity are tested to verify the theory. In this future, this technique could be used to determine the thermal conductivity of unknown materials.

20 – Electrically Pumped Photonic Crystal Surface Emitting Lasers for High-Brightness Laser Applications

Akhil Raj Kumar Kalapala
Advisor: Weidong Zhou
Electrical Engineering Department

Photonic crystal surface emitting lasers (PCSELs) exhibit competitive functionalities such as high power, high beam quality and high beam-steering

capability in addition to photonic device integration. The major advantage of PCSELs is the utilization of band edge effect to achieve single longitudinal and transverse oscillations in a two-dimensional (2D) photonic slab. As a result, strong in-plane coupling occurs due to multi-directional Bragg diffraction and forms a two-dimensional photonic cavity mode with surface-normal emission. This enables the scaling of lasing area to achieve higher laser power with single mode operation. The geometrical design of the photonic crystal provides the key to control the polarization and beam shape of the laser. Nano-sized circular airholes are etched into GaAs using e-beam lithography and reactive-ion etching process to realize the 2D photonic crystal, which provides the feedback to the designed surface emitting laser.

21 – Well-To-Wheel CO_2 Emission Assessment of Gasoline and Electric Vehicles

MD Mamunur Rahman
Advisor: Yuan Zhou
Industrial, Manufacturing and Systems Engineering Department

Road transports in the U.S. are almost entirely dependent on the consumption of fossil fuel. This high dependency on fossil fuel is significantly contributing to CO_2 emission, one of the leading greenhouse gases responsible for global warming. Electrification of passenger vehicles is one of the alternatives to curb GHG emission. Though electric vehicles have zero tailpipe emission, the power required to charge EV batteries may not necessarily come from carbon-free power plants. In reality, if the electricity required for charging EV batteries comes from coal-fired power plants, EVs might be responsible for releasing significantly higher levels of environmental emissions compared to conventional gasoline vehicles. In this study we quantified the well-to-wheel GHG emissions from battery electric vehicles, plug-in hybrid electric vehicles and internal combustion engine vehicles for the evaluation of true impact on environmental emission. Federal tax credits for EVs are the same across the 50 states, assuming they are equally clean, but according to the CO_2 emission index, we revealed that the benefits of EVs are not similar. The study will help decision makers design their policies for EV adoption.

22 – Rapid Large-scale Fabrication of Metasurfaces with Multipart Periodic Unit Cells

Hafez Hammati
Advisor: Robert Magnusson
Electrical Engineering Department

Diffractive elements, recently referenced as metasurfaces, composed of periodic wavelength-scale features can be made with favorable effective properties, enabling the manipulation of electromagnetic waves for a wide variety of photonics applications. Generally, with increasingly intricate unit-cell composition there emerges a wider design space and bolstered functional capability. Unfortunately, advanced devices deploying elaborate unit cells are typically generated via electron-beam patterning involving a tedious process not suitable for large surfaces and quick turnaround. Ameliorating this condition, we present a novel route toward facile fabrication of complex periodic metasurfaces based on sequential exposures by laser interference lithography. With our proposed method, we have successfully patterned and fabricated one-dimensional and two-dimensional multipart unit cell devices. Thus, zero-order transmission spectra of an etched four-part 1D grating device are simulated and measured for both transverse electric and transverse magnetic polarization states of the normally incident light. Furthermore, it is shown that this method of fabrication not only can be implemented to design and patterned periodic symmetric/asymmetric designs, but also to realize non-periodic metasurfaces.

Research Experiences for Undergraduates

23 – Design and Fabrication of Patient-Specific Hip Implant Using Selective Laser Melting Method

Behzad Farhang, Aasma Sapkota, Carolina Favela, Sourabh Hemant
Advisor: Amir Ameri
Mechanical and Aerospace Engineering and Bioengineering Departments

With an increase in demand for patient specific implants, additive manufacturing brings cost-effectiveness and increasing complexity to its prime. The focus of this research is to determine the biological defect, preparation of CAD design, analysis, optimization and fabrication of a hip implant using AM. The implant being patient-specific provides a better fit and functionality when compared to traditional implants. With the resources available in the Advanced Materials Engineering Research and Innovation Lab in the Mechanical and Aerospace Engineering Department, the scope of this research is expected to overcome the current issues faced by the medical industry.

24 – The Impact of Porosity in Additively Manufactured Lightweight Aircraft Structures

Henry Javier Barahona Miranda, Valentina Bulhoes, Behnaz Hassanpour,
Martin Nguyen, Srihari Srivathsan
Advisor: Amir Ameri
Mechanical and Aerospace Engineering Department

The introduction and development of additive manufacturing has led to rapid rise in the innovative design and fabrication of lattice structures with metal. These lattice structures with different levels of porosity offer customized mechanical properties and reduction in weight. There is a huge demand for lightweight structures in the aviation sector for improving the efficiency of aircrafts to reduce fuel consumption in the coming years that can be made possible through different porous lattice parts. The team of undergraduate student will design CAD files and carry out Finite Element Analysis to derive the desired results in these unorthodox parts.

25 – Integration of IMSE Tools and Development of an Undergraduate Class Project

Phoebe LIght, Travis Major
Advisor: Bonnie Boardman
Industrial, Manufacturing and Systems Engineering Department

In the BSIE curriculum students learn many software tools. They never, however, get the opportunity to see how some of those tools interact and complement each other. For example, in the first year they learn to use a CAD program, in the second they learn to program in VBA, and in the third they learn a simulation language. What they don't know is that those three programs can work together and feed information from one to the other. This project will allow a group of current students to learn how to get the software products to interact. They will also design a project that can be used by future students.

26 – Pressure Ulcer Prevention Using Soft Non-Grasp Manipulation

Joshua Ferrigno, Vishnu Perincheery, Ayush Thapa
Advisor: Alan Bowling
Mechanical and Aerospace Engineering Department

The Dynamic Sensory Force Bed is designed to prevent pressure ulcers that form on a bedridden patient. This is accomplished using soft non-grasp manipulation, which periodically redistributes contact forces over the body so that previously stressed skin can fully recover. During recovery, blood freely circulates through the skin where previously forces constricted blood vessels and restricted nutrients from reaching the tissue. The bed will do this redistribution automatically so that patients do not need to rely solely on medical staff to keep their skin healthy. The focus of this proposal is the development of the sensory feedback required to achieve soft non-grasp manipulation. A key development in the proposed work is the shift to vision-based feedback.

27 – Development of 3-D Printable Ultra-high-performance Fiber-Reinforced Concrete for Cost-effective Maintenance and Construction of Transportation Infrastructure

Marilyn Gonzalez
Advisor: Shih-ho Chao
Civil Engineering Department

Reduction of construction time and production costs for transportation infrastructure have profound impact on the construction process. A new construction paradigm, known as 3-D concrete printing or additive manufacturing of concrete provides such solution. Together with emerging advances in robotics and artificial intelligence, the new technology can fabricate complex 3-D concrete components directly from computer-aided design models without any formwork, tooling, and extensive labor involvement. However, conventional concrete has very low cracking strength and steel reinforcing bars are needed in order for the structure to sustain high loads. Placing rebar is a labor-intensive and time-consuming process. Conventional concrete also needs a long curing time (weeks) to achieve sufficient design strength, which prevents concrete industries and AMC from fast production. In addition, when using AMC with conventional concrete, placement of reinforcing bars in various orientations in the structures does not allow a full automation of AMC, which is needed if it is to compete with conventional precast reinforced concrete structures. This research will study the rheological properties of fresh UHP-FRC and develop a new 3-D printable UHP-FRC which will have balanced extrudability and buildability. The developed UHP-FRC will still maintain excellent mechanical properties and durability.

28 – To Design and To Build a Cost-Effective Perfusion Bioreactor

Oluwagbemisola Olugbenle, Kamsi Ubeh, Syeda Fariha
Advisor: Charles Chuong
Bioengineering Department

A bioreactor is an engineered device that supports a biologically active environment under controlled, sterile conditions mimicking the in-vivo physical and chemical environment for specific cultured cells, tissues and organs. Bioreactors are widely used in research labs, medical device, pharmaceutical industries to evaluate the effects of chemical, mechanical stimuli on the homeostasis of biological systems. A commercial unit typically costs tens of thousands dollars. Availability of low-cost bioreactors with easy access for educational use is highly desirable. This project aims to design and build a prototype perfusion bioreactor for studying the effect of shear stress on endothelial cells in cardiovascular system on their cytoskeletal remodeling.

29 – Development of Child-Pedestrian Training Module for Advanced Transportation Systems

Shanila Rashid, Prabishan Shrestha, Su Zixiu
Advisor: Shuchisnigdha Deb
Industrial, Manufacturing and Systems Engineering Department

Pedestrians aged 14 and younger show the highest rate of injuries and fatalities in the USA. Besides their vulnerable physical structures, children lack proper knowledge in traffic rules, processing information from traffic environments, and making decision under risk. In this project, undergraduate students will develop android-based mobile apps to teach children about traffic infrastructures, signs, and rules; vehicle physics; and advanced transportation system with conventional and automated vehicles. Children aged 8-14 will be trained using the apps and tested in virtual traffic environments, before and after training. Results will demonstrate the efficacy of child-pedestrian training and testing tools reducing traffic injuries and fatalities.

30 – Human Interaction and Perception Toward a Service Robot in a Healthcare Environment

Biken K C, Jacob Duffy
Advisor: Brian Huff
Industrial, Manufacturing and Systems Engineering Department

The healthcare industry is emphasizing quality of care and encouraging the high-skilled workforce to focus on direct care tasks as opposed to service tasks. An automated service robot can effectively reduce time and cost while increasing reliability and predictability of hospital pharmaceutical deliveries. However, presence of a robot can make employees uneasy and affect their performance. In this project, students will operate a service robot at a hospital and observe how caregivers interact with the robot and respond to the changes caused by its use. Results will explore future research opportunities implementing service robots in healthcare.

31 – Video-based Cognitive Assessment for Persons with Dementia

Guarav Ajariwal, Isabella Reyna
Advisor: Chen Kan
Computer Science and Engineering and Industrial, Manufacturing and Systems Engineering Departments

This project aims to propose a machine learning framework for video-based cognitive assessment for persons with dementia. Integrated into the mobile app designed in our prior study, the proposed framework will identify changes of PWDs' cognitive functions and help family caregivers proactively adjust caregiving tasks to address the care needs of the PWDs. This, in turn, will reduce the risk of the disease and improve the quality of life of both the PWDs and CGs.

32 – Mitigation of Third Rail Operational Failures Through Implementation of New Technologies

Sagar Hamal, Behzad Rouhanizadeh, Kishan Yadva
Advisor: Sharareh Kermanshachi
Civil Engineering Department

Rail transit systems are important components of the nation's transportation network, particularly in large metropolitan areas. Third-rail transit systems are used in many parts of the world, including the U.S. They have recently attracted the attention of researchers globally, but many aspects remain unstudied. We investigated different aspects of third rail systems, including major issues and solutions for mitigating potential failures and challenges. A thorough review of the current literature revealed that local environmental conditions cause degradation over time, and performing maintenance and inspections at predetermined intervals is very effective at diminishing the issues that lead to failure. This research serves as an appropriate source of information about third rails for researchers and practitioners who work on/with third rail systems and need to address their potential challenges.

33 – Rebounding from Disruptive Events: Optimization of Post-Disaster Reconstruction Activities for Critical and Interdependent Infrastructure Networks

*Zara Farooq Khan, Bishal Pandit, Elnaz Safapour**
Advisor: Sharareh Kermanshachi
Civil Engineering Department

Natural disasters create remarkable issues and challenges for the people living in the affected areas. Accordingly, the responsible governments commonly make major efforts to reconstruct transportation systems as critical elements in returning a community to its pre-event state. This study aimed to identify and classify the key factors affecting post-disaster reconstruction of transportation- critical systems. Additionally, the relationships and interactions of the key factors and categories were modeled and analyzed. The results revealed that project prioritization pertaining to the planning category is one of the significant factors affecting the duration of post-disaster reconstruction of transportation systems. The results also demonstrated that centralizing the information belonging to the reconstruction procedure would be useful for preventing reworks. Moreover, the results clearly presented that with professional documentation, efficient coordination would possible, the probability of rework occurring might decrease, and the probability of schedule delays would decrease. The results of this study will assist decision-makers and program managers in considering key factors affecting the process of post-disaster reconstruction of transportation systems, and adopt best practices that will prevent schedule delays in the restoration of the damaged infrastructures.

34 – Temperature and Pressure Perception Glove for Nerve Substitution in the Hand

Dema Elansari, Jazlyn Gallego, Dion Medina, Martin Ortega
Advisor: Young-Tae Kim
Bioengineering Department

Nerve conditions, such as hand numbness, can lend to making everyday actions challenging. These disorders can mean that a person loses sensory information from the nerve-damaged area, most commonly pressure and temperature. Therefore, the focus of our study will be building a silicone-based wearable glove that can sense temperature and pressure and create a feedback path from the technology to the user.

35 – Designing a Virtual Logistics Community for Texas Farmers

Amy Marusak
Advisor: Caroline Krejci
Industrial, Manufacturing and Systems Engineering Department

To ensure the survival of their farms, regional food producers must find ways of extending their market reach. Larger markets are typically located in urban centers that are distant from farms, and most small-scale producers do not

** – Graduate student*

have the transportation infrastructure to support efficient distribution. This project will develop an information-sharing platform to enable Texas farmers and ranchers to connect with transportation providers via a virtual logistics community. This platform, which is based on crowdsourced shipping and the sharing economy, will address the challenges and advantages of coordinating transportation within and between regions with highly diverse geographies, climates, and cultures.

36 – Development of Fucoidan Nanoparticles-based Device for Household-Level Water Treatment

Ahmed Gure
Advisor: Kytai Nguyen
Bioengineering Department

Fucoidan is derived from seaweed containing sulfated polysaccharides in their cell wall. Increasing resistance of bacteria towards known disinfectants and 6.2 billion people still relying on improved water resources has pushed the market towards natural product discovery where new and novel antibacterial products are sought after. Anti-bacterial along with its biosorption properties of fucoidan have already been reported in literature and usage of fucoidan to disinfect water would be a cheaper and effective way especially in developing countries. In this project, we would assess the disinfection efficiency of fucoidan-based micro-/nano-particles and build a device for portable household-level water treatment with low impact on environment.

37 – What is a Strong Bond? How Can We Predict Composite Bond Performance?

Monalisa Karim, Damon Latham
Advisor: Rassel Raihan
Mechanical and Aerospace Engineering Department

The aerospace, marine, and automotive industries, among others, are using composite materials in abundance, due to the reduced weight and increased structural performance. The primary challenge facing composite materials is a lack of understanding on how to bond different composite materials to make structures and, concordantly, predict their strength and performance. The goal of the project is to assess the material state of the bonded joints using Broadband Dielectric Spectroscopy and Thermally Stimulated Depolarization Current.

38 – City of Arlington Project

Natasha Wooten
Advisor: Melanie Sattler
Civil Engineering Department

The goal of this project is to create an equation that predicts the future corrosion rates of manholes. In the lab, we measure biochemical oxygen demand (BOD) when microorganisms use oxygen to break down organics found in wastewater. We also measure the amount of sulfate when regular oxygen is consumed. We finally measure the amount of sulfide formed when microorganisms use oxygen from sulfate for respiration.

39 – Winter Weather Operations Management System

Sean McCauley
Advisor: Mohsen Shahandashti
Civil Engineering Department

This project will augment a research project funded by TxDOT. Winter weather maintenance operations for TxDOT maintenance crews is an extremely dangerous job. Although every precaution taken by the maintenance operators, winter operations vehicles have been hit in the rear, causing injury to the operators as well as the traveling public. Winter operation vehicles are not often deployed in locations with the highest priority. The objectives of this project were to (1) synthesize and critically evaluate existing methods and devices used by various TxDOT districts for enhancing the safety of winter weather operations; (2) identify and evaluate the applicability of innovative methods and devices used by other U.S. States; and (3) recommend appropriate practices for TxDOT maintenance crews for utilizing the best methods and devices during winter weather operations considering the conditions of different TxDOT districts. Using the results of the TxDOT project, the student will create a Geographic Information System-based program to (1) visualize the locations that the winter operation vehicles are deployed and (2) determine their optimum future locations considering the locations of vehicles and the current and forecasted temperature data.

40 – Studying the Microstructure Variation in Additive Manufactured Parts

Cecile Pavelka, Behzad Farhang, Taiwo-Bayonle Olayiwola, Vignesh Ram Kumar Rajendran, Kaitlin Robles, Mayuko Shinohara
Advisor: Narges Shayesteh Moghaddam
Mechanical and Aerospace Engineering Department

Additive Manufacturing (AM) has emerged as an upcoming technology which offers unique ability to fabricate parts compared to conventional manufacturing processes. Microstructure analysis is a widely used method to reveal the possible defects and the exact composition of alloys. Through analyzing the microstructural properties, it is possible to evaluate the quality of a part and optimize the process parameters. This research aims to investigate the variation of microstructure properties in an AM part and propose applicable solutions to eliminate the defects.

41 – Towards Geometrical Accuracy in Additive Manufacturing

Lloyd-Wayne Bird, Kiriti Mamidi, Alyssa Nolen, Bharath Bhushan Ravichander, Aresch Panahgahi, K Chalise Sandesh
Advisor: Narges Shayesteh Moghaddam
Mechanical and Aerospace Engineering Department

The primary goal of this proposal is to obtain optimal process parameters for Inconel 718, manufactured using Selective Laser Melting. This project is about developing several process parameters that are required to deposit a layer of metal powder and developing a model to predict parameters as it is challenging due to the high level of interrelation between the manufacturing process parameters and the CAD geometry. The best fit for a predictive model is achieved with the response surface methodology approach. The group will utilize UTA's Innovative Additive Manufacturing Lab for conducting this proposed research.

42 – Investigating the Future Advancement of Science and Engineering Communication Through Stakeholder Participation

Nicole Ndegwa
Advisor: Kathleen Smits
Civil Engineering Department

Traditional methods of science communication, such as reports or technical presentations, limit the ability for the public to engage with and learn from scientists. Academic researchers and scientists are currently plagued by poor science communication efforts, limiting the impact of ground-breaking research. One way to enhance science and engineering communication comes from the creation of appealing visual representations of research results. Able to be used as both infographics and graphical abstracts, visual representations offer opportunities to present a scientific narrative in a creative way that limits jargon and inaccessible language. This study will examine methods of visual science communication that supplement these barriers within science communication in order to understand what components of visual representation are the most critical for public learning and effective communication.

43 – Migration of Gas Leaks Through Soil Layers and Subsurface

Parth Thapa
Advisor: Kathleen Smits
Civil Engineering Department

This research focuses on the migration paths of gas leaks when an underground pipe leakage occurs causing the methane released to travel through the soil and affect surrounding environment. In this research, we evaluated about 50 sites and studied the pathways in which gas travels from the main leak source. The research then inputs the distance of the barholes inserted into the ground and measure its coordinates in the xy-direction. We create a statistical excel spreadsheet to analyze all the values that were input to decide the percent error and determine the accuracy of the entire procedure.

44 – Evaluating and Developing Setback Distance for Natural Gas Pipelines in the United States

Nathaniel Steadman
Advisor: Kathleen Smits
Civil Engineering Department

The United States has an ever-increasing need for energy which has been aided by the increase of fracking and transportation of natural gas through established pipelines. With increased urbanization and population growth, communities are now facing the question of how close should these pipelines be to homes, business, and other major centers of activity. In the United States these distances are not federally regulated, resulting in widely varying distances of safety based off of public perception of safety and local legislation. These distances have had very little experimental data to back them, but instead are based on what people perceive as being the safest to their health and safety. In this study, a model will be conducted that shows the dispersion of natural gas through soil and through the air from a point source in the soil.

45 – Conceptual Design Methods for Small 3D Printed Aircraft

Melanie Kunzi
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

Small 3D-printed aircraft could fill certain small UAV missions but their design challenges conventional aircraft conceptual design methods due 3D printing effects on materials and structures. This work will examine the influence of 3D printing process parameters and the resulting materials and structures on aircraft conceptual design methods. Based on process induced weaknesses, such as local stress concentrations that weaken the structure and increase structural mass, and opportunities, such as generatively optimized biomimetic structural configurations, an enhanced methodology will be developed to account for these considerations. The methodology will be implemented in a design tool and validated with a 3D-printed test aircraft. The work will focus on the MultiJet Fusion 3D printing technology developed by Hewlett Packard.

46 – Validation of Optimization Driven Structural Scaling for 3D-Printed Models

Steve Berdote
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

3D printing technologies provide enhanced design freedom to scale stiffness through material and geometric configuration. Such design freedom offers enhanced efficiency and effectiveness for applications such as aeroelastic wind tunnel models where scaled structural response is critical and conventional methods are costly. This work aims to enable rapid, low cost scale model design for flight vehicles using optimization methods to leverage design freedom enabled by 3D printing technology to establish similarity between models of

different scales. An optimization approach developed in previous work is used to design a scaled high aspect ratio wing model for structural similarity with a larger scale model. Validity of the approach is investigated using both multi-material and single material 3D printing technologies. For each 3D printing technology, a scale model will be optimized, implemented in a CAD model, 3D printed, and tested statically for similarity with the large scale structural response. The work will be executed in collaboration with the U.S. Air Force Research Lab Aerospace Systems Directorate.

47 – Phase Stabilization of Optical Frequency Comb

Simran Rana
Advisor: Michael Vasilyev
Electrical Engineering Department

We develop a sub-system to realize phase stabilization of the optical frequency comb, obtained by electro-optic modulation. The optical phase-locking technique is used in this research to lock the phases between different frequency components of the comb, which pass through independent optical paths. Pound-Drever-Hall (PDH) scheme is cost-effectively implemented using an Automatic Bias Control (ABC) module originally designed for Mach-Zehnder-Modulators (MZMs). This allows locking the phase to a minimum, maximum and quadrature points of the interference pattern.

48 – Recycling and Reusing Thermoplastic Waste from 3D Printing

Esequiel Aguilar Villareal, Murphy Balsomi, Prissha Krishna Moorthy, Srishti Nag, Jennifer Okpala, Richard Robertson, Utkarsh Singh, Lin Tran
Advisor: Yiran Yang
Industrial, Manufacuturing and Systems Engineering; Bioengineering; Computer Science and Engineering; and Mechanical and Aerospace Engineering Departments

Compared to traditional manufacturing processes, additive manufacturing is able to enhance the design freedom and manufacturing complexity, and thus has been favored in a wide range of application domains such as aerospace, automobile, healthcare, etc. A great amount of AM waste, especially thermoplastic waste like acrylonitrile butadiene styrene and polylactic acid, are generated in various shapes and forms, which, if directly disposed, could cause severe environmental consequences. The overarching goals of this REU project are (1) proposing a framework in AM to address this waste recycling issue; (2) collecting and sorting thermoplastic waste from 3D printers; (3) recycling the waste into new filament to be used in 3D printing; and (4) characterizing the molecular weight distribution variation of the recycled material using the state-of-the-art Gel Permeation Chromatography system.

49 – Topology Optimization of 3D-Printed Aircraft Wings with Less Material Use

Pratiksha Acharya, Phyllicia Gitumbi, Jennifer Okpala, Sindhu Parajuli, Azza Sheriff
Advisor: Yiran Yang
Civil Engineering, Computer Science and Engineering, Industrial, Manufacturing and Systems Engineering, and Mechanical and Aerospace Engineering Departments

Additive manufacturing or 3D printing fabricates parts by adding materials, usually layer-by-layer. Attributed to the layer-wise production method, AM technologies have great advantages such as enhanced manufacturing complexity, reduced production time, and higher level of customization and design freedom. During the past a few decades, AM technologies have been favored in diverse industries such as aerospace, automobile and healthcare. The global AM market is continuously growing. More specifically, in the aerospace industry, it has been estimated that by 2021, 75% of military aircrafts will contain 3D-printed components. Hence, the design and fabrication of these components have attracted increasing research interest. In this REU project, the following tasks will be conducted: (1) generating different 3D designs for aircraft wings; (2) performing topology optimization and finite element analysis; (3) 3D printing optimized designs; and (4) characterizing the quality/performance of 3D-printed aircraft wings.

50 – Synthesis and Characterization of αICAM1-EpoR-PLGA-NP to Treat PAD

Claire Sissons
Advisor: Kytai Nguyen
Bioengineering Department

Cell-based therapy demonstrated restoration of blood perfusion; however, transferred cells were poorly targeted to and survived in ischemic tissues. Gene therapy, a non-invasive method, can regenerate new blood vessels in ischemic tissues. Our "proof of concepts" results indicate that EPOR loaded poly(lactic-co-glycolic acid) nanoparticles improved cell protection, cell proliferation, cell migration and tube formation in in-vitro studies and restored blood perfusion and limb functionality in Balb/c murine PAD models; however, off-target was a limitation of the design. To address this limitation, a new approach will be proposed to specifically target to ischemic tissues in order to enhance therapeutic effects while reducing side-effects. In this project, anti-intercellular adhesion molecule 1 (αICAM1) conjugated EPOR loaded PLGA nanoparticles (α-ICAM1/EPOR-PLGA) will be developed as a targeted and noninvasive approach in combating PAD.

51 – Investigation of Therapeutic BPLPAT Nanoparticles in the Treatment of Peripheral Arterial Disease

Vy Tran
Advisor: Kytai Nguyen
Bioengineering Department

In peripheral arterial disease, the blood flow to the lower extremities is limited due to the blockage of the blood vessels. PAD has affected over 8.5 millions of Americans and leads to high rates of morbidity and mortality. Surgical intervention is the common approach to treat PAD; however, this invasive approach can cause complications such as restenosis while causing discomfort to patients. Erythropoietin receptor (EpoR) can regulate the hormone erythropoietin to improve the production of red blood cells. Aniline doped biodegradable photoluminescent polymer (BPLPAT) has dual modalities in fluorescence and photoacoustic imaging. In this study, we are developing EpoR loaded nanoparticles using BPLPAT as a theranostic approach to treat PAD.

52 – An On-Chip Microfluidic Device for The Production of Targeted Drug Carriers

Blake Brady, Ali Mohamedi
Advisor: Kytai Nguyen
Bioengineering Department

Drug delivery is an essential part to treating patients, especially those who have cancer. While many treatments include conventional delivery of anti-tumor drugs through intravenous administration, a large growing field has come in the form of nano-scale drug carriers. In this project, we demonstrate how the production of nanoscale, targeted drug carriers can be automated through microfluidic devices. The device includes microchannels made from Polydimethylsiloxane (PDMS) made from a mold that was generated via a soft lithography process. Within these channels the synthesis of antibody conjugated nanoparticles (immunoliposomes), which can load anti-tumor drugs, occurs. An additional separation of these immunoliposomes is also taken place in the microfluidic devices. Our results indicate that we have developed a novel cost efficient and practical sized microfluidic device, which is designed to synthesize and separate targeted drug carriers to treat various diseases, including cancer.

53 – PLGA Nanoparticles Conjugated Microbubbles for Theranostic Applications

Dustin Luu, Na Nguyen
Advisor: Kytai Nguyen
Bioengineering Department

Microbubbles have been used as contrast agents to enhance the ultrasound imaging signals. FDA-approved PLGA nanoparticles have many advantages such as high bioavailability, compatibility and controlled drug release. PLGA nanoparticles conjugated microbubbles can release nanoparticles on demand at the targeted tissues by applying the ultrasound waves. In this study, we propose to optimize the conjugation of microbubbles and nanoparticles to improve the conjugation efficiency and to use these conjugates for theranostic applications.

54 – Can Hot Spots Policing Reduce Crime?

Girgis Farag, Nadine Khatib, Keerigan Rudd, Deependra Thakur
Advisor: Yuan Zhou
Industrial, Manufacturing and Systems Engineering Department

Police operations play a key role in ensuring safety and well-being of citizens. However, the complexity of policing systems creates enormous challenges to law enforcement agencies in developing cost-effective solutions to reduce crime. Over the past several decades, a number of policing strategies have been explored by researchers and policing practitioners. One of the most famous strategies, hot spots policing, targets resources and activities to those areas where crime is most concentrated. Although there has been a growing consensus that hot spots policing is an effective strategy, a critical argument was raised recently concerning its true effectiveness. We know little about the possible impacts of hot spots policing on police jurisdictions or large areas, such as cities, as the majority of the existing literature has focused on examining its impacts without considering the potential of crime displacement – criminals may commit crimes in other areas. This project will address the impacts of hot spots policing from a system's perspective by targeting three specific objectives: Gain deeper knowledge of hot spots policing and its impacts; Identify hot spots of crime by analyzing the data that have already been collected from the Arlington Police Department; Examine the impacts of hot spots policing systematically.

Senior Design

55 – Split-Hopkinson Pressure Bar Approach for Low-Impedance Material Testing

Adedeji Adenuga, Sanjana Choudhary, Anuoluwapo Eletu, Jordan Horn
Advisor: Ashfaq Adnan
Mechanical and Aerospace Engineering Department

The split Hopkinson pressure bar is used to measure the compressive stress-strain responses using high strain-rate testing for soft materials such as polymers. The conventional split Hopkinson pressure bar is unable to determine the compressive stress-strain behavior accurately. We have designed a modified split Hopkinson pressure bar that is able to accurately determine the compressive stress-strain behavior of a low-impedance material. Different designs were studied to optimize the impact response of the design in order to accurately predict the sample's fracture and failure properties. Computational results were used to justify the predictions with the modified split Hopkinson pressure bar. We are building a successful working modified split Hopkinson pressure bar and verify with a variety of low impedance testing materials.

56 – Airbus Control Panel Cooling

Erin Hollingsworth, Miranda Hucaby, James Nguyen
Advisor: Dereje Agonafer
Mechanical and Aerospace Engineering Department

Due to the ever-increasing technological needs of the modern helicopter, new equipment is constantly being innovated and implemented into the control panel. The abundance of electronic equipment results in hot spots that could lead to apparatus failure as the original design did not take into consideration the equipment's need for cooling. The objective of this project is to improve upon the air circulation and cooling behind the Airbus Helicopters H125 helicopter control panel. During hot days with high solar radiation, the temperature within the cockpit can reach critical temperatures that cause equipment failure. Each electronic component has a specific thermal range for ideal operations and power consumption which were utilized to develop a simulation for the worst-case condition for the control panel during hover. The goal of the final design will be to utilize fans, vents, and ducting to lower the maximum air temperature in the control panel to 55°C. The simulation results for different methods will be used to narrow the options to two solutions; one will be the most efficient at cooling and the other will take into consideration cost, manufacturability, weight and ease of implementation.

57 – A Finger Photopletysmography for Measurement and Display of Adult Heart Rate

Lorenzo Fabri, Trang Nguyen, Viet Nguyen
Advisor: Khosrow Behbehani
Bioengineering Department

Wearable heart rate monitors based on photoplethysmography (PPG) have become increasingly popular recently due to its simplicity, cost-effectiveness and non-invasion. The principle behind PPG devices is visual detection of blood volume changes in the microvascular bed of tissue. The device has three main components: the electrical signal, the Pyboard (microcontroller) and the LCD screen sitting on top of the microcontroller. As the electrical signal passing along the circuitry, it is obtained by photo-emitter (visible and IR light) and phototransistor. This signal is then processed to produce PPG waveform that is displayed on the LCD screen. The PPG waveform is composed of a pulsatile ('AC') physiological waveform and 'a baseline ('DC') waveform. The AC component is superimposed on the DC component. The AC component is the result of the cardiac synchronous changes in the blood volume with each heartbeat, whereas the DC components contains various lower frequency components that contributed to respiration, sympathetic nervous system activity and thermoregulation.

58 – Development of a Delivery System to Apply Multiple Stimulations for Stem Cell Differentiation

Liam Biard, Sheccid Loya, Lia Molina Cortez, Noemi Salgado
Advisor: Michael Cho
Bioengineering Department

There are many potential applications for the increase of stem cell differentiation rate and yield over independently using light stimuli or electric field stimuli. Some applications include: being able to perform more experiments more often, being able to create the necessary resources for an experiment efficiently and quickly, and for teaching purposes. In recent studies, light and electric field stimulation have been shown to increase differentiation of stem cells when used independently. There is yet to be an experiment done that uses both stimuli simultaneously. Our goal for the exposure chamber is to have the ability to apply the two forms of stimulation with the hopes of increasing differentiation rate and yield, over independently using light and electrical field stimulation; However, maintaining biocompatibility, sterility, cost and weight efficiency, and minimizing the degree of error (less than 10%) is an area of focus.

59 – Hypersonic Convergence as a Method for Supersonic Transport Analysis

A Savage, Aditya Panigrahi, Dylan DeGoes, Aaron Jackson, Arthur Koster, Michael May, Shelby Vanover
Advisor: Bernd Chudoba
Mechanical and Aerospace Engineering Department

The purpose of this study was to verify a modified hypersonic convergence design synthesis methodology by comparing conceptual design level results such as aircraft size and preliminary performance evaluations for a supersonic transport to the characteristics of the Aérospatiale/BAC Concorde. This report focused primarily on the performance aspects of the SST as well as the design synthesis methodology used to organize the conceptual design phase. The HC design method utilizes eight separate independent disciplinary analyses which form a multidisciplinary analysis.

60 – Defining Conceptual Design Solution Space Topographies for the Future of Hypersonic Technology in Near-Future Commercial and Military Applications

Kshitiz Bhandari, Cole Carson, Michael Ibanez, John Krans, Alan Montemayor, Lauren Savage, Monica Soltero
Advisor: Bernd Chudoba
Mechanical and Aerospace Engineering Department

Hypersonic vehicles are being developed by both commercial and military enterprises around the world to meet demand for high-speed travel by passengers, businesses and modern warfare. Several commercial aerospace companies and defense contractors are developing demonstrators of high-

supersonic and hypersonic concept vehicles. Companies are working to create the first viable high-speed passenger aircraft, while past high-speed vehicle concepts, such as Saenger II, LapCat, Skylon and Hotol failed. The common denominator among all of these corporations and concept designs is the simple fact that each was developed from a single point-design. Without performing a solution-space screening of all possible vehicle conceptual designs prior to developing a design based on one point, it is impossible to forecast if that point design will be viable. Every past design has failed accordingly. Rather than performing a hypersonic aircraft point-design and continuing the design process from conceptual design through detail design, a solution space topography will be developed based on hypersonic convergence methodology. Multiple continuums will be created, the local maxima on the topographies will be analyzed for feasibility and the chosen point designs will be further analyzed with three-dimensional models produced for visualization of viable hypersonic aircraft designs.

61 – Liquid Fueled Bi-Propellant Rocket Engine

Sudarshan Chettiar, Anthony Corneau, Jamil Hinedi, Tyler Jones, Nihal Kumarswamy, Nkechukwu Ebolum*
Advisor: Bernd Chudoba
Mechanical and Aerospace Engineering Department

The Aero Mavericks is a mechanical and aerospace student organization at UTA. One of our current interests is developing a liquid-fueled bi-propellant rocket engine. This project involves developing a design methodology based on reliable sources and historical results of rocket propulsion systems, as well as developing a process for engaging and instilling design-build-test-fly proficiency in new student members. To conduct an engine test, the team must first conduct a series of sub-system tests to verify that the engine will perform as designed. One major test the team has conducted is a cold flow test of our engine's injector. Our team has developed a system so that we would be able to characterize and finalize the design for our injector. This test allows us to determine the discharge coefficient of the orifices and the pressure drop across the injector for both the fuel and oxidizer side. After completing the design for the injector and the engine, the project will include hardware manufacturing and testing. This engine allows the team to build up our engine design proficiency and will be tested on a test stand once all the sub systems are integrated.

62 – AI Trader

Ashwin Babu, Aravjit Sachdeva, Shreyash Shrivastava
Advisor: Chris Conly
Computer Science and Engineering Department

Application of Artificial Intelligence in trading financial securities is a baffling research problem. Amid endless possibilities for the development of trading algorithms, the territory of reinforcement learning has been infrequently conquered. We have developed a trading bot that leverages reinforcement learning for profitably trading in capital markets. We have developed a web application that will allow users to visualize the bets made by the algorithm with a myriad of buy and sell tactics.

** – Graduate student*

63 – AR Sandbox

Jamshed Jahangir, Nhi Luong, Eric Zelaya
Advisor: Chris Conly
Computer Science and Engineering Department

The AR Sandbox is used to show how changes in terrain will affect topography. Users can interact with the sand to create different topography such as rivers, mountains, trees and animals. We also plan to integrate virtual reality into the project and potentially make some games out of the sandbox.

64 – Bowdie

Sergio Guerrero, Micah Hall, Connor Morris, Vivek Patel, Roshan Shrestha
Advisor: Chris Conly
Computer Science and Engineering Department

Bowdie is a smartglass application designed for the Vuzix Blade Smart Glasses that enhances the user experience capabilities of the glasses. The application adds additional voice and gesture command interactions that allow users to navigate through the application easily. Additionally, Bowdie adds new visual search capabilities that allow users to recognize and learn more about objects simply by taking pictures of them. After identifying an object, Bowdie displays the information about the object directly in the lens of the glasses allowing the user to perform online searches about the object quickly. Lastly, Bowdie provides an augmented reality display that allows users to view their current map routes from services such as Google Maps. Through the augmented reality display, users can follow routing directions without having to turn their heads away to look down at their phones.

65 – Cookums

Kasi Cross, Geetesh Kalakoti, John Livesay, Quinton Tompkins, Kevin Tung
Advisor: Chris Conly
Computer Science and Engineering Department

Cookums is a virtual reality cooking game in the setting of a food truck.

66 – Laser Harp

Cameron Gratts, Dustin Le, Vy Tran
Advisor: Chris Conly
Computer Science and Engineering Department

Our group designed a transportable, lightweight harp that plays all notes in tune, along with a stepper pedal to play notes for longer durations. We will write software to produce the notes/sounds to eliminate the need for manual tuning, therefore reducing the amount of human error involved. Our product

will, upon any contact with a laser, emit a sound. This product should be used to showcase the vast areas that technology can be implemented into. While this is our main purpose, it is also possible to use the product in any musical performance. The intended audience of the product is K-12 students.

67 – Laser Harp

Sidharth Banerjee, Zackery Gualandi, Mitchell Lux, Muhammad Siddiqui
Advisor: Shawn Gieser
Computer Science and Engineering Department

The Laser Harp is an electronic system that mimics the performance of a harp, a musical instrument. Laser Harp will be a "string" instrument, but instead of strings, it will have lasers that when you break the line of light, it will make the corresponding tone from different instruments like a string. The 13 lasers emitted by the system represents a full musical octet. This is intended to be used as a complete replacement of a traditional music device and concept systems like these would revolutionize the electronic musical space. The instrument will be built in a compact design with everything in a all in one device for portability, so the user of this system will be able to play it without having to carry a bulky musical instrument. This device will be easy to use with simple controls to be able to connect with as many age groups as possible.

68 – Marcie's Eye-Tracking

Divyansh Acharya, Iyemenvile Itipo, Joanne Matthew, Esha Shah, Joseph Soriano
Advisor: Chris Conly
Computer Science and Engineering Department

Marcie is a UTA alumna who was diagnosed with amyotrophic lateral sclerosis. Her affliction has rendered her unable to use most of her motor functions, including ability to speak, eat, and move. She currently uses an outdated system that's almost 20 years old that cannot be upgraded for legal reasons within the company. Our project allows Marcie to continue living her daily life through modern technology without the worry of system failure.

69 – MavRA

Ibukunoluwa Aboderin, Luis Estrada, Juan Diego Gonzalez German, Shubham Gujar
Advisor: Chris Conly
Computer Science and Engineering Department

Resident Assistants at UTA spend a large amount of time and energy tracking and remembering information needed to perform their duties. The current solutions are geared toward Residence Directors and the leaders of University Housing Office but there is no software created with RAs in mind to help handle their responsibilities. Whatever software exists is expensive, bloated, and designed for large companies. MavRA aims to solve the problems faced by this target customer by being a unified web-based cloud application where RAs can access the resources they need. They can use our platform as a Housing-oriented planner, notebook, and scheduler to store the information they gather about their Residence Halls, the people that live there, and their tasks. The accessibility of a web interface makes it easy to use anywhere by all the staff members and the cloud-based nature of it encourages and simplifies communication and team-work within the application. This system will help cut back on the effort needed to customize other solutions for this type of work, and avoid having to work on this data in a non-digital way.

70 – Meerkat

Nika Davis, Quan Doan, Hy Nguyen, Teresa Nguyen, Saurav Subedi
Advisor: Chris Conly
Computer Science and Engineering Department

Meerkat is a web application aimed at improving the experience of group entertainment via movies and videos. Due to the inconveniences of planning in-person gatherings and complicated features of other services already on the market, we wanted to build a platform that will allow people to share their watching experiences effortlessly and painlessly.

71 – Outreach Automated Drawing Robot

Jesee Calzada, Pratikshya Devkota, Jeswin Matthew, Alexander Windeler
Advisor: Chris Conly
Computer Science and Engineering Department

A 3D printer will draw whatever a person draws on a tablet.

72 – Traffic Sign Detection

Yiyambaze Yehoyada Nkhoma, Sandhya Sharma, Lewis Shemery, Khom Bahadur Sitaula, Shivangi Vyas
Advisor: Chris Conly
Computer Science and Engineering Department

We have built an application that detects traffic signs in real time.

73 – Trash Cleanup

Jeevan Gyawali, Aabhas Kharel, Safal Lamsal, Subhechha Shrestha
Advisor: Chris Conly
Computer Science and Engineering Department

This is a mobile app that is designed to assist during trash cleanup events. It allows organizers to create and easily manage the event and volunteers/ participants in the event. This will have possible features like selecting a cleanup area via Google Maps and creating an event, and keeping in touch with all the participants during the event.

74 – WeAdvise

Sajan Dangol, Ashrit Koirala, Dongqing Ye
Advisor: Chris Conly
Computer Science and Engineering Department

WeAdvise is a web app that facilitates either an advisor or a student regarding their academic advising. Currently, there is not a web application available which helps students get their advising online. Students have to wait in line for a long time before meeting with an advisor, not knowing how long the wait will be, and advisors are unaware of how many students are waiting to see them. WeAdvise is a solution to these problems. The app offers students the opportunity to "Get in line, online" through a website. WeAdvise makes it easier for students to meet with their preferred advisor in a time-efficient way. The main vision of WeAdvise is to overcome long waiting times to meet an advisor from anywhere using any kind of browser.

75 – Arcwave

Stuart Balaban, Casey Cravey, Javier Garcia, Camdyn Liening, Cole Maas, Nathan Wright
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

The Arcwave is a whole-body vibration platform designed to stimulate and strengthen muscles and neural connections throughout the body. Previous iterations have proven to help patients improve muscle performance. This new oscillatory platform is larger than some of its predecessors and can sustain larger forces of up to 550 pound-force at frequencies of 5-15 Hz through remote control. The platform also has Bluetooth connectivity and speakers to allow users to play any song though the Arcwave. This larger whole-body vibration platform will allow any users, young or old, to stimulate and build their muscles by simply standing on the device. Other positions can also be implemented to stimulate a variety of muscle groups while allowing even the most aggressive workouts to be made with the Arcwave in military training applications.

76 – Automated Residential Hydroponics

James Chanthalangsy, Jeffrey Joens, Collin Perry, Sam Ray
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

Growbotics is a Senior Design team working toward building a prototype for automated residential hydroponics. The overall hydroponics market is projected to grow from $8.1 billion in 2019 to $16 billion by 2025. There are many products offered to the public that boast the capability to grow plants from seed to harvest with automation. We are refining a design for a primary and secondary unit that are comparable to the price of current products on the market but with a much larger growing capacity. This prototype will be a single unit with two separate plant zones: one which uses deep water culture and the other which uses a soilless medium. Functionality of the unit will be the predominant focus, but the data that we will gather will allow us to make projections about how cost will scale as a function of harvest capability.

77 – AVRSL Indoor Mapping Robot

Alfredo Arpero, Jonathan Escalante, Hector Elizalde, Nathan Lara, Khanh Le,
Alberto Rueda-Munoz, Yesmeen Nasir
Advisor: Brian Huff
Mechanical and Aerospace Engineering Department

We will deliver a system capable of mapping real-life indoor environments in three-dimensional space and creating a virtual, navigable world in a fast and efficient manner. 3D Mapping Solutions will focus on developing a system that will acquire the necessary data to create the 3D space such as dimensions, images, and relative position of the system with respect to the target space. We project a target time for a scanning mission of a regular classroom (900 sq. ft.) to be one hour or less. 3DMS will also design and fabricate an electrical housing and support structure as an attachment to the mobile platform provided. The structure and housing will carry many of the data acquisition devices such as pan-tilt-zoom cameras and sensors not already equipped by the mobile platform. The combined system should be able to effortlessly travel through a standard door frame (36 inches wide and 80 inches high). The system will provide a deliverable package including a 2-D floor plan, a navigable 3D virtual space, and a manner of providing a live feed of the robot's view.

78 – Electric Heating

Alejandro Avila, Jacob Bailey, David Draper, Trevor Johns, Ethan Mitha, Shaktim Nepal,
Duc Nguyen, Zachary Shively
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

The project consists of being able to simulate heating through various heaters given certain parameters in extreme weather conditions, such as those expected in northern Canada. The simulations will have a goal of performing a comparative analysis of the different heaters in order to figure out which will heat up faster, without approaching temperatures at which self-ignition would be an issue. Along with the simulations, this project will demonstrate the associated costs, benefits and downsides to each of the technologies.

79 – HVAC Design for Archives Center in Mumbai, India

Christian Lowery, Sudipt Panta, Pawan Panth, Marissa Peplinski
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

We will select and analyze three HVAC systems for a three-floor, 17,500 sq. ft. archive center in Mumbai, India. Systems must be chosen based on low life-cycle cost, low environmental impact, comfort and health, creative high-performance green design and synergy with architecture. Given the mixed-use nature of the building, all systems chosen will be hybrid systems consisting of several sub-systems. Three separate configurations of sub-systems will be analyzed. Load calculations were completed using Trane's Trace 3-D software. It will also allow for cost analysis and system design selection and testing.

80 – Neuro Arc Meditative Vibrational Platform

Jason Alford, Brandi Garland, Kelly Johnson, Lukas Willingham, Joseph Wyatt
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

The Neuro Arc chair will provide meditative benefits to users to alleviate symptoms of stress, depression, and anxiety, while lowering blood pressure and aiding in the relief of drug addiction, alcoholism and more. The goal of Pulse Engineering is to design a new, unpatented system to produce vibrations throughout specified locations within the chair, resulting in a targeted displacement of these locations. The new system will be more cost-effective than existing technology and will result in the user achieving a brainwave frequency within a range known to mimic the effects of a meditative state.

81 – Stahl Heated Make-up Brush

Justin Battle, Tyler Freeman, Eleena Heidelberg, Jessica Lueckhof, Christian Slaughter
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

Cosmic Technologies Inc. has been tasked with developing a heated make-up brush that will aid in the application of foundation make-up to the facial area. The design will incorporate an internal heating element that will be used to heat the surrounding air flow. This heated air flow will increase the temperature of the bristles to the desired temperature range specified by the client. Upon delivery of the product to the client, the brush head will be able to maintain a user specified heat range for an average time of 3 to 5 minutes and will be able to be safely cleaned and reused by the consumer. By the end of this semester we plan to deliver a working model of the heated makeup brush in order to change the way in which foundation make-up is applied by consumers, greatly enhancing the smoothed finish of the makeup.

82 – 2020 IEEE Robotics Competition

Osbaldo Alvarado, Johan Barradas, Shreyosi Endow, Luis Flores, Daeyoung Lee, Tyler Nguyen, Gerardo Rodriguez, Muhammad Murad Ghaani Siddiqui, Rajvi Tiwari
Advisor: Shawn Gieser
Computer Science and Engineering Department

Littering is a persistent problem that makes tackling pollution more difficult than it already is. With this problem in mind, IEEE came up with the vision of a robot that raises awareness about the consequences of littering, holds those who continue to litter accountable and finds an optimal way to pick up and dispose of litter. The robot may eventually be used to clean up badly littered areas, such as streets after a parade. To achieve a greater level of accountability, we will be creating an autonomous robot that can collect and ideally sort different types of trash and recyclable litter dropped by a litterbug. The robot will be able to communicate with the perpetrator and hold the person liable for polluting. This will dissuade continuous contamination of the environment and encourages responsible, ethical disposal of trash. By unifying hardware and computer vision algorithms, our robot will have the capacity to make a cleaner world.

83 – Hands-On

Caleb Jolley, Paras Sharma, Christopher Willingham
Advisor: Shawn Gieser
Computer Science and Engineering Department

The most important aspects of commercial software are intuitiveness, responsiveness and ease of use of the user interface. In-home hospice care systems provide generous amounts of aid to a patient's attending physicians. However, charting systems in hospices and in healthcare, in general, have not been user-friendly and by some accounts lead to an inordinate ratio of time spent by nurses on the system rather than helping patients. The UI is not the sole problem that we have heard of. Some other problems include conflicting physician permissions, portability, the disparity in layouts of similar applications, and unjustifiable amounts of time taken to find forms. Due to the inherent difficulty in operating these systems, the ratio of time spent caring for a patient versus time spent attempting to manipulate the software is heavily weighted toward the latter. Hence, the opportunity exists in this market for a system to be rid of said problems and such a system is also feasible.

84 – Infrared Arena

Edgar Acevedo, Justine Batongmalaki, Linda Phanvilay, Danny Vu, Jean-Marcel Yacho
Advisor: Shawn Gieser
Computer Science and Engineering Department

Infrared Arena will allow users to have their own private laser tag matches with their friends. The system will consist of a laser tag gun and Android phone application. The laser tag gun contains an emitter, sensors, bluetooth and phone mount. The Android phone application will be created using Unity and available on the Google Play Store for free. The app will allow users to create and join multiplayer matches which will be hosted on a cloud server. The intended audience for this system is users 12 and up. The hardware will also be available commercially to the public. The total development costs will not exceed $800.

85 – Lasers: Combat Evolved

Jason Autry, Diptin Dahal, Katarina Gomez, Phu Ly, Tausif Zaman
Advisor: Shawn Gieser
Computer Science and Engineering Department

A new approach to the traditional game of laser tag. Lasers: Combat Evolved is a simple-to-use Android application that works with a gun and vest pair to allow the user to play a game of laser tag in a geographical area of their choosing by making use of the phone's GPS tracking ability. The application tracks enemy and allied movements to allow for real-time collaboration and strategy with teammates.

86 – License Plate Recognition Advanced Parking System

Mohammed Edhi, Jonathon Kirkpatrick, Abdul Rafay Mohammed, Thomas Perappadan, Lu Sukidi
Advisor: Shawn Gieser
Computer Science and Engineering Department

We will implement a system that will be able to tell which exact spots are occupied in a parking lot and how busy it is. This information can be used by people who have our app to find the closest parking spot and to purchase and manage their parking permit. This also lets the parking administrators easily verify parking permits and identify people who are parking in a lot where they don't have parking privileges. This will also be one of the first such applications that will harness the power of the blockchain to let users buy parking permits in exchange for crypto-currency.

87 – Advanced Control Actuation Drive System Software

Chase Craig, Jonathan Gilbert, Theodore Mays, Trinh Nguyen, Sophia Salemizadeh, Mohamed Sawan
Advisor: Shawn Gieser
Computer Science and Engineering Department

A control actuation system controls aerodynamic surfaces such as fins and canards to provide attitude and directional/steering control on aerospace vehicles. The Advanced Control Actuation Drive System is intended to be a motor drive amplifier that will be able to provide guidance for an aerial vehicle. The ACADS is designed to drive a brushless DC motor in forward and reverse directions and provide braking in both directions. When an electrical machine is required to work as both a motor and a generator in both forward and reverse directions, it is called four-quadrant operation. The ACADS will operate in all four quadrants. The ACADS will also have a human-to-machine interface using Ethernet TCP/IP stack communication protocol that can provide real-time data visualization and input controls. The system provides motor controls that operate within -40° to +40° in 1° increments while maintaining a high angular slew rate (1° per 100ms). The ACADS can operate over a wide range of input voltages (18V DC - 60V DC) and temperatures range (up to 65°C).

88 – Advanced Control Actuation Drive System Hardware

Kathia Cortes, Calvin Locascio, Duke Ly, Sina Saeidi
Advisor: David Wetz
Electrical Engineering Department

A control actuation system controls aerodynamic surfaces such as fins and canards to provide attitude and directional/steering control on aerospace vehicles. The Advanced Control Actuation Drive System is intended to be a motor drive amplifier that will be able to provide guidance for an aerial vehicle. The ACADS is designed to drive a brushless DC motor in forward and reverse directions and provide braking in both directions. When an electrical machine is required to work as both a motor and a generator in both forward and reverse directions, it is called four-quadrant operation. The ACADS will operate in

all four quadrants. The ACADS will also have a human-to-machine interface using Ethernet TCP/IP stack communication protocol that can provide real-time data visualization and input controls. The system provides motor controls that operate within -40° to +40° in 1° increments while maintaining a high angular slew rate (1° per 100ms). The ACADS can operate over a wide range of input voltages (18V DC - 60V DC) and temperatures range (up to 65°C).

89 – Nursing Empathy in VR

Zachery Gentry, Emmanuel Gonzalez, William Moseley, Brianna Peterson, Daniel Ramirez
Advisor: Shawn Gieser
Computer Science and Engineering Department

The vision is to build a virtual reality center dedicated to the inception, design, and implementation of VR in all disciplines across campus to enhance interdisciplinary education. The focus of this Nursing VR Simulation is to teach empathy and compassion in addition to technical skills in palliative care. There are a lack of affordable VR solutions that teach these aspects of nursing. A completed VR project would allow the sponsors to teach empathy in a life-like atmosphere which is not achievable in any other typical medium. This specific project is beneficial because the student nurse will be debriefed at each stage and allowed to process the experience in the hopes that in real life, they will be fortified to handle this type of crisis. Our hope is that the nursing students participating in this scenario will gain valuable skills in many areas.

90 – Ready-GO!

Jordan Burnes, Rahme Butaineh, Md Sadat Hossain, Michael Santellan, Dongchen Ye
Advisor: Shawn Gieser
Computer Science and Engineering Department

Ready-GO! is a chess playing application utilizing machine learning and computer vision. Trained with a YOLO object detection model and custom hough transform model to detect the edges of each square, the application will detect the pieces and their positions on the board to determine the state of the game. It will then transfer this state to be analyzed by a Stockfish chess engine API to determine the next best move at varying levels of player-chosen difficulty settings. Finally, the state of the game will be displayed via a Unity game engine UI. The goal of Ready-GO is to act as an outreach program to upcoming high school students interested in computer science. We will give insight to some of the usages and techniques of computer vision and machine learning, as well as discuss the future of STEM and how to get into the field. The ultimate vision of the project is to make prospective CSE students excited about joining the program here at UTA.

91 – Software Control of Smart Blink Shutters

Atafo Abure, Dung Nguyen, Deion Nwaefulu, Haris Qureshi, Aditya Rajguru
Advisor: Shawn Gieser
Computer Science and Engineering Department

The Smart Shutter is a system that is able to automatically open and close shutters on a schedule or upon a user's request. The intended users are nursing homes or any other assisted living setting, but eventually we want to expand our project to every home. Users will be able to interact with the shutters from their mobile device using the accompanying mobile app. On the app users can set a schedule for when the shutters can open or close, and users can open or close the shutters. We plan on having the mobile application communicate to either the shutter directly over bluetooth or through wifi using a hub. Our key requirements include the product's overall cost to be around $20, should be able to be controlled over WiFi, and the product should have a set up time of 15 minutes. The Smart Shutter is a system that performs the single task of opening and closing shutters either from user input or from a schedule. In order to accomplish this task, users will have to interact with the shutters through an app available on either iOS or Android.

92 – Mobile App Control of Smart Blink Shutters

Alejandro Escobar, Khoa Huynh, Tamunonengiye Nga, Jose Quintero, Umesh Shrestha
Advisor: Chris McMurrough
Computer Science and Engineering Department

A cross-platform application running on both Android and IOS mobile systems designed to remotely control window shutters. The application communicates through wireless transfer protocols to a hub which sends user inputted signals from the app to the shutter so as to perform specified events.

93 – Electronic Hardware Integration to Smart Blink Shutters

Ken Barriere, Jeffrey Feig, Ivan Montelongo, Kenyatta Theriot, Hunter Walters
Advisor: David Wetz
Electrical Engineering Department

A low-cost, app-controlled plantation shutter for use in senior living centers, hospitals, or homes. The app will control the position of individual shutters or groups of shutters depending on the time of day or personal preference. Individual shutters will communicate using Bluetooth to a hub system connected to WiFi. The shutter system will run for three months on rechargeable batteries and the position of the louvers will be changed and monitored with a stepper motor and rotary encoder.

94 – Whatchamabudget

Anil Karki, Robert Kemp, Emily Knowles, Hedges Omordia, Roshan Shrestha
Advisor: Shawn Gieser
Computer Science and Engineering Department

Whatchamabudget is the banking app that allows users to view their transaction history, track spending, set goals and budget with multiple bank accounts. Its main benefit is to provide users peace of mind, as they don't need to keep track of multiple bank accounts because they can view everything into one place.

95 – Microfluidic System to Fabricate Sodium Alginate/Gelatin Beads

Aishwarya Acharya, Isabella Boullion, Bryce Morehead
Advisor: Yi Hong
Bioengineering Department

We are designing a microfluidic system that will be able to fabricate alginate gelatin beads. The size of the beads should be between 100 microns to 1mm. The size of the beads will be varied by tuning the fluidic parameter.

96 – A 3D Bioprinter for Fabricating Protein Structures with Micron Resolution

Madyson Chance, Nathan Ortega, Rami Barakat
Advisor: Justyn Jaworski
Bioengineering Department

To print pure proteins at the micron scale relevant to cells and tissue and that can more closely mimic natural systems, we are building a system that can produce 3D microscale protein architectures. The 3D Bioprinter design project is a joint project with teams from the Electrical Engineering and Bioengineering departments. The system consists of a 3-axis printing system and an electronic control system. The Electrical Engineering team was responsible for the electronic control portion and the Bioengineering team was responsible for the mechanical stage portion. The bioprinter is capable of printing collagen structures. The speed of the axes is adjustable from 10μm/min to 10mm/min with a resolution of 1μm. Optical sensors detect when the stage moves to a specified limit and stop the motion. The motion of printing is controlled by two analog joysticks, and the speed and position are displayed on an LCD display. We have made progress in the design and production of a bioprinter for the custom fabrication of functional microscale patterns of proteins, particularly collagen, with the goal of improving positioning accuracy over the prior bioprinter design.

97 – Electronic Control of a 3D Bioprinter for Fabrication of Protein Structures with Micron Resolution

Roberto Ibarra Aranda, Didier Valery Fomegang Pelap, Quddus Salako, Fairooz Simlan, Kevin Thompson
Advisor: David Wetz
Electrical Engineering Department

The 3D BioPrinter is a joint project between teams from the Electrical Engineering and Bioengineering departments. The system consists of a 3-axis printing system and an electronic control system. The Electrical Engineering team was responsible for the electronic control portion and the Bioengineering team was responsible for the mechanical stage portion. The BioPrinter is capable of printing collagen structures. The speed of the axes is adjustable from 10μm/min to 10mm/min with a resolution of 1μm. Optical sensors detect when the stage moves to a specified limit and stop the motion. The motion of printing is controlled by two analog joysticks, and the speed and position are displayed on an LCD display.

98 – Bioelectronic Medicine for Hypertension: Non-invasive Blood Pressure Control

Bijan Gaire, Aseem Kandel, Rachana Kandel
Advisor: Young-Tae Kim
Bioengineering Department

Hypertension is one of the major causes of premature death worldwide. An estimated 1.13 billion people today are suffering from hypertension. We are making a non-invasive bioelectronic device to treat patients with hypertension.

99 – Mobile Platform Design for Underground Conduit Prognosis and Inspection

Bao Tran, Quan Tran, Giang Vu, Sixu Zhou
Advisor: Daejong Kim
Mechanical and Aerospace Engineering Department

Malfunctions in the underground conduit system in chemical plants and oil refineries can cause catastrophic failure, substantial financial burden for a company, and even casualties. Therefore, a prognosis and inspection platform is required to detect flaws such as broken cables and leaking gas before they escalate into larger problems. SafeBot is to research and integrate vision sensors, temperature sensors and gas sensors into a robotic platform that navigates itself around the conduit and inspects the circuitry. The analysis and testing of this project will be used for the concept of a mothership – drones system, where a big platform houses multiple drones that spread around the conduit to save time and human resources.

100 – Compact Plane Illumination Plugin for Light Sheet Fluorescence Microscopy

J Mata, Tom Overman, Kunjani Pathak
Advisor: Juhyun Lee
Bioengineering Department

Light sheet fluorescence microscopy is a high-resolution microscopy technique that uses thin planes of light to illuminate a cross-section of a sample to be imaged. These slices can then be stacked to create a 3D image of the sample. Modern light sheet microscopes are prohibitively expensive, so an add-on device for a traditional inverted microscope was desired. Using 3D printed parts and common optical components, we were able to build an inexpensive add-on device that enabled light sheet fluorescence microscopy. The device employed a dual-side approach to illuminate the sample with laser sheets coming from both sides of the device, allowing for an even illumination of the sample. The device was built with flexibility in mind, so the only component that needs to be adjusted for different microscope models is the stage adapter. The design and performance of the device is presented.

101 – The Visualization of Convex Optimization

Ariella Amanuel, Shivangi Vyas
Advisor: David Levine
Computer Science and Engineering Department

Every day, entities such as ERCOT, CAISO, and AESO attempt to optimize power grids in their respective regions by anticipating demand and minimizing the cost. Demand is estimated using a variety of variables such as weather, time of day, and season. Although this problem is computable, it is not solvable within reasonable time and impossible to find the most optimal solution within a 24-hour time period. We have taken a theoretical approach to this problem and worked on developing a way to visualize optimizing two hypothetical generators, P1 and P2. In order to do this, we graphed P1 and P2 against their respective cost functions and created a convex hull. As we have 3D printed our models, we can demonstrated the convex optimization algorithm, Gradient Descent on our modek.

102 – 3D Printing of a Hypertrophic Heart

Barsha Bogati, Tristan Mahler, Mutinta Musozya, Eyerus Tessema
Advisor: Jun Liao
Bioengineering Department

The project aims to reconstruct the human heart in the ScanIp software and print the heart model so that a surgeon can practice prior to a surgery. This project would significantly help surgeons plan surgeries for treatment and also to communicate with the patient. The project would mimic the patient's heart with the help of a CT scan of the patient and would be 3D printed with material that mimics a human heart.

103 – Driving Fatigue Detection Using an Immersive Simulated Environment

James Brady, Andrew Miller
Advisor: Fillia Makedon
Computer Science and Engineering Department

For drivers today, fatigue and anxiety have become more of a problem as distractions have increased while on the road. There are many different types of distractions that can occur while driving, including rain, fog, and icy weather, low visibility, heavy traffic, reckless drivers and boredom. These distractions have caused higher stress levels and increase the likelihood of an accident. To address these issues, it is important to understand how much mental fatigue is induced for these different types of distractions. Towards this end, we are developing a system that can detect a participant's fatigue levels while driving in a virtual environment with varying distractions. Different scenarios will be created in the simulated environment that contain various types of distractions. These scenarios will be ranked in order of difficulty as either easy, medium, or hard. The scenarios will be created using the BeamNG.Drive physics simulation engine and will allow the user to drive a virtual vehicle in a physically accurate simulated environment. This system will use wearable sensors to detect the induced fatigue and a webcam to analyze facial reactions.

104 – Autonomous Lawn Mower

Ulysses Aguilar, Alex Ho, Phu Nguyen, Aderinsola Oladaiye, Jerry Olds
Advisor: Chris McMurrough
Computer Science and Engineering Department

Our team will modify the Mean Green CXR-52 electric mower to mow an area autonomously and also be able to be controlled by an Xbox controller.

105 – CleanUp

Raey Ageze, Kadjo Anoh, Joseph Brewster, Austin Donovan
Advisor: Chris McMurrough
Computer Science and Engineering Department

CleanUp is a new mobile application for Android & iOS devices which will connect volunteers to cleanup events, and facilitate coordination between event organizers, providing a better and more efficient system to increase the satisfaction of everyone involved in cleanup efforts. Both mobile applications will have full login systems as well as systems for creating and joining events. Any user with an account will be able to host a cleanup event at a given location, and any user with an account will be able to search for events in their location to participate in. Each event will be managed by the event organizer or the user who created the event, who will choose where the event is located and what areas need to be cleaned up. The area of an active event will be shown to all users as a map on the event's page. This map will displays pins with circles depicting the area that needs to be cleaned up, and users will be able to update the status of the pins as the event progresses.

106 – Fuelly

Joshua Abuto, Bhuwan K C, David Kaurin, Miracle Omoloja, Deep Patel, Thomas Tran
Advisor: Chris McMurrough
Computer Science and Engineering Department

A mobile app that uses optical character recognition to extract data from images a user takes. The application helps users monitor their car's fuel economy.

107 – Komodo API

Sudip Ghale, Scott Gouldsbrough, Kenny Huynh, Ashish Mainali
Advisor: Chris McMurrough
Computer Science and Engineering Department

The Rust Komodo API is here to supply Rust developers with the opportunity to create applications that use the Komodo Blockchain without having to understand the inner workings of the blockchain itself. With our built-in methods and configuration file, any developer will be able to call the functions they need using the natural input style of Rust and the API will convert it into a usable input of Komodo and return the output to the developer. Using a simple web application, we are able to show the basic functionality of the API in a currency trading app. Without having to know how Komodo's blockchain takes input when accessing the wallet, we can see our balance, send money, and request money from another user within our chain.

108 – Project LTunes

Amir Dhungana, Raul Jimenez, Rabinson Shrestha, Roberto Torres
Advisor: Chris McMurrough
Computer Science and Engineering Department

Encouraging children to get involved with STEM not only opens opportunities for their future, but also sparks their imagination to build the future. We set out to build a laser harp that would encourage children to get involved with STEM. We took safety precautions into account, pointing lasers down to mitigate potential eye damage, and designed the system in such a way that a child could operate it using a touch screen. A laser being cut off from its respective photoresistor causes a note to be played from the speaker, similar to how a harp string would be plucked. Additionally, to inspire children to participate in STEM this system must be transported from school to school. Thus, the system was designed to be lightweight enough to transport, but heavy enough such that it was stable while playing the instrument. From this project, we hope to increase the number of students participating in STEM.

109 – ScrewIt: The Fastener Identifier Tool

Subodh Dhakal, Cristian Garces, Ruben Martinez, Andrew Ridout, Muraj Shresha
Advisor: Chris McMurrough
Computer Science and Engineering Department

Simply identifying screws/fasteners take a lot of effort and requires multiple time-consuming steps. Because of this, it is easy to screw up on several occasions. In order to make this process easier, we are developing a tool that will make identifying screws easier and faster. Essentially, all one has to do is to take a picture of a screw and our tool will be able to identify it, whether it be m2, m3, or even m6. This can be done in one of two ways using computer vision or a neural network. We will be using both to study the efficiency of each technique to determine what is the best method that benefits end-users the most.

110 – Augmented Reality Integration Using Sensorium Sensor System

Randy Bui, Quinn Causey, Hayden Conkling, Michelle Dinh, Kevin Lopez, Kanyon Loyd, James McAllister, Luke Owens, Jimmy Pham
Advisor: Chris McMurrough
Computer Science and Engineering Department

Two CSE teams are working with a piece of hardware called a “Sensorium” board. The board can pick up RF signal data like Wi-Fi, Bluetooth, temperature, and humidity. Each team is working on a different aspect of the board. The Cloud team is using Amazon Web Services as a cloud infrastructure to host the data transmitted from the Sensorium. Also, machine learning will be used to predict scenarios, such as weather, using Sensorium data. The AR team will pull the data from the cloud and use the Microsoft HoloLens to visualize the data in an augmented reality environment in real time.

111 – Integration of a Software Defined Radio into Sensorium

Qussai Abuawad, Joseph Reinmiller, Zachary Holloway, Jakob Scantlin
Advisor: David Wetz
Electrical Engineering Department

Sensorium is a multipurpose general sensing solution. It is a sensor network which can capture ongoing operations and display that information in an intuitive way so that customers can take informed actions. The network accomplishes this by collecting the information that is caused by disturbances in the environment near the sensor. Data can then be processed to produce features that are correlated to specific events. This design is classified as a general-purpose sensing system because it is one device used to interpret many different events. In addition, each sensor would not be limited to only one environment, making the system independent from one particular setting or location.

112 – Sensorium Augmented View

Edward Lara, Amanda Losh, Ricky Skoch, William Wilson
Advisor: David Wetz
Electrical Engineering Department

Sensorium is a multipurpose general sensing solution. It is a sensor network which can capture ongoing operations and display that information in an intuitive way so that customers can take informed actions. The network accomplishes this by collecting the information that is caused by disturbances in the environment near the sensor. Data can then be processed to produce features that are correlated to specific events. This design is classified as a general-purpose sensing system because it is one device used to interpret many different events. In addition, each sensor would not be limited to only one environment, making the system independent from one particular setting or location.

113 – UR5CYCLE

Francis Le, Dai-Anh Ngo, Andrew Tran
Advisor: Chris McMurrough
Computer Science and Engineering Department

UR5CYCLE is an autonomous robotic system that will sort plastics in a recyclables sorting pipeline in recycling plants and facilities. Users of the UR5CYCLE will be able to reduce their total operating costs while simultaneously increasing the amount of sorted recycled plastics in a shorter amount of time. The UR5CYCLE will provide an effective, cost-efficient service that will replace workers that manually sort plastic materials. The UR5CYCLE will be able to operate at a faster rate, at a cheaper cost, and for a much longer duration with minimal maintenance.

114 – Paper Strip for Microbial Detection

Paola Alvarenga, Jazlyn Gallego, Mariam Soliman
Advisor: Kytai Nguyen
Biongineering Department

There has been a growing emphasis on the application of real-time detection devices with high specificity and sensitivity in identifying microorganisms in clinical samples. We are developing a low-cost, one-time use multiplex paper biosensor design that is able to quickly identify the presence of both E. coli and S. aureus, which are two of the more frequent causes of nosocomial infections in developing countries. This is achieved by the use of streptavidin-conjugated quantum dots for a colorimetric indicator that can react with bacteria-specific biotin-conjugated antibodies to form a direct sandwich ELISA complex for a fluorescent indication of bacterial presence.

115 – Custodial Labor Optimization at DFW Airport

Ali Al Masoud, Maise Alawwad, Musharey Binsara, C'Era Sneed
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

DFW Airport is recognized as a leading international airport with outstanding customer service. One component of the customer experience is clean facilities, and DFW Airport Board's goal is to ensure increased levels of customer satisfaction through outstanding custodial services. In our senior design project, we will increase customers' overall satisfaction with regard to cleanliness in all five terminals at the airport. We will closely investigate custodial cleaning operations around gate areas and restrooms for every contractor, including APPRO and DFS.

116 – First Company Production Improvement

Bhargavi Dinivahi, Brice Durbin, Clement Kwizera, Edgar Munoz, William Neri
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

First Company was founded in 1966 and since then, it has built and delivered over 5.5 million units to the multi-family HVAC industry. First Co. production facilities are located in Dallas, Texas where we have steadily grown to a present size of more than 550,000 square feet. The expansive complex boasts both state-of-the-art manufacturing equipment and a stable, experienced, highly skilled workforce, many of which have been with them for over 30 years. The Dallas facility has many different implementations of different automation processes throughout the manufacturing plant. With our Capstone project, we hope to work with First Co. to implement different efficient process improvement strategies to reduce lead times and increase throughput. This report will cover four different data-driven steps to improve our process: the Define, Measure, Analyze, Improve, and Control (DMAIC) process.

117 – Portable Imager for the Detection of Bacteria on Chronic Wounds

Unisha Aryal, Ethan Enneking, Sahar Javed
Advisor: Liping Tang
Bioengineering Department

Chronic wounds affect 6.5 million people in the United States alone. Our team is working to design and build a portable imager for diagnosing chronic wounds or infected wounds. The device will use an optical characteristic of bacteria to detect the presence of bacterial colonization on specimens in vitro in less than 5 minutes. Research within these requirements led us to break the design down into three main components: the black box, the camera and computer. The requirements led us to three alternative principles to achieve bacterial detection. The most practical principle allowed us the cheapest alternative by using an enzyme mixture to create a bioluminescent effect. This principle guided us into the formation of a preliminary design concept for each of the three components. The final system uses a black box that is a hollow ellipsoid shape that allows light to reach the camera efficiently. We use reflective paint for the inside walls. The enzyme mixture contains Luciferin and Luciferase and reacts with ATP within the bacteria to create light. Lastly, we are using a CCD scientific camera to detect the light and using HC Image Live © to process the image.

118 – 3D-Printed, Fixed-Wing Aircraft Competition

Carter Buono, Hayden Hale, Fernando Medina-Lopez, Alyssa Nolen
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

The scope of this project encompasses creating an additively manufactured fixed-wing aircraft for the 4th annual 3D Printed Aircraft Competition at UTA. This will be done by following the design parameters from the customer which include reducing the overall aircraft weight while maximizing flight time. The aircraft is being produced using an iterative design process. The most recent design is constructed using data collected from previous successful test print results. As instructed by the customer, this aircraft will be made using the Hewlett-Packard Jet Fusion 580 Color 3D Printer using the material Polyamide 12 (PA-12). However, the center spar and aft fuselage section will be additively manufactured using a carbon fiber and nylon matrix in the MarkForged 2 Printer. Finally, we will apply our test results from last semester to implement compromises between structures, aerodynamics and the additive manufacturing process to show the symbiotic relationship between advancing design capabilities from the use of additive manufacturing.

119 – Feature-Based Porosity Design of Experiments for Direct Metal Laser Sintering for the United States Air Force

Lloyd-Wayne Bird, James McQuade, Damion Millhouse, Vinh Nguyen, Zachary Poster, Tsu Teng
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

The United States Air Force would like to characterize porosity as a function of geometric features to produce parts through additive manufacturing for their legacy jets. Porosity has a concerning amount of negative impact when it comes to the fatigue life of the part and is often ground zero for crack propagation that will in turn cause critical failure of the part. Due to this physical property and its negative effects, any methods to reduce porosity will increase the expected service life of printed parts. This experiment seeks to create a correlation between the presence of porosity and the corresponding geometry that is being created. To conduct this experiment, the process of creating a test matrix, printing test specimens, performing nondestructive inspections, and analysis of the inspections will be done to test the desired materials and collect porosity results. These results will be used to generate the relationships between four geometric features: slopes, holes, sharp edges, and overhangs, with porosity presence in the part. This data will then be used to create a model that will drive design optimization for parts created with metal additive manufacturing.

120 – Wheelchair Dynamometer

Olateju Ojeyinka, Rolando Robles, Javier Salazar, Jason Sanchez
Advisor: Greg Turner
Electrical Engineering Department

Fitness is a rapidly growing industry in today's society. Many people exercise for a healthier lifestyle but also for athletic performance. Several machines have been invented to exercise in different ways and stay fit, but there are very few machines specifically meant for wheelchair users. The wheelchair dynamometer is designed for wheelchair users to, like an able-bodied individual, exercise when needed, as well as track performance parameters important in their sport. With a resistance setting, the dynamometer can accommodate a wide range of users at different fitness levels that can see workout/performance parameters through interaction with the included display.

121 – Railgun and Capacitor Charging Power Supply

Boris Dostinov, Ummey Haque, Ian Jackson, Yu Cheng Liu, Alexander Mace, Nehemiah Sam
Advisor: Greg Turner
Electrical Engineering Department

This team has designed and will build a small table-top railgun. The railgun system is comprised of four subsystems: the power supply, the capacitor bank, the microcontroller system, and the barrel. After the power supply charges the capacitor bank, the microcontroller activates a sequence of SCRs that allow current to flow through the barrel and armature. The current produces an electromagnetic force which accelerates the armature down the barrel.

122 – Battery Tab Welder

Jose Alvidrez, Alan Hornsby, Juan Rodriguez, Pa Demba Saine
Advisor: David Wetz
Electrical Engineering Department

When soldering connections isn't acceptable, spot welding offers an alternative. For example, battery packs that need to be connected can be damaged by the temperature of a soldering iron. Spot welding delivers enough current to melt the materials at point of connection which solidifies upon cooling. Our goal for this project is to create a battery tab welder that will use capacitor discharge to create a dual pulse current that will clean the welding location and then do a complete weld. Connections capable include welding nickel 201 strips to 18650 and 26650 Li-ion cells and common, homemade thermocouples.

123 – Fiber Optic Transmission of Analog and Digital Control Signals

Ayman Ahmed, Kumar Jyoti, Muhammed Khan, Yousuf Khan
Advisor: David Wetz
Electrical Engineering Department

This is a concept and design of a fiber optic transmission of two digital signals and one analog signal. This design is applied to isolate the ground in high-voltage systems for the protection of low-voltage components in and between systems. The analog signal is converted to a digital signal, then added to the two existing digital signals in a multiplexer for digital modulation. The modulated signal is sent through an LED source and then to a desired length of fiber optic cable with minimum data loss. It is critical for electronic manufacturers to separate high and low voltages in their system while simultaneously keeping the required data flow without loss. This design differs significantly from existing market products and provides a better ground isolation loop. Most importantly it is believed that this product can provide far superior results at a much lower cost totally meeting industry-standard requirements.

124 – Portable Four-Channel Data Logging Oscilloscope

Abdulaziz Altamimi, Hoang Dinh, Beshoy Hanna, Taha Shujaat
Advisor: David Wetz
Electrical Engineering Department

With the size of electrical components becoming smaller and smaller daily, comes the demand for portability in the devices and instruments used. This extends to the oscilloscopes used in the market today, whose primary purposes are for displaying various AC signals simultaneously in real time with one another for analysis. Therefore, the implementation of a portable oscilloscope eliminates the need for multiple, expensive, and often bulky substitutes. The project, initially conceived as a portable logic analyzer, has evolved into a portable long storage oscilloscope which features four separate channels for reading analog signals in real time, displaying the respective voltage vs. time plots on a 7'' touchscreen LCD screen, and storing data on an SD card for up to two hours. The features of this project lend themselves to the educational, military, and electrical demographics.

125 – Hardware In the Loop Simulation of Energy Storage Devices

Rony Mathew Abraham, Andrew Cole, Blaine Shotts, Daniel Whittington
Advisor: David Wetz
Electrical Engineering Department

In this project, hardware in the loop has been used to emulate empirically validated models of thermal, lithium ion, and lithium polymer batteries, respectively. A PC104 is being used to run Matlab-based models of the devices under test and hardware amplifiers are used to emulate the model at voltages and currents, respectively, that are relative to the application in which they may be deployed. The models developed, the PC104 HIL platform being used, and the results obtained to date will be presented.

126 – Three-Wheeled Electric Scooter

Siddhesh More, Andrew Murphy, Edmond Pajaziti, Sunil Aravind Shanmugasundaram, Daniel Tramel, Armaan Zirakchi
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

Galvani Engineering is tasked with improving steering stability issues for a previous senior design three-wheeled electric scooter project. The scooter prototype received at the beginning of this project contains dynamic stability issues causing the rider to be bucked off the scooter when taking a turn. Adjusting the steering fork and independent suspension will yield desirable dynamic characteristics when taking a turn, allowing the rider to remain on the trike safely. Extensive brainstorming has led to the development of several designs that allow the rider to counteract the movement generated by centrifugal forces experienced during a turn. These include translating the front steering fork with an additional degree of rotation, adjusting the rake angle and trail of the scooter to allow it to geometrically lean easier into turns, changing the spring rate of the independent suspensions in each wheel, or a combination of these. These concepts have been tested mathematically, and simulation in SolidWorks has been used to aid in design. Scale model testing has also been implemented by developing a 1/3 scale model and altering geometric characteristics of the trike to see the resulting lean angle, among other factors.

127 – Power Supply for an Electric Motorcycle

Ernesto Davalos, Aaron Demesa, Oghenemine Ejayeriese, Abdul Samee Meghani, Subrat Parajuli
Advisor: David Wetz
Electrical Engineering Department

The project deals with building an electric motorcycle which can carry up to two passengers with a combined weight of 400 pounds. The motorcycle should have a range of at least 100 miles in a single charge and a top speed of 80 mph. The project will incorporate a battery management system for increased reliability of the battery and to ensure the safety of the rider. The project is divided into three teams, one from the Electrical Engineering Department and two from the Mechanical and Aerospace Engineering Department. Our team will address one of the constraints for this project: the battery. The motorcycle must use a Lithium-iron phosphate battery to power the motorcycle.

128 – Electric Motorcycle Concept-Demonstrator Chassis and Powertrain Design

Bryant Campbell, Sterling Greback, Oscar Rivera, Abdallah Shishani, Michael Vazquez
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

In a day where society is becoming increasingly environmentally conscious and the use of electric and hybrid transportation options are becoming more prevalent, the motorcycle industry has failed to bring a product to the market to meet this demand. Our proposed solution will feature commercially available parts and subcomponents to develop a vehicle capable of a range of 100 miles with a maximum speed of 80 miles per hour while carrying a combined passenger weight of 400 pounds. The vehicle will feature lithium phosphate batteries and will be capable of being charged from a standard residential 120-volt power outlet. Our group will focus on the analysis, design and fabrication of the powertrain, chassis, and major subsystems of the vehicle. The final product will serve as a proof-of-concept demonstrating how effective an electric motorcycle is suited for urban commuting with the intention of adapting the design to produce a personal enclosed electric vehicle in the future.

129 – Vulk Stabilization System

Bernardo Huerta, Moises Martinez, Howdy Pike, Cesar Rodriguez
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

Imperium Design is prototyping a self-balancing system for a two-wheel electric vehicle. The advantages to a self-stabilizing two-wheel vehicle bring additional elements of safety and comfort to the passengers. With the proposed design, passengers can mount the vehicle while having the peace of mind that neither user error nor an external force may dismount them during operation. Additionally, this same concept applies when the passenger approaches a red light or stopping point while on the road. The primary purpose of the system is to stabilize the vehicle at speeds below five miles per hour during normal operation under normal circumstances. Imperium Design conducted research to model the mechanisms and configurations which can potentially stabilize the vehicle by means of either linear actuators, motorized pendulum, or spinning reaction masses. The selected balancing configuration from the conducted analysis is that of the motorized pendulum. The major goals for Imperium Design include a proof of concept for the proposed stabilization solution, and thus a working prototype along with drawings for implementation into the to-scale motorcycle.

130 – A 5th-Generation Wearable American Sign Language Translation Device

Karmina Calderon, Prissha Krishna Moorthy, Thao Nguyen, Jennifer Tran
Advisor: Oguz Yetkin
Bioengineering Department

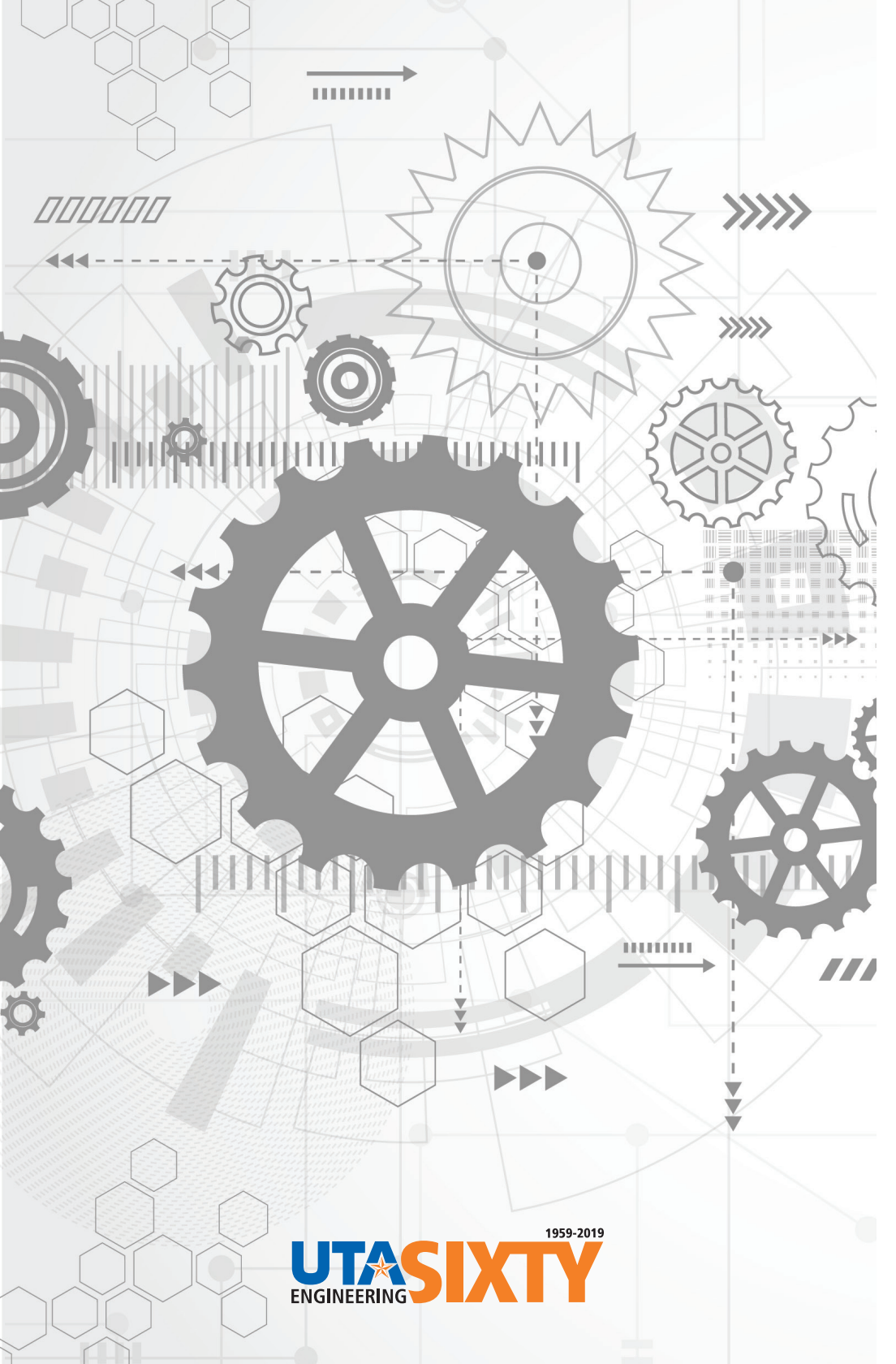
American Sign Language consists of the movements of the hands and face. This language has become the main means of communication for the deaf and the mute. Our team is developing an ASL translation device which will enable ASL users to communicate with people who are not familiar with the language. The current prototype of the device will be capable of translating 24 out of the 26 letters of the alphabet. Our device consists of three parts: the wrist, ring and fingernail units. The wrist-based unit houses the main board which functions to drive the rings and collects the signals. It is wired to the rings whereas the fingernail units are wireless and communicate optically with the rings. Each ring contains three infrared 850 nm infrared (IR) emitter/receiver pairs and

each fingernail contains two. The IR LEDs on the rings are flashed in sequence and the fingernail devices respond to detected IR light with pulse-modulated IR. The system determines hand-pose using a light intensity matrix from the ring-worn IR sensors. The intensity matrix will be used to train the neural network to determine the alphabet being signed.

131 – Multi-Contrast Seed for Breast Tumor Localization

Dema Elansari, Silvia Imam, Ruth Florah Mwangomo, Vy Tran
Advisor: Baohong Yuan
Bioengineering Department

Several methods of breast tumor localization are on the market and are currently used in hospitals, with the gold standard of these methods being preoperative wire localization. Despite wire localization being the most widely used due to its cost and ease of use, it still isn't the most effective procedure for tumor localization as many issues can occur. For example, the implanted wires can migrate, reducing the accuracy of localization. Therefore, the creation of a more effective system to detect tumors could enhance the surgical process of tumor removal. We worked with Dr. Baohong Yuan and his lab to design the seed meant to act as a beacon for tumor localization using fluorescent nanoparticles. The execution of this project was done by analyzing the requirements and quantifying the needed outcomes with the knowledge that the proper dimensions of the seed should be between 2-3mm and the materials used should fit the requirements to implement the seed. The critical requirements for this project are the stability of position in the breast tissue, imageability by both ultrasound and CT, transparency to light, biocompatibility, easy delivery into the body, and cost-effective and straightforward fabrication procedure.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