April 15, 2019

KNOWLEDGE
SOLUTIONS
TRANSFORMATION
DISCOVERY
RESEARCH

Innovation Day

UTA COLLEGE OF ENGINEERING

PROJECT ABSTRACTS AND PARTICIPANTS

Schedule

9-11:30 AM

Bluebonnet Ballroom, University Center

Poster session and senior design project displays

11:30 AM-1 PM

Rosebud Theater, University Center

Lunch (Must have reserved a ticket to attend)

Keynote Address: Alfonso Lopez, Raytheon

Awards ceremony

All Day

Atrium, Nedderman Hall

Dean's Freshman Challenge poster presentations

Keynote Speaker

Alfonso Lopez, Raytheon

Alfonso Lopez is a cyber-security engineer based out of Richardson. He has been with Raytheon for five years. He has supported the accreditation and certification of multiple customer-driven GIS programs to ensure mission success. He has also contributed to multiple IR&D efforts and emerging tech groups, exploring exciting new technologies such as cloud, blockchain, internet of things, and virtual/augmented reality.

Lopez supports university research and design projects within the Dallas area and frequently participates in STEM outreach and recruiting events.

He is a member of the Cityline Site Council, whose purpose is to engage and listen to site employees to provide a better workplace environment. He has also represented Raytheon in external activities such as the Aviation Week Young Professional Engineers and NCCDC.

Lopez holds bachelor's and master's degrees in computer science from UT Dallas and a CISSP and Security+ Certification. He is also a graduate of the Raytheon Certified Cyber Professionals Program.

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Research Experiences for Undergraduates Projects

Undergraduate Project

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Research Experiences for Undergraduates

** – Graduate student*

1 – Hand-Mountable Magnetic Field Detector

Will Capell, Karissa Helmberger, Zachary Holloway Chase Ortega, Colby Ortega, Martin Ortega, Sophie Soueid
Advisor: George Alexandrakis
Bioengineering Department

We are working to generate an optimum design for a hand-mountable magnetic field detector. Bioengineering students have worked in collaboration with electrical engineering students to implement their designs and start testing. There are two separate sensors of interest: Linear Hall Effect and MEMS. We are in the process of understanding the pcl libraries and attempting to convert image data to point cloud data types. We are working on implementing the voxel filter that will do the actual downsizing of the point cloud data. We are also setting up a server to transfer data between the different components.

2 – Migration-Induced, Therapy-Resistant Dormancy of Prostate Cancer Cells

Emily Hills, Victoria Kuhn, Fariha Murshid
Advisor: Young-tae Kim
Bioengineering Department

Prostate cancer is the most common cancer and the second-leading cause of cancer death in American men, specifically when it metastasizes to bone. Many patients will appear cancer-free, only to have a resurgence years later, suggesting that the cancer cells became dormant during that time frame. This study will focus on two prostate cancer cell lines, PC3 and DU145, to determine if migration through a 3D confined space induces therapy resistant dormancy. It is necessary to replicate this environment to understand the epigenetic changes these cells use to develop new treatments which will effectively target these dormant cells.

3 – Identifying, Weighting and Causality Modeling of Social and Economic Barriers to Rapid Infrastructure Recovery from Natural Disasters: A Study of Hurricanes Harvey, Irma and Maria

Dylan Joan Field, Dante Claudius Cathcart, Behzad Rouhanizadeh
Advisor: Sharareh Kermanshachi
Civil Engineering Department

The use of fiber reinforced polymer is a popular technique for repairing or rehabilitating bridges. However, the long-term performance of FRP-strengthened bridges is still not clearly known. In 2006, a semi-truck hit and damaged the girders of an overpass that carries State Highway 183 over Loop 12. The girders were repaired with mortar and strengthened with FRP. The goal of this research is to study the performance of the FRP strengthening scheme of this bridge after 11 years of various environmental and live loads exposure.

4 – Optimizing Powder Bed Fusion Process for Minimum Energy, Weight and Waste

Carmen Green
Advisor: Jafar Razmi
Civil Engineering Department

The objective of the research is to optimize the powder bed fusion (PBF) process for minimum energy, weight, and waste. This process involves parameters such as layer thickness, beam power, type of material and design variables. Mathematical models for energy consumption, waste generation and weight of a part are developed based on input parameters. A two-level optimization technique will be used. In the first level, the 3D model is optimized by minimizing the material waste and surface roughness. In level 2, optimization is done for each slice of the part which is combined with the developed adaptive slicing approach.

5 – City of Arlington Project

Pablo Choquis Rosales, Bria Wooten*
Advisor: Melanie Sattler

We will collect water samples from manholes and measure biochemical oxygen demand (BOD), sulfate, and sulfide.

6 – An Experimental Study of Evaluating the Effect of the Litter Layer on Evaporation

Zhen Li, Nicole Ndegwa
Advisor: Kathleen Smits
Civil Engineering Department

The litter layer plays a significant role in conserving soil water and reducing diurnal amplitude of soil temperature. The characterization of the litter layer in numerical models and its effects on the soil evaporation have been a challenge due to lack of experimental data. In this study, a series of evaporation experiments with different types of litter layers and varying litter layer thickness will be conducted. The effects of the litter layer on evaporation will be analyzed based on measurements of the evaporation rate, soil water content and soil temperature underneath the litter layer of different scenarios.

7 – STEM Communication for Sustainable Development

Nathaniel Steadman
Advisor: Kathleen Smits
Civil Engineering Department

Communicating ideas and research findings in developing communities is critical for the success of science, technology, engineering or math (STEM) projects focused on sustainable development. Traditional methods of STEM communication, such as reports or technical presentations, may dissuade

community members from participating due to different levels of literacy and education. Likewise, community distrust in scientists may prevent effective communication over the course of a study. This project will examine different methods in which STEM communication is conducted in developing countries to develop strategies that engineers can use to effectively communicate STEM

8 – Virtual Reality Tasks for Cognitive Assessment

Andrew Miller
Advisor: Shawn Gieser
Computer Science and Engineering Department

Virtual reality, which most would relate to video games, has been applied in medical and industrial fields. We propose to create a VR environment where the user has to perform a task, or tasks, while the system is monitoring the user's behavior to detect physical and cognitive fatigue. Data will be collected from the sensors used to interact with the virtual environment. This data, as well as the user's performance in the task, will be used to calculate the level of fatigue the user experienced. Survey data will also be collected to verify any results.

9 – Natural Language Processing and Machine Learning Algorithms for Countering Online Misinformation

Jacob Devasier
Advisor: Chengkai Li
Computer Science and Engineering Department

This project aims to build novel computing tools for countering misinformation, with a specific focus on understanding and analyzing online factual claims. Students will develop natural language processing and machine learning algorithms and conduct experiments to understand the algorithms' effectiveness and limitations. The students will work with the PI, graduate students, and their collaborators on the project. The expected outcomes of the project include prototype tools, publications, and proposals to external funding agencies.

10 – Deep Reinforcement Learning for Robot Grasping

*James Brady, Joe Cloud, Michail Theofanidis**
Advisor: Fillia Makedon
Computer Science and Engineering Department

Our work describes a two-phase system for motor skill learning. As an input, the system receives data from a demonstration of the desired motor skill. In the first phase, a series of actions are performed based on a pair of pre-trained forward and inverse models. In the second phase, the system learns an initial state-action policy by using the Dynamic Movement Primitive framework. This system is tested on the Rethink Robotics Sawyer manipulator.

11 – A Low-Noise Glucose Monitoring System based on a Painless Non-Enzymatic Micro-needle Sensor

Duy Nguyen
Advisor: Sungyong Jung
Electrical Engineering Department

The most common method of blood glucose monitoring is through sampling of blood at the patient's fingertip using a tiny lancet. However, frequent blood sampling leads to trypanophobia for many diabetic patients. Hence, the purpose of this research is to develop a microneedle glucose sensor as a non-invasive blood testing device for diabetic people. To provide low-noise output readings from the sensor, an analog correlator, or low-pass filter, along with an I-V converter have been studied and developed together to form an analog-correlator based glucose monitoring system for micro-needle sensor.

12 – Machine Learning for Human Activity Classification

Alexia Acosta, Patrick Cannell
Advisor: Ioannis Schizas
Electrical Engineering Department

The use of biosignal processing via personal area networks has garnered increased attention in the fields of healthcare and sports medicine. This REU is an example of how machine learning can be implemented to classify physical human activity. A wearable device will collect accelerometry and heart rate data that wirelessly transmits to an Android device for processing. The primary algorithm under investigation is Principal Components Analysis. We will explore the applications of machine learning to classify a wide range of human activity, ranging from athletic performance to epileptic seizures.

13 – Wireless Soil Moisture Sensing

Tyche Doe, Rachael Watson
Advisor: Saibun Tjuatja
Electrical Engineering Department

Soils are the foundation of terrestrial ecosystems which provide services that are essential for humanity. Our knowledge of subsurface dynamic changes in soils is limited due to the lack of observation capabilities for measurement of key soil variables over large areas and long periods of time. This project seeks to establish the feasibility of a novel, subsurface soil variables sensing system that can be scaled to provide large measurement area and cost-effective long term measurements. The proposed system consists of in-situ backscatter soil sensors, a polarimetric radar/remote sensor interrogator, and a soil parameters estimation algorithm. The backscatter soil sensor is modeled using HFSS. The sensor is modeled with an excitation between two rods which had a set diameter of 3mm. The probe was modeled as inserted into sandy loam soil. The length of both rods were equal and varied together in increments of 0.175m The spacing between the rods was also varied in increments of 1.75cm. Each probe variation was modeled with four different moisture levels of medium to begin

determining a pattern between soil moisture level and S11 backscattering. The sensor is also modeled having the two rods shorted together, with all other variables the same. These 200 preliminary simulations are to determine closer approximation of optimum sensing polarization, frequency range, backscatter soil sensor design and configuration, data processing and soil parameter retrieval algorithms.

14 – Interfacing the Pixycam with the MSP432

Kyle Breidenthal, Zachary Holloway, Tanya Stratton
Advisor: Greg Turner
Electrical Engineering Department

The purpose of this project is to produce a quality, well-documented MSP driver for the Pixy2 camera that anyone can use in their microcontroller projects. Since there are no existing drivers that support MSP microcontrollers, this will greatly expand the applications of the Pixy2 camera.

15 – Inertial Electrostatic Confinement Fusor

Benjamin Barnett, Taylor Shead
Advisor: David Wetz
Electrical Engineering Department

There are many different types of plasma confinement schemes studied at national labs and international universities. The most popular means of plasma confinement is magnetic confinement. Devices like stellerators, tokamaks, z-pinch plasma studies and many novel hybrid approaches like Lockheed Martin Skunkworks' CFR project are being researched today. The "Farnsworth Fusor" project is an Inertial Electrostatic plasma Confinement (IEC) device that functions by utilizing the charge on the ions within the device to accelerate the ions to plasma formation temperatures and contain them at a central location. Large and expensive magnets are not required to build a Farnsworth fusor. Although the Farnsworth Fusor was created in the mid-1960s, there is still much to be gained by exploration into this field of research. Metrics for how changes in the inner grid geometry effects the efficiency of the fusor will be collected by tracking power input, gas pressures, and plasma temperatures for each test.

16 – Regional Food Transportation for Texas Farmers

Andrew Schoen
Advisors: Jaime Cantu and Caroline Krejci
Industrial, Manufacturing and Systems Engineering Department

The objective of this research project is to compile, and transcribe the completed interviews for a current grant: "Regional Food Logistics for North Texas Urban Communities." Dr. Krejci and I have informally interviewed several people on the supply/demand, logistics infrastructure for regionally-produced specialty crops in Texas. These initial surveys were able to help identify the problems small (50 acres & under) organic producers struggle with. Our next step is follow-up with a subset of respondents via semi-structured interviews. Within

Texas the demand for local sustainable produce/livestock is growing, yet at the same time small producers find themselves going out of business due to the lack of markets. If successful, this research will allow us to help small organic producers in Texas to become financially sustainable through logistic solutions. This will have positive impacts on both rural economies and urban access to fresh healthy food.

17 – Analyzing Collaborative Logistics in Food Assistance Networks: An Agent-Based Approach

George Gerges
Advisor: Caroline Krejci
Industrial, Manufacturing and Systems Engineering Department

To address the persistent problem of hunger in the U.S., food assistance networks distribute donated food to food-insecure households via a supply network of donors, food banks, and food pantries. Much demand goes unfilled, not because of insufficient supply, but rather because of inefficiencies in inventory management. In particular, supply is unpredictable and often leads to imbalances in the quantities and varieties of food available at each pantry. A potential solution to this problem is to connect the food pantries and enable them to balance supply and demand between themselves via transshipments. The objective of this research project is to develop an empirically-validated agent-based model of a food assistance network to study the potential impact of collaborative logistics on food insecure households in Tarrant County.

18 – Pressure Ulcer Prevention Using Soft Non-Grasp Manipulation

Joshua Ferrigno, Regan Kubicek
Advisor: Alan Bowling
Mechanical and Aerospace Engineering Department

"Hard and soft" body manipulation have long been studies applied within the field of biomedical engineering. Further research within this field has the capability of revealing many hidden secrets of how the human body changes when in contact with various surfaces. The object in this study is the human body, and the goal is to manipulate the size and duration of contact forces acting on the skin to prevent the formation of pressure ulcers. In doing so, the primary product of this experiment is to create a "Forcebed" capable of shaping itself to the human form in order to collect a time history of pressure distribution across the subject's body. Through data collection of contact forces on the patient's skin, the Forcebed can autonomously offload high concentrations of normal and shear forces by means of redistribution. This method of redistributing forces prevents any form of direct grasping on the patient's body. We refer to this method of object control as soft, non-grasp manipulation. This is accomplished through a soft, flexible human-robot interface in tandem with a parallel closed chain rigid mechanism. The device presented in this work is a novel approach to the detection and prevention of pressure ulcers.

19 – Influence of Angular Orientations on the Mechanical Properties of Polymer Samples Manufactured by Stereolithography

Sunil Aravind Shanmugasundaram
Advisor: Jafar Razmi
Mechanical and Aerospace Engineering Department

The objective of this project is to investigate the dependency of build direction, angular orientations, and scanning directions in polymer specimens, designed according to ASTM D638 standard, and manufactured by stereolithography (SLA) on mechanical properties. The degree of mechanical anisotropy is evaluated through tensile testing of specimens built in different orientations. The mechanical properties that are evaluated include Young's modulus, yield strength, ultimate tensile strength, and ductility. These properties are compared with standard data to compare how SLA performs against both traditional manufacturing methods such as casting, as well as against other additive manufacturing methods such as electron beam melting or selective laser sintering.

20 – Investigation of Thermal Management of Li-ion Batteries Using Phase Change

Ali Mhowwala
Advisor: Ankur Jain
Mechanical and Aerospace Engineering Department

This project involves investigating thermal conductivity of thin wires using temperature distribution. Two wires of different materials were coated with graphite and connected to a heat source at one end. Thermal conductivity of one wire is known and the objective is to find thermal conductivity of another. Temperature distribution data is collected using 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.

21 – Imaging and Measurement of Transient Evolution of the Cross Section of an Extruded Polymer Filament in Additive Manufacturing

Christian Lowery
Advisor: Ankur Jain
Mechanical and Aerospace Engineering Department

3D printing is known for its ability to create complex parts. However, due to bonding imperfections, the parts tend to possess inferior mechanical and thermal properties when compared to similar parts manufactured through other methods. Thus, the bonding of 3D-printed parts will be studied over the school year by collecting and analyzing data about the change in height and width of an individual filament while varying printing parameters such as bed temperature. This will be accomplished using a laser scanner. Experimental results will help form recommendations for printing parameters to optimize the physical properties of printed parts.

22 – Development of Cu-VACNT Composites for Nanoelectronic Applications

Garrison Frost, Bijan Niakan
Advisor: Leila Ladani
Mechanical and Aerospace Engineering Department

Copper is the most common material for interconnects in microelectronics. However, it is losing its advantage for nanoscale applications due to electromigration and high resistance. New 2D materials such as graphene, CNTs, and TMD materials are being developed for the next generation of interconnects. Fabrication of these materials often requires high temperatures that exceed the limitations of copper in microelectronic processing. When these 2D materials are used in conjunction with copper, it is desirable to delay copper deposition to the later stages of fabrication to avoid exposing copper to high temperatures. It is proposed that a seed layer be deposited before deposition/growth of CNTs/graphene or other TMD materials, so that later deposition of copper via electroplating is feasible. This seed layer must be able to withstand high temperatures, must not migrate or diffuse into silicon or barrier layers, and must also be a suitable seed layer for copper electroplating. This research focuses on the development of a seed layer and method of electrodeposition for construction of this composite. SEM and EDX are then performed on the samples to verify satisfactory copper coating. The effect of the deposited copper layer's interactions with the CNTs at high temperatures is also analyzed by utilizing simulations. By using COMSOL, wettability contact angles between a melted copper sheet and the interspatial walls of CNTs are observed at various temperatures.

23 – Green Engine Model Car – Nitinol Metal Engine Driven by Hot Water

Mason Cockrum, Matthew Depalma, Roger Haro, Raymond Harris, Michael Ibanez, Erika Jones, Richard Martinez, Kiriti Mamidi, Taiwo-Bayonie Olayiwola, Nischal Pokharel, Bharath Bhushan Ravichander, Haris Sajid
Advisor: Narges Shayesteh
Mechanical and Aerospace Engineering Department

The primary goal of this proposal is to design and optimize a Nitinol heat engine that will use the unique shape memory property of Nitinol alloy to generate mechanical motion from heat, which can then be used to drive a small toy car. The group will utilize UTA's FABLAB for conducting this proposed research. Innovation and utilization of functional Nitinol heat engines will open innovation frontiers in disciplines such as automotive actuators and other mechanical devices (steam turbines, etc). Nitinol alloys, as well as other shape memory alloys, can also serve a large role in sustaining a clean environment.

24 – Topology Optimization of 3D Printed Arm Casts for Additive Manufacturing

Colin Bednarz, Mason Cockrum, Tobias Dornai, Behzad Farhang, Rupak Luitel, Apurva Pitale, Ayush Thapa
Advisor: Narges Shayesteh
Mechanical and Aerospace Engineering Department

Custom 3D printed casts provide a better fit for users, as they are more comfortable and facilitate more effective treatment. Restoring normal appearance and function after bone fracture still remains an important unresolved problem. This research activity aims to develop patient-specific lightweight arm casts through innovative 3D scanning, design, optimization, analysis and manufacturing technologies. These topology optimized custom-fitted arm casts are expected to improve the recovery time, give more stability to the fracture, and maximize comfort. The group has full access to a range of facilities at UT Arlington FABLAB for conducting the proposed research.

25 – Wheelchair Attachable Assistive Robotic Arm

Lorenzo Alba, Collin Chapin, Amelia Jackson, Regan Kubicek, Michaela Stallings, Jeremy Trollinger
Advisor: Panayiotis Shiakolas
Mechanical and Aerospace Engineering Department

The ARMS (Assistive Robotic Machines) team has been tasked with creating an assistive robotic arm to append to an electric wheelchair. The arm should be capable of reaching a distance of 2 feet and returning a water bottle to the operator. The cost goal for our prototype is $1,500. Current robotic arms on the commercial market with this capability cost around $35,000 and are not covered by insurance. Through the completion of our project, ARMS hopes to return mobility to those who could not previously afford it.

Undergraduate

26 – Calibration of Cantilever Beam Load Cell for Measuring Pressure and Shear in Prosthetic Socket Applications

Elida Sorto-Ramos
Advisor: Haiying Huang
Mechanical and Aerospace Engineering Department

Advancing medical technology has enabled the complete and timely rehabilitation of a patient and return to normal ambulation after amputation by use of prosthesis. The correct fit of the prosthesis is essential for comfort and increased quality of life. To better understand the forces at play at the delicate interface of the limb and the prosthetic socket, sensors must be developed. A cantilever beam load cell (CBLC) was developed to measure interfacial forces. With a pressure or shear force applied the CBLC would deflect. This deflection was captured through strain gages that measure the change in resistance of

a material due to elongation. The strain gages transmitted their signal to an Arduino microcontroller for data acquisition. The measured strains were used to inversely determine the pressure and shear that produced it. The measurement system was verified with theoretical calculations and computational analysis. Laboratory tests verified that the cantilever beam load cell predicted the pressure induced on it within 1% of the actual value. The results produced a cantilever beam load cell that can calibrate a patch antenna sensor for noninvasive measurement of interfacial stresses at the prosthetic socket-residual limb interface and a variety of biomedical applications.

Graduate

27 – A Novel Theragnostic Approach to Repair and Restore Disrupted Brain Endothelium

Edidiong Inyang, Aneetta Kuriakose
Advisor: Michael Cho
Bioengineering Department

Traumatic brain injury is a serious concern among military personnel. Although the mechanisms responsible for the disruption of the brain endothelium (BE) are not well understood, the development of reliable diagnosis along with effective treatment is urgently warranted. One mechanism is microcavitation (MC) following exposure to a blast. We previously demonstrated that MC caused cell death/disruption of tight junctions. Also, the injured BE expresses a high level of E-Selectins (CD62e). The upregulation of this protein can be exploited for theragnosis. We hypothesized that BE disrupted by an explosive blast could be targeted and treated for restoration. To test this hypothesis, we engineered nanoparticles (NPs) that are decorated with antibodies to specifically bind to the injured endothelial cells (EC) and loaded with therapeutic reagents to enhance cell proliferation. Poly (lactic-co-glycolic acid; PLGA) NPs, which have stable and tunable properties, were successfully fabricated and characterized using dynamic light scattering and SEM/TEM imaging. The PLGA NPs were loaded with potential therapeutic reagents, conjugated and functionalized with ligands (CD162) to target CD62e on the injured ECs. The cells showed high affinity to conjugated NPs compared to unconjugated. The conjugated NPs internalizations were quantified by measuring the accumulation of intracellular NPs. Preliminary data show internalization of a surfactant poloxamer P188 induces proliferation of BE. Quantitative analyses are being performed to establish a statistical significance of the BE restoration in response to the P188 treatment. This study provides a platform for the validation of potential theranostic approaches for the treatment of TBI.

28 – Examination of Nuclear Morphology in Mesenchymal Stem Cells During Adipogenic Differentiation Using a Combined Experimental and Computational Modeling Approach

Andrew McCulloch
Advisor: Michael Cho
Bioengineering Department

While much research has been done regarding cytoskeletal remodeling, relatively little has been done on identifying the structural changes of the nuclei. As stem cells progress toward distinct lineages, specific gene activation must occur to generate unique cell types. Studies have shown the positioning of chromosomes determines genetic activation, and that the major structural component of the nuclear envelope, lamin a/c, influences nuclear shape. This work attempts to quantify the nuclear remodeling of human mesenchymal stem cells during biochemically-induced adipogenic differentiation. Nuclear deformation and lipid deposition were quantified by fluorescence microscopy. Results show the size of nuclei decreased over time as the lipid expression is up-regulated. Stem cell nuclei exhibited an exponential decay over time. Increases in the lipid expression appear to lag the nuclear reorganization, suggesting the nuclear deformation is a prerequisite to adipocyte maturation. Furthermore, lamin a/c expression was increased and redistributed to the nuclear periphery, along with a subsequent increase in nuclear aspect ratio. To further assess the nuclear shape influence on differentiation, a nuclear morphology with high aspect ratio was achieved using a microcontact-printed substrate to regulate the cell and nuclear morphology. This nuclei shape failed to differentiate stem cells more efficiently, suggesting the cellular process of nuclear reorganization cannot be overcome mechanically. Finally, a bio-mechanical model was generated to track the nuclear shape change during differentiation and attempt to predict the forces acting upon the nucleus to direct this change.

29 – Potential Applications for Non-Invasive Electric Field Stimulation in Diabetic Therapies

Caleb Liebman, Thao-Mi Vu
Advisor: Michael Cho
Bioengineering Department

For those affected by Type I diabetes, blood glucose monitoring and insulin analog injections are an everyday part of life. A more permanent solution would require replacement of the insulin producing beta cells destroyed by the disease. Experimental procedures such as islet transplantation and various stem cell therapies could provide such cells; however, the impairment of these cells' functionality hinder their efficacy. Previous research has demonstrated that exogenous electric fields can affect various areas of cell physiology including proliferation, differentiation, and migration. Therefore, we aimed to determine the physiological response of beta cells to non-invasive electric field stimulation (EFS) in order to elucidate its capacity for improving beta cell functionality. Our results demonstrate the capacity for EFS to elevate intracellular calcium via L-type voltage gated calcium channels (VGCCs). In addition, further experimentation

indicated an elevation of the transcription factor PDX1 which is linked to beta cell functionality, proliferation, and cell survival. Given this, EFS could have potential for improving the functionality of insulin producing cells and overcoming challenges facing both diabetic islet transplantation and stem cell therapy.

30 – Assessing Viability of Carsharing for Low-Income Communities

Farah Naz
Advisor: Kate Hyun
Civil Engineering Department

In this study, social workers and transportation engineers collaborated to understand the needs, accessibility, affordability, and willingness to use car-sharing. A mixed methodology was used, including spatial analysis, mathematical modeling and qualitative focus groups. For quantitative analysis, the 2017 National Household Travel Survey (NHTS) data was used to investigate the effects of individuals' socioeconomic characteristics, travel behavior and technology access on car-sharing usage. Zero-inflated binomial regression method was used to investigate the relationships between sociodemographic, travel behavior and financial related variables and car-sharing usages. The results indicate that individuals who experience financial burden tend to use carsharing service as their mobility option along with rideshare services. Focus groups were conducted with service providers providing assistance in low-income communities to assess their awareness of and sense of clients' willingness to use car-sharing. The results showed that the participants were relatively unfamiliar with car-sharing in comparison to its shared-mobility counterpart, ride-sharing. The participants also identified that affordability and technological barriers beside a lack of familiarity and consequence misconception as the potential causes of the lack of awareness or willingness to use car-sharing services.

31 – Modeling Relationships Among Barriers to Timely Post-Disaster Recovery

Behzad Rouhanizadeh
Advisor: Sharareh Kermanshachi
Civil Engineering Department

As the occurrence and magnitude of natural disasters have significantly increased, a single country may need to utilize limited financial, machinery, and human resources to perform recovery activities in multiple urban and rural areas simultaneously. As the recovery of urban areas receives more attention and priority in the reconstruction processes, most rural areas stay unrecovered for a longer durations. Therefore, it is important to identify the sources of delay in the recovery process of rural communities as late post-disaster restoration causes further challenges for the affected communities. An example to this reinforcing challenge is the postponement of non-governmental developments, migration of the affected communities, bankruptcy of small businesses in these areas, abandoned housings, increased poverty and theft, and further economic crisis which will impact the growth of the rural areas for years, if not decades. One challenge to achieving timely recovery is that the recovery environment is a dynamic atmosphere, which hardly follows a certain defined path, and the

process is not systematically uniform across all sectors of society. Therefore, as late post-disaster recovery imposes substantial direct and indirect costs to the communities, societies, and nations, it is necessary to identify and model timely post-disaster recovery barriers and determine the national, state, and local level overcoming strategies. As a result, this study aims to develop a conceptual causality model, which determines the interdependency relationship of rapid recovery barrier factors and investigates the impact of these factors on regional communities of the affected areas. This causality model helps policymakers to timely assess the short-term recovery barrier factors in rural areas and address the preventive factors based on their associated impacts.

32 – Natural Frequency of Earthen Dams at Different Induced Strain Levels

Md Ashrafuzzaman Khan
Advisor: Anand Puppala
Civil Engineering Department

A method is proposed to estimate the degradation of the first natural frequency of vibration of earthen dams with increase in strain levels induced due to seismic events. A synthesised wave, referred to as the 'sum of sines', generated by the superposition of sinusoidal waves with frequencies ranging from 0.01 Hz to 25 Hz, is scaled to different peak accelerations and used to simulate seismic excitations at the base of the dam. The natural frequency is then determined by studying the response of the structure in the frequency domain. For this study, four dams with varying complexities of geometry, constituent material properties, and known natural frequencies were at first selected from previously published literature to establish the validity of the proposed method for determining natural frequencies of the dams at small strain levels. Plane strain models of these structures were constructed and analysed, using a commercially available finite element method-based software that is capable of performing time-history analyses. Results from the analyses indicate a good agreement between the natural frequencies predicted using the proposed method and the frequency values reported in the literature for the corresponding structures at small strain levels. The method was later used to determine the strain-dependent natural frequency of a hydraulic-fill dam in North Texas. Twenty-one different earthquake conditions, with different peak ground accelerations, frequency contents, and mean periods, were used to thoroughly validate the applicability of the developed methodology. Numerical analyses indicate that the strain-dependent variation of the first natural frequency follows a similar trend as that obtained using the 'sum of sines' excitation when the dam is subjected to widely different earthquake conditions.

33 – Prioritization of Manholes in the City of Arlington for Corrosion Protection

Mithila Chakraborty, Sunakshi Hada, Aiswarya Acharat Mohanak, Ketan Shah
Advisor: Melanie Sattler
Civil Engineering Department

The overall goal of this project is to lengthen the lifespan of manholes and pipes in City of Arlington sewers by reducing chemical deterioration due to hydrogen sulfide, saving the city money over the long-term. One of the major causes of

corrosion in sewers is the build-up of hydrogen sulfide (H2S) gas. Hydrogen sulfide is formed in the liquid phase under low-oxygen conditions and then volatilizes to the gas phase under turbulent conditions. The gas-phase H2S then adsorbs onto concrete surfaces, where aerobic bacteria oxidize it to sulfuric acid. Manholes in Arlington are made from concrete, and thus are particularly vulnerable to corrosion. Factors affecting sulfide generation, volatilization, and corrosion of concrete manholes and pipes include: Wastewater characteristics, such as dissolved oxygen, the presence of sulfur compounds, biochemical oxygen demand, temperature and pH, and sewer system characteristics, such as slope and velocity, turbulence, whether the pipe is flowing full, accumulated grit and debris, sewer pipe materials and concrete alkalinity.

34 – Analysis and Categorization of Drive-by Download Malwares Using Sandboxing and YARA Ruleset

Mohit Singhal
Advisor: David Levine
Computer Science and Engineering Department

With the increase in usage of websites as the main source of information gathering, malicious activity, especially drive-by download, has exponentially increased. A drive-by download refers to unintentional download of malicious code to a user computer that leaves the user open to a cyberattack. It has become the preferred distribution vector for many malware families. The purpose of this research is to analyze malware that was obtained from visiting approximately 90,000 malicious URLs, then running these binaries in sandboxes and analyzing their runtime behavior with a software tool (YARA) to categorize them and classify what malware family they belong to. Out of the first 200 program executables (binaries) that were captured, 25 were false-positive, 168 were Trojan and 56 families were discovered.

35 – Implementation and Analysis of Caching mechanism on Cloud Cluster for LHC ATLAS Experiment

Priyam Banerjee
Advisor: David Levine
Computer Science and Engineering Department

This research focuses on how feasible the adoption of Xcache into ARDC cluster would be, finding the network dependencies, performance parameters of the cache (hit rate for reusability, rollover or cache rotation using high and low watermark, bytes input and bytes output for monitoring the network). This is to find an alternative for limited storage space and, at the same time, using a sub-system (Xcache) to reduce bandwidth and access latency (reduced network traffic).

36 – Develop Neural Network Model to Predict the Classification of Claims

Xiao Shi
Advisor: Chengkai Li
Computer Science and Engineering Department

Train a neural network model to classify given sentences into one of the three classes: NFS, UFS, CFS. It belongs to the area of natural language processing.

NFS: Non-Factual Sentence (Subjective sentences (opinions, beliefs, declarations), questions, do not contain any factual claim

UFS: Unimportant Factual Sentence (Factual claims but not check-worthy, the general public will not be interested in knowing whether these sentences are true or false.)

CFS: Check-worthy Factual Sentence (Factual claims, he general public will be interested in knowing whether the claims are true.

37 – A Triboelectric MEMS Vibrational Nano-energy Harvesters for Nano-sensor Applications

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

The power requirements for portable and wireless sensors are continuously decreasing due to the increasing importance of the Internet of Things (IoT) and technological advancements, which continuously push for more power-efficient devices. As a result, powering these devices through green energy from environmental vibrations using nano-scale energy harvesters is becoming much more viable. This work presents a novel design, optimization and fabrication technique of a triboelectric nano-energy harvester to harvest energy from high frequency ambient vibration sources. The integrated design, modeling and dynamic optimization of the triboelectric energy harvester enables it to be fabricated and packaged as a Micro Electro Mechanical System (MEMS) in a traditional cleanroom environment. Simulation shows that at 800 Hz vibration frequency with an acceleration magnitude of 9.8 ms-2, which is the primary vibration frequency coming out of an aircraft skin, the triboelectric nano-energy harvester can generate an average power of 196.91 nW with surface and volume power densities of 13.1 mWm-2 and 1544.4 Wm-3, respectively. The dynamic optimization on the geometric structure of the device reduced the device dimensions and mass while increasing the output power and power density dramatically. Due to this small size, low mass and comparatively high power density output from the triboelectric nano-energy harvester, it can have a significant impact in expanding the applications of the nano-sensors in wireless sensor nodes, in automobile industry, in space exploration programs, in micro-robotics and in prosthetics.

38 – Uncertainty-Exploited Game Theory for Adaptive Optimal Control with Real-Time Reinforcement Learning

Mushuang Liu
Advisor: Yan Wan
Electrical Engineering Department

Control-theoretic differential games have been used to solve optimal control problems in multi-agent systems. Most existing studies on differential games either assume deterministic dynamics or dynamics corrupted with additive noise. In realistic environments, high-dimensional environmental uncertainties often modulate system dynamics in a more complicated fashion. In this paper, we study stochastic multi-player differential games for systems of general uncertain linear dynamics. We first formulate two stochastic differential games including the two-player zero- sum and multi-player nonzero-sum games. We then show that the optimal control policies, which constitute Nash equilibrium solutions, can be derived from the corresponding Hamiltonian functions. The stability is proved using the Lyapunov type of analysis. To solve the stochastic differential games online, we integrate reinforcement learning (RL) and an effective uncertainty sampling method: multivariate probabilistic collocation method. Two learning algorithms, including the on-policy integral RL (IRL) and off-policy IRL, are designed for the stochastic games. We show that the proposed learning algorithms can correctly find the Nash equilibrium solutions for the stochastic games with reduced computational costs.

39 – Design and Evaluation of a Hybrid Energy Storage Module

Joshua Ruddy
Advisor: David Wetz
Electrical Engineering Department

As ships become more electrically propelled, electrical load profiles will exhibit characteristics that have not been traditionally encountered. Conventional power generation devices are unable to meet the unique demands of these load profiles and so must be bolstered with energy storage devices to alleviate transient loading. Active hybrid energy storage modules offer both high-energy and high-power density when compared to traditional energy storage devices. Fuzzy logic control offers a method of controlling such a system to meet the strict power requirements on a shipboard system while requiring little knowledge of the system components. This paper evaluates a fuzzy logic controller's ability to maintain an energy storage module voltage while accommodating a bi-directional transient load that is representative of one that could be seen aboard a future ship.

40 – Design of a 1000 V Lithium-Ion Battery

David Dodson
Advisor: David Wetz
Electrical Engineering Department

Lithium ion batteries are becoming more widely used, even in high-voltage applications demanding very high transient power. To meet the power and energy requirements of these unique applications, large quantities of cells must be connected in a series/parallel manner. Given the unique operational profiles, advanced protection schemes are required to monitor the large number of cells and notify the overarching control system of eminent problems. Batteries as high as 1000 VDC are being considered and studied. Evaluation of batteries at this voltage level has not been widely performed. In the work discussed here, a 1000 VDC battery, utilizing the lithium-iron phosphate (LFP) chemistry, has been developed and studied while powering loads as high as 300 kW. Two novel sensor systems have been implemented, including a Luna Innovations LLC thermal fiber optic sensing (FOS) system and a Nexceris LLC electrolyte leak detection system, respectively.

41 – Dielectric Breakdown of Carbonate Electrolytes

Charles Nybeck
Advisor: David Wetz
Electrical Engineering Department

There is an increased interest in utilizing electrochemical energy storage, in the form of lithium-ion batteries, as both backup and prime power supplies within intelligently controlled electrical power systems. DC bus potentials as high as 1 kV have been proposed. This voltage amplitude is significant and must be designed with caution. The amount of energy stored in a shipboard battery could exceed a few GJ in some instances making it critical that any potential electrical breakdown weaknesses be identified and studied in detail. Though it is likely easy to engineer the battery such that dielectric clearances well exceed any 1 kV potential in a normal operating conditions, it is unclear how failure of a cell, and the leakage of electrolyte gas from a sealed cell(s), may affect the surrounding environment and the dielectric strength between high voltage electrodes separated by air. Reduction in the dielectric strength could result in a cascading effect whereby more cells are allowed to fail. The dielectric strength of vented electrolyte gas has not been previously documented and it is the aim of this work to fill this knowledge gap.

42 – Evaluation of High-Voltage Pulsed Capacitors

Christopher Martinez
Advisor: David Wetz
Electrical Engineering Department

In the work presented here, a well-controlled study has been performed to characterize the performance of a high-voltage, pulsed-power capacitor when it is recharged to 100 kV in 100 μs. A CLC testbed has been assembled to supply the high rate pulsed recharge current to the capacitor being studied.

Experiments are being performed in a controlled temperature environment ranging from 20oC to 60oC. The capacitors are of interest for use in compact, repetitive rate, Marx generator sources used to supply pulsed power to a few different loads. The testbed will be discussed along with the performance results collected to date.

43 – Model Validation of Multi-Pulse AC/DC Rectifiers

Brian McRee
Advisor: David Wetz
Electrical Engineering Department

It is conceivable that the future electrical ships will deploy multiple high-power AC and DC loads that must be reliably energized. Integration and operation of AC and DC loads will likely be achieved using an intelligently controlled microgrid architecture that is able to actively regulate and distribute power from both AC generation sources and DC energy storage devices. Some future loads may utilize intermediate energy storage that is highly capacitive, 10s of mF, and they may operate in a highly transient manner that is very stressful on the shipboard power system. Silicon controlled rectifier (SCR) based, multi-pulse rectifiers that are intelligently controlled may be an attractive option for regulating AC power to charge capacitive DC loads in a repetitive manner. Though SCR multi-pulse rectifiers are well documented in the literature, there has been no published work found that studies their power quality when they are used to power repetitively operated capacitive loads. The work discussed here is aimed at developing experimentally validated Simulink® models of small scale, ~ 1 kW, 6, 12, 18, and 24 pulse rectifiers, respectively, when they are used charge repetitive capacitive loads.

44 – Boiresorbable Pressure and Temperature Sensor for Brain Implantation

Zhonghe Liu
Advisor: Weidong Zhou
Electrical Engineering Department

We developed an optical pressure and temperature sensor to monitor intracranial, intraocular, and intravascular conditions for diagnostic and treatment of brain injury, glaucoma, and cardiovascular diseases. The sensor is made of biodegradable materials to eliminate the extra surgical process to remove the sensor after the treatment, comparing to other commercial sensors.

45 – RFID-Enabled Aerial Detection System

Anand Newadkar
Industrial, Manufacturing and Systems Engineering Department

This project will develop an Unmanned Aerial Vehicle which will have an RFID reader attached that will be capable of flying over inaccessible areas during offshore calamities. The UAV will have the capability to detect an RFID tag on an offshore worker's clothing and triangulate the worker's position based on an iterative process to localize the co-ordinates of the RFID tag and send that

information back to the controller. Once the worker is located, rescuers can be notified and necessary actions can be taken. The main objective of the project is to equip emergency responders and safety officers with appropriate tools needed to track crew members and launch a targeted evacuation rescue effort when an accident occurs on an offshore oil rig. The drone's advantage of proximity and maneuverability enables detection of RFID tags, providing real-time location. The tags will also provide health status information of onboard personnel from a safe distance and assist with providing responders with the decision-making tools necessary for proper prioritization of response efforts.

46 – An AI-Based Decision Support Tool for the Treatment of Warts

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

Warts are non-cancerous tumors that can appear on the top layer of skin of different parts of the human body. Cryotherapy and immunotherapy are two commonly adopted methods to treat warts. However, the effectiveness of these treatment methods varies from patient to patient. By utilizing a secondary data set that was originally collected in a dermatology clinic on 180 patients, this study aims to develop classification models to predict the effectiveness of these two treatment methods on individual patients. To sort out the important factors, fuzzy entropy and mutual information-based feature selection methods has been utilized. Several machine learning algorithms have been deployed and the classification performances of these algorithms have been examined by the 10-fold cross-validation method. Two, KNN and CART, have been found to provide promising results with an overall accuracy of 96.8% (sensitivity = 0.956, specificity = 0.981) and 83.9% (sensitivity = 0.869, specificity = 0.726) for cryotherapy and immunotherapy, respectively. There are several potential benefits of this study. The classification models will assist physicians as a tool to help them determine when to select cryotherapy or immunotherapy for each unique patient. Therefore, valuable time and hospitals' resources can be saved by reducing readmissions and possible side effects may be avoided.

47 – Application of 2D Materials in Microelectronics

Behnaz Hassanpour
Advisor: Leila Ladani
Mechanical and Aerospace Engineering Department

This project is about the application of 2D materials like graphene and TMDs in microelectronics.

48 – High-Frequency Ultrasound Analysis in Experimental Level to Understand the Micro Structural Change in Soft Tissues

Koushik Paul
Advisor: Leila Ladani
Mechanical and Aerospace Engineering Department

High-frequency ultrasound has become a popular tool in characterizing small-

scale soft materials. This method is particularly effective in pitch-catch mode. It has been used in tissue phantoms to evaluate the microstructure. This method has the potential to be used in determining the tissue pathology in cancer and other tissue degenerative diseases. Among different types of parameters of ultrasound, peak density has been found to be most sensitive to the microstructural and scatterer variations in soft materials. 25 MHz ultrasound wave is used in a pitch-catch mode to evaluate mm scale tissue phantoms with micro-scale scatterers on different thickness level. FFT is used to convert the receiving signal to frequency domain, calibrate to remove the noise and analyze the peak density.

49 – Laser Interaction with Surface and its Impact on Temperature Profile, Bead and Melt-Pool Geometry

Faiyaz Ahsan
Advisor: Leila Ladani
Computer Science and Engineering Department

Many researchers have focused on thermal, structural or other multi-physics modeling of laser and electron beam powder bed processes. However, in most cases, the laser heat source distribution is considered Gaussian as an ideal beam. Power intensity distribution is a function of many parameters that need to be considered if realistic modeling of laser interaction with surface is desired. This work seeks to model the process in a more comprehensive and realistic manner by taking the laser physics into consideration, including wavelength, laser quality factor and laser beam parameter product. The model also uses a level set method to determine the shape of the bead and melt pool. Other physics including heat transfer and fluid flow are incorporated in the simulation to model the whole process. This multi-physics process is used to model the melt-pool geometry, and results are compared against an experiment for Inconel 718 alloy.

50 – Surface Characterization of the As-Built Ti-6Al-4V Parts Produced Using Electron Beam Melting Technology (EBM)

Md Jamal Mian
Advisor: Leila Ladani
Mechanical and Aerospace Engineering Department

Ti-6Al-4V is an extensively used titanium alloy which has its application primarily in aerospace, medical implants and chemical plants because of its high strength-to-weight ratio, high melting temperature and excellent corrosion resistance. Among many of the manufacturing processes of these parts, electron beam melting (EBM) is a state-of-the-art additive manufacturing technology which is cost, time and energy efficient. The surface characterization of the as-built Ti-6Al-4V parts produced using EBM technique is very crucial because it is related to the wear and friction property hence lifetime and performance of parts. Besides, modification of surface irregularities by post-processing is very costly and sometimes very challenging for complex geometries. For that reason, this study focuses on surface measurement of the as-built, EBM-produced Ti-6Al-4V parts in three different orientations with the built table using various measurement techniques and relates them to other mechanical properties of titanium parts.

Senior Design Projects

51 – A Photoplethysmography Device for Heart Rate and Blood Flow

Sagar Bhaukaji, Frank Din, Clemente Velazquez-Munoz
Advisor: Khosrow Behbehani
Bioengineering Department

Electrocardiogram (ECG) is the gold standard to measure a person's heart rate. However, it is not possible for the general population to buy an ECG machine, and it is expensive and trivial for non-clinical personnel to own one. As an alternative to utilizing an ECG machine, photoplethysmography (PPG) is a non-invasive technique which also calculates heart rate. The device measures the rate of change of blood volume with the help of a photo emitter and photodetector. Available PPG devices in the market today use two light sources to measure a change in blood volume, and a few display the PPG waveform. Our team will build a safe and portable heart rate monitoring device using photoplethysmography.

52 – LED Exposure System for Stem Cell Differentiation and Proliferation

Grace Akinmoyede, Jacqueline Fu, Arturo Velazquez, Joselyne White
Advisor: Michael Cho
Bioengineering Department

Photobiomodulation (PBM), formerly known as low-level laser therapy, is a term that encompasses various techniques that use light to manipulate or stimulate biological processes. Applications of these techniques include dermatology, stem cell research, neural stimulation, inflammation reduction and wound healing. This project focuses on the stem cell research aspect of the PBM and is designed to promote stem cell differentiation and proliferation using an inexpensive LED. Currently, the most widely-used method to promote stem cell differentiation includes a variety of expensive biological growth factors. Through the design and validation of this photobiomodulation device, we may be able to eliminate the need for costly growth factors while providing a systematic way to facilitate the intended stem cell differentiation. Our device is non-invasive, inexpensive, relatively lightweight, and user-friendly.

53 – Visualization of Blood Flow Streamlines Within a Diseased and Stenotic Coronary Artery

Nathaniel Fox, Ingrid Guerrero, Emily Hills, Victoria Kuhn
Advisor: Cheng-Jen Chuong
Bioengineering Department

Atherosclerosis is a disease in which plaque develops in an arterial wall, causing the luminal diameter to narrow with constricted or even blocked blood flow. The left coronary artery is one of the most predominant vessels in which atherosclerotic plaque can form. This is usually treated by angioplasty followed by the implantation of a stent. Since atherosclerosis can start developing during childhood, it is crucial to educate children about the affect plaque formation

has on blood flow. We aim to design and fabricate a display for a children's museum consisting of three scaled-up models of the left anterior descending artery to mimic coronary circulation within a healthy artery, a diseased artery, and a stenotic artery. The project was designed with the parameters necessary to develop a dynamically similar model in which the flow streamlines and the development of recirculation zone are accurate and easily visualized. The goal of the display is to raise awareness and promote a healthier lifestyle in children, thus minimizing the risk of developing coronary artery disease.

54 – Evaluation of Biomechanical Behavior of Small-Diameter Vascular Grafts Using a Computer-Modulated Biomechanical Testing System

Vy Dang, Zakia Mizan, Fariha Murshid
Advisor: Jun Liao
Bioengineering Department

This project is a biomechanical testing system for small-diameter vascular grafts, intended mainly for laboratory research/use. The system should be able to determine pressure-diameter relations of the graft as fluid flows through it. It should also be able to determine the compliance and burst pressures of the graft. These characteristics are to be modulated using a programmable motor pump (for fluid flow rates and pressure) and camera (for image capturing), via LabView. The system design includes an efficient and sturdy mounting mechanism for the graft; this design will make it easy to mount and remove the graft for each test run. The mounting mechanism will also be able to accommodate grafts of varying lengths and diameters without damaging them in any way.

55 – A Wavelength Switchable Device for Photobiomodulation

Jackie Allison, Dat Ha, Michael Perna
Advisor: Hanli Liu
Bioengineering Department

Photobiomodulation (PBM) is a form of low-level light therapy that can be used to aid in wound healing and easing muscle pain. Using red to near-infrared light, cytochrome c oxidase is activated in the mitochondria and a chain of events begins that stimulates the tissue. Most photobiomodulation devices currently on the market are designed primarily for lab use and cost thousands of dollars. That is why we are creating a prototype of a handheld device slightly larger than a cell phone that is easy to use. The device has an adjustable power density output and an interchangeable head housing an array of 660-nm and 855-nm LEDs. The interchangeable head allows for different wavelengths of LEDs to be used. A smooth, rounded handle with an optional strap makes the battery-operated device easy to handle for people experiencing muscle and joint pain. The prototype PBM device is tested in a laboratory tissue phantom, showing its penetration depth about 2 cm within tissue, which also depends on electrical power applied to the LEDs. A quantitative relationship between the electrical power controlling the LEDs and penetration depth is studied; also thermal effects for the device delivered to the tissue are examined and quantified for future human uses.

56 – On-Chip Microfluidic Device for Production of Liposomes

Baibhav Bhattarai, Katherine Livingston, Tommy Nguyen
Advisor: Kytai Nguyen
Bioengineering Department

Liposomes are microscopic lipid encapsulations formed when lipid bilayers (under certain conditions) spontaneously form. Liposomes are useful because of their use as laboratory models, genetic delivery system, and drug delivery system. Liposomes can form unilamellar vesicles (UV) and multilamellar vesicles (MLV). In this proposal, the team will design a system that creates MLV liposomes that encapsulate drugs using a microfluidic device on a chip. The specific method of manufacturing the microfluidic device to create liposomes was chosen because of its convenient portability, ease of use and cost-effectiveness. The proposed design will be able to produce liposomes that can carry drugs, be close to 300 nm in diameter, have a polydispersity of 0.2 or less, and be conjugated with antibodies. Simulations were done in COMSOL to look at the velocity at certain sections of the microfluidic device.

57 – Portable Optical Imager for Diagnosing Wound Infection

Logan Garner, Sachin Kaluarachchi, Celeste Yanagi
Advisor: Liping Tang
Bioengineering Department

This is a portable, non-intrusive optical imaging device to detect infection in skin wounds. The device consists of a cellular camera and LED light source. The imager will detect the presence of bacterial colonization in wounds based on their unique optical signature. The LEDs excite the bacteria which then emits a spectrum captured by the camera that is then analyzed on a computer. Harmful bacteria is identified and from there the doctor can determine the best course of action for treatment. This allows for immediate diagnosis and early detection of infection.

58 – Study of Gastric Cancer Cell Metastasis Through a Microchannel Device

Tanzeel Abdelrahman, Nowmi Haider, Darah Palencia
Advisor: Young-tae Kim
Bioengineering Department

We are studying the nature of gastric cancer cells' metastasis by seeing how they migrate through the microchannel device. It will have 600 microchannels with a 5x8 mm for each microchannel. Any epigenetic and protein expressions will be recorded to see if there are any differences in the cells from when they first started migrating to after they migrate through the whole microchannel. A Western blot analysis will be done to obtain this information. We will also test the gastric cancer metastasis in hypoxic conditions as well.

59 – Wearable ASL Translator

Dona Antony, Neshat Baset, Elias Johnson, Allison Palomino
Advisor: George Alexandrakis
Bioengineering Department

Five percent of the world population, about 466 million people, suffers from hearing loss. American Sign Language (ASL) is the predominant language for the deaf community, and there could be communication issues with those who do not understand ASL. Most currently available ASL translators rely on a camera (vision-based approach), a glove-based approach, and/or EMG sensors used to detect muscle potential. These devices have three main issues: they are not portable, they are expensive and/or they interfere with daily activities. We created a portable translator that uses a microcomputer and that does not cause any haptic encumbrance. Smart nail devices are connected to smart rings which communicate through Bluetooth to a microcomputer in the wrist piece. Both smart devices have LED receiver/transponder pairs that send sensor readings to the microcomputer, and the wrist piece contains an Inertial Measurement Unit to recognize the two letters in the ASL alphabet that require dynamic movement (J and Z). The microcomputer takes hand position as inputs through the sensors, associates them with a letter, then displays and speaks the letter.

60 – Reflectance Factor Calculation Based on Sun Geometry/Angle for Controlled TSS Sample

Joshua Mendez
Advisor: Habib Ahmari
Civil Engineering Department

When the sun travels across the sky, the reflectance number gathered from a photo is subjective to the angle of the sun with respect to the surface of a body of water. When a picture is taken with recordings of a specified sun angle of a shallow body of water, a multiplier will be outputted from a function of the sun angle to the water surface to the reflectance number at that instance giving a corrected reflectance value closer to the true value in ideal circumstances.

61 – Fort Worth Multi-Family Land Development Project

Steve Briceno, Carlos Iglesias, Edgar Medina, David Zamarripa
Advisor: Andrew Kruzic
Civil Engineering Department

Layout and design a proposed 200-unit, multi-family development on an approximately 20-acre tract of land. Design will include, but may not be limited to, site plan layout, drainage system analysis and design, investigation of detention pond requirements, analysis and design of water and sewer infrastructure for service, including offsite public sewer infrastructure, design of a 4-lane divided public street and an extension of an existing public side street, and analysis of site development grading.

62 – BNSF/West Prosper Trail Grade Separation

Muhasina Manjur Dola, Sachini Madanayake, Carlos Mendizabal Molina, Elio Salloum, Romy Salloum
Advisor: Jim Williams
Civil Engineering Department

This project will analyze possible solutions for the BNSF railway crossing at West Prosper Trail to reduce possible accidents and delays due to trains. This project will include structural, hydraulic, transportation, geotechnical, environmental, and construction analysis. The team will analyze two alternatives for the grade separation that include building a bridge over the train tracks or building an underpass. The design of the bridge is the most logical because it would has the potential to solve most the constraints that were found in the project. The main constraints in the project are the safe crossing of vehicles over the train tracks and the noise reduction in that area. Pros and cons of the two alternatives will be analyzed and recommendations will be suggested to the town of Prosper.

63 – Collin College Celina Campus

Dylan Field, Aaron Hunt, Ian Wardlow
Advisor: Michael Zaretsky
Civil Engineering Department

We are working with Beck Architectural Firm to design the structural system of the new Collin College Celina Campus in Celina, Texas. This is a four-story structure that overlooks a pond and has a major walkway passing underneath a portion of the building. There is a cantilever above this walkway that creates a unique challenge. The longest span for the cantilever is roughly 90 feet. We are looking into options of either designing this portion of the structure with steel trusses or a hybrid of steel trusses and post tensioning concrete beams while maintaining proportions of the architectural design that the architect wants.

64 – Regimen Smart Workout Machine

Daniel Benninghoff, Cory Falvo, Jared Gilstrap, William Sizemore, Caleb Sparks
Advisor: Linda Barasch
Computer Science and Engineering Department

Our project is a functional workout platform that any user of any age or skill set can pick up and use. This machine will improve workout efficiency by allowing the user to use a higher weight in a safer environment. The machine is designed to constantly increase the weight with each rep, depending on how much resistance the user decides to apply. With the built-in user interface, each user's activity will be logged into a database to keep track of their progress. The U.I. will also allow for instructions on how to do each workout with built in tutorial videos.

65 – Traffic Pi

Jacob Devasier, Ethan Duff, Miguel Fraire, Kevin Tiller, Seth-Amittai Tisbi
Advisor: Linda Barasch
Computer Science and Engineering Department

Our project consists of a portable lightweight computer vision capable of being placed near a stretch of road and recording long amounts of footage of said road. The camera used to film will be attached to a raspberry pi computer and will use a neural network and vision processing to count the number of cars passing and their relative speed. The program can generate its GUI, allowing users to create a readable breakdown of the percentage of speeding cars in any video. This is very useful for government agencies considering the current black box method of traffic studies is extremely expensive. This method would allow cheaper and more self-empowered studies to be conducted by civilians as well as the government.

66 – Wax

Christopher Alkhaz, James Boyd, Christopher Jakins, Jordan McGalliard, Kevin Ramirez
Advisor: Darin Brezeale
Computer Science and Engineering Department

The wax project is a trading platform that gives the user candle data from various exchanges and allows them to graphically view it and perform technical analysis.

67 – BASS – Better Advertising Using Smarter Screening

Micah Clarke, Mehul Jain, Sakshi Nag, Eric Sauber, Divyanshu Sharma
Advisor: Chris Conly
Computer Science and Engineering Department

Advertisers are increasingly moving away from traditional advertising media and focusing on social media with the help of popular social media personalities or influencers. These influencers post "sponsored" content mixed-in with their regular posts. This makes the sponsored advertisements seem out of place and reduces the users' quality of experience. A good way to check whether an advertisement would blend naturally and smoothly into an influencer's social media is to analyze the similarities between the advertiser and the nature of the influencer's past content. Our team proposes BASS, a software solution that uses tools such as computer vision and data mining to generalize the trends among brands, themes, and objects that recur in the influencer's past social media posts. Upon acquiring these trends, a matching algorithm ranks different influencers in order of natural fits for a given advertiser.

68 – Eye Gaze

Jonathan Aguilar, Henry Bang, Khoa Pham
Advisor: Chris Conly
Computer Science and Engineering Department

Our mission is to support an eye-tracking system that can assist users in identifying which object they are looking at. We will obtain two dedicated

high-quality cameras, to be placed on ski goggles, that will capture the user's eye movements. One camera will face the eye and the other will face outward to the user's surroundings. Further, they will have a wireless or wired connection to a raspberry pi, where our built program can feed in the images and translate them into vectors. The vectors will provide a clear direction to where the eye's pupil is pointing. The program will then exploit its algorithm to analyze related information about the object based on stored databases, and these details will be displayed on the user's monitor. Lastly, one of the main requirements is that the system must be able to perform its operation on various eye colors and shapes.

69 – Formula SAE Team

Addison Clark, Prabesh Khadka, Megan Myers, Jeff Pinkos, Thomas Shipman
Advisor: Chris Conly
Computer Science and Engineering Department

The UTA Racing Formala SAE car has a five-element wing with three flaps with four quadrants. The original system has an active aero system with limiting switch. The purpose of this project is to design and implement a computerized system to control the positioning of the wing. A central computerized system will intake data from accelerators and filter noise. Once a certain force of gravity (g) is reached, using hysteresis, the central computer communicates with slave computers, located near the wings, to control the positioning of the wings.

70 – Intelligent Problem Solver

Brandon Carter, Anh Phuoc Do, Faryal Farooq, Ali Mohammed,
Salvador Medina Nava, Sajen Shrestha

Advisor: Chris Conly
Computer Science and Engineering Department

Intelligent Problem Solver is a powerful tool that can be used to solve a variety of discrete structure problems. It will be accessible in a web application designed using React with a server side using node.js. The intelligent problem solver utilizes the wolfram API, a program that can prove propositional logic problems. Problems related to binary relations are currently in development.

71 – iSpy

Ivy Moore, Abdul Mannan, Cameron Howard, Gaganjeet Singh, William Truong
Advisor: Chris Conly
Computer Science and Engineering Department

iSpy is an Android smart-phone app that uses the camera to photograph and find the object in the picture in local stores. iSpy will use machine vision to identify the object in the image, which can be taken from the app itself or uploaded from gallery. iSpy will search online for the object, and then find where it can be purchased locally, using the phone's GPS to identify the user's location. iSpy will use machine learning to better its search and identification algorithms. With the information it collects, iSpy will recommend a store based on price and distance.

72 – LifeTrack

Kyle Benjamin, Ahmed Durodoye, Trang Hoang, Adam Madet,
Marc-alain Muteba, John Tieken
Advisor: Chris Conly
Computer Science and Engineering Department

The LifeTrack software will allow users to input their income and expenses and schedule recurring expenses. Users will be given a projected statement of cash flow so they may be made aware of upcoming financial shortfalls. Users will be provided with historical financial performance analysis and financial projections based upon the user's entered income and expense expectations. Users will be able to enter the value of their assets (property, bonds, stock, etc.) as well as any liabilities. The user's stocks/bonds valuations will, when possible, be updated automatically using external market price API. The user may schedule asset depreciation. All finances from all sources will be compiled into a single form in which the user may view their overall financial performance.

73 – Synthify

Mary Huerta, Minh-Quan Nguyen, Gerve-Endy Pluviose, Mitchel Smith,
Kolton Sturgill, Dominic Young
Advisor: Chris Conly
Computer Science and Engineering Department

Synthify is a music player that allows a user to bring all of their content from different platforms and services (YouTube, Spotify, etc) into one place. Synthify will allow users to sign in with different providers to fetch their content from the respective platforms. This will allow users to have all of their content in one place. Synthify is open to anyone who wants to use the service. It requires users to provide their login credentials for each service that it is connected to. If a user does not have an account with one of the music services that can be connected with Synthify and he/she wants to start using that service, he/she must meet the requirements of that service.

74 – The Spicie Boi

Matthew Hilliard, Douglas Hoang, Irving Avila Mireles, Jesus Serna, Nhan Vu
Advisor: Chris Conly
Computer Science and Engineering Department

Device used to measure and grind spices based on a recipe. Comes with touchscreen, a database of spice recipes, GUI and containers to house raw ingredients. Made with the intent to become a common kitchen appliance.

75 – VR Work Space

Umair Hafeez, Murtaza Molai, Ian Strnad, Kyle Teixeira, Michael Teixeira, Jacob Viele
Advisor: Chris Conly
Computer Science and Engineering Department

VR Work Space is a virtual environment meant to simulate the office space of your dreams. With a fully customizable background environment and the ability to have each individual desktop program run as its own virtual screen, VR Work Space is expected to increase productivity and ease of use while immersed in the application. VR Work Space is intended to be geared towards developers working on coding projects in a VR space, but that by no means implies that the regular user can not use this application as a work station for other types of projects or regular computer usage such as browsing the web or writing in Word. For this application to be a viable option for developers, it needs to be as easy to use as a traditional computer with a mouse and keyboard.

76 – Sound Vest

Ugo Okoye, Sochima Omenkeukwu, Jeovanni Santos, Anena Sims, Connor Twohey
Advisor: Chris Conly
Computer Science and Engineering Department

Sound Vest takes in music from your cellphone, separates the frequency wave into lows, mids, and highs then passes the waves to shakers that vibrate to the beat of the music.

77 – UR5 Robot Arm Capable of Playing Jenga

Joe Cloud, Carlos Crane, Sammy Hamwi, Gabe Lewis, Maxwell Sanders
Advisor: Chris McMurrough
Computer Science and Engineering Department

The objective of this project is to implement a Jenga-playing robot system involving a human opponent. Our solution will utilize 3D computer vision to develop scans of the tower's state, and a vacuum gripper to grip blocks. The human opponent will take turns with the robot performing block pulls and placing them at the top of the stack. The goal isn't necessarily to defeat the human opponent, but build a system capable of make multiple moves prior to the tower collapsing.

78 – AutoMav - Intelligent Ground Vehicle Competition (IGVC)

Amgad Alamin, Andrew Break, Warren Smith, Awet Tesfamariam, Dario Ugalde
Advisor: Chris McMurrough
Computer Science and Engineering Department

The purpose of this project is to design and construct an intelligent ground vehicle. Our goal is for our vehicle to qualify and participate in the Autonomous Navigation Challenge at the 27th Annual Intelligent Ground Vehicle Competition (IGVC). During this project, the team will experience designing and developing a functional product from scratch while becoming familiar with new technologies.

79 – Chess Robot

Andrew Delgado, Lena Ngungu, Rodrigo Ramirez, Ray Robinson, Katherine Younke
Advisor: Chris McMurrough
Computer Science and Engineering Department

We are creating an interactive chess playing robot that will be used for university outreach and to encourage potential students to enroll at UTA. We will achieve this vision by creating a chess board that has a CPU opponent capable of moving its pieces without assistance through a device underneath the chess board. We will showcase the capabilities of university-level engineering students to the best of our ability and make sure that all components are visible to the users of our product. The game will have varying difficulties with untimed play modes so that those with varying skill levels can enjoy and understand the intricacies of the board development. Allowing for an untimed play mode will be better suited for demonstrations in schools, serving our purpose of student outreach.

80 – ELAWaves

Mason Beckham, Jimmy Chen, Grayson Ebarb, Brandon Tran, Charles Wilson
Advisor: Chris McMurrough
Computer Science and Engineering Department

Our vision is to create a decentralized platform for text-based communication. The goal is to have a chat platform that users can completely trust. It is to be transparent to its users, thus open source. This project is one step toward bringing everyday communication software and beyond into the hands of the community. To build a peer-to-peer chat application, powered by blockchain technology to maximize message security and privacy.

81 – FSAE Active Aerodynamics

Rabab Antria, Brandon Hanner, Danny Meneses, Shweta Shikarkhane, Grace Yeon
Advisor: Chris McMurrough
Computer Science and Engineering Department

Race cars enjoy the benefits of aerodynamics to further shorten lap times and increase lateral G's. Many aero systems are fixed, which inhibits top speed due to drag. Modern Formula 1 cars have a drag reduction system, or DRS, that can manually be triggered for straights, allowing for faster speeds. Once the car approaches the corner the driver can disable the DRS thus enabling full down force for maximum corner grip and maximum corner speed. We envision a product that takes this concept a step further to automate this process to allow the driver to focus more on racing and increase the responsiveness and precision that an automated system can deliver. Our mission is to design a product that observes the car in motion and intelligently orchestrates the flaps on the formula race car to maximize grip in the corners and minimize drag on the straightaways, all without the need for driver interaction or distraction. We aim to provide a tool that will augment the racing sport and drive it forward. We will accomplish this using modern day MEMS, coupled with sophisticated signal processing to analyze data to make calculated decisions in real-time.

82 – PDX

Jose Cervantes, Brian Jimenez, Giannina Pachas, Bryan Tu, Michael Vu
Advisor: Chris McMurrough
Computer Science and Engineering Department

Representation of workflow for pharmaceutical software

83 – Raytheon Drone Project (VISION)

Saurya Bhattarai, Anna Cox, Luke Hardin, Jake Nissley, Dawsen Richins
Advisor: Chris McMurrough
Computer Science and Engineering Department

We are team ViRal working on the project VISION, which is a dual department project working with an electrical engineering team. The basic idea of the project is to create a system that collects and displays wireless data in a virtual environment which would give the user the ability to visualize signals that are around them. The environment is built in Unity and uses a device called a Sensorium to collect all the signals for the project.

84 – UTA-SC

Pavanaj Biyani, Robert Brady, Brandon Chase, Kartik Gupta, Nicholas Reimherr
Advisor: Chris McMurrough
Computer Science and Engineering Department

UTA Summer Conferences hosts close to 100 camps every summer but due to loosely tied applications and human error, the organization has an estimated $50,000 in lost revenue each summer. By providing a streamlined complete solution to manage tasks, from requesting to host a camp to managing billing, Summer Conferences will reduce their losses, improve efficiency, and increase their professional appearance. Our team's mission is to migrate Summer Conferences from their old processes rooted in Google Sheets to a full stack web application that can be accessed from any networked device. This application will manage most areas that Summer Conferences needs such as contract details, registering camps, managing rosters, check-in and check-out of campers, checking out equipment, parking and billing. A major aspect of the system will be its usability and its efficiency to interact with custom-made API requests.

85 – VoicePrint

Brian Leonard, Kamal Mistry, Quy Pham, Peter Severynen, William Wallace
Advisor: Chris McMurrough
Computer Science and Engineering Department

VoicePrint is an Android app that allows a user to control a 3D printer with voice commands.

86 – Wheelchair Vision

Rauhaan Aamir, Jason Do, Quinton Helton, David Jaime, Aninda Zaman
Advisor: Chris McMurrough
Computer Science and Engineering Department

Current prosthetic arms are very expensive. Furthermore, though they are commanding such high prices, they possess few, if any, functional properties. This project seeks to bring forward a change in this regard by providing vision technology to already developed robotic prosthetic arms to give them added utility. This change will improve the livelihoods of people who are dependent on such prosthetic arms by providing low-cost alternatives to existing ones.

87 – Super Sensor

Saurya Bhattarai, Michael Cardona, Andrew Clute, Anna Cox, William Ellis, Luke Hardin, Alessandra Marchi, Jake Nissley, Dawsen Richins
Advisor: David Wetz
Electrical Engineering Department

The Sensorium is an all-encompassing super sensor that can detect and analyze its environment. The portable device is equipped with nine physical sensors capable of sensing fourteen different properties: temperature, pressure, humidity, illumination, color, motion, proximity, acceleration, rotation, magnetic fields, thermal imaging, electromagnetic interference, wireless signal frequency/intensity, and global position. The design allows nearly all of these sensing capabilities to be contained within an 90x100mm PCB. The Sensorium communicates via WiFi to Amazon Web Services. As data is being collected in AWS, the open-source graph composer Grafana is projecting the information on a user-friendly interface. Grafana runs as a web application, providing users a coherent view of the data using graphics updated in real-time. The team is working in conjunction with the Computer Science and Engineering Department to enhance visual data using virtual reality.

88 – First Responder Emergency Notification System (FRENS)

Tyche Doe, Erika Laffiteau, Miguel Paniagua, Bishrut Subedi
Advisor: Greg Turner
Electrical Engineering Department

First Responder Emergency Notification system (FRENS) allows drivers to detect any incoming first responder vehicles from within 300 yards without clear line of sight. This alert system is designed to notify the driver if there is an emergency vehicle approaching based on the sirens incorporated into ambulances, police cars, and firetrucks. The system will display the type of emergency vehicle, its direction in relation to the car, and the vehicle's approximate distance from the car. The FRENS Alert is an array of four audio sensors, a signal processing unit, and a driver alert module. The four sensors are used to detect the sirens of the emergency vehicles and the signal processing unit is used to determine the type of siren, the distance to the siren, and the direction it comes from. The driver alert module includes an LCD screen to display this information to the driver.

89 – Two-Channel Rotating Speaker Cabinet

Ahmed Alamin, Andrew Bouasry, Dustin Crowley, Nathan Lockhart
Advisor: Greg Turner
Electrical Engineering Department

This project is a 2-audio channel, rotating speaker cabinet that has been modernized. The changes that modernize the speaker are the ability to select a cutoff crossover frequency, direct motor drive for the rotating parts, variable speed control that sweeps in a target RPM range, the use of tube amp preamplification, the use of solid state power amplification and the ability to externally measure the frequencies and amplitude of the output signal. In addition to the changes made to the original speaker cabinet, known as the Leslie speaker. The Leslie speaker utilizes the spinning of an open-ended horn and baffle (sound waveguides) to modulate the frequency of emitted sound to replicate the Doppler effect. The emitted sound is the result used to determine the quality of the speaker, and the modifications made to the original design justifies building a modern speaker.

90 – 3D BioPrinter

Sadia Ahmed, Colin Catozzi, Melissa Esquivel, Shane Little, Brigette Ruby
Advisor: David Wetz
Electrical Engineering Department

Regenerative medicine is a new practice impacting patients' lives by facilitating human tissue rejuvenation, regeneration and providing replacement tissue to diseased and damaged organs. Regenerative medicine is supplemented by tissue engineering in which emerging 3D bioprinting technology is utilized. 3D bioprinting affords researchers the ability to implement several effective techniques including autonomous self-assembly, microtissues and biomimicry. Our 3D bioprinter will provide a resolution of 1.5 micrometers, offer control through both software programming and joystick control and implement a simplistic yet effective biomaterial extrusion process known as capillary action. This 3D bioprinter will be realized as a two-part system consisting of an electric control system and a stage assembly.

91 – Battery SOC/SOH Monitoring System

Raymond Davis, Miguel Garcia, Alexander Johnston, Andy Ochoa
Advisor: David Wetz
Electrical Engineering Department

This project is to design a universal battery state of health (SOH) and state of charge (SOC) monitoring system for 18-32 volt batteries. In this range of electric potential, there are little to no monitoring systems that can accurately or efficiently track SOC/SOH. Secondly, the systems can only monitor one battery. With that in mind, this project will provide a low power, efficient monitoring system that will be able to monitor any battery within specifications. As a tertiary aspect, the system will be able to fit inside a battery storage module along with the batteries in question.

92 – Better Block Wireless Sensor System

Kouame Djah, Samuel Graf, Ololade Mafimidiwo, Derek White
Advisor: David Wetz
Electrical Engineering Department

In our global economy, a continuous improvement process is paramount to the ability of a business or city to remain relevant and competitive. Many government entities/business owners who service the public already significantly invest in improving the quality of their services and products but are not putting the same effort into their public spaces. Optimizing public space can considerably increase the quality of service provided, thereby benefiting these organizations economically and socially. For a smart city approach, using a sensor system for public space monitoring is the most efficient and accurate option to provide the necessary insight on a continuous basis. Better Block Sensor System is an integrated sensor system that combines highly accurate and robust sensors with sophisticated processing modules and a sleek user interface to easily provide data to users for analysis of their public space. Other highlights of our system are the protection of user privacy in the monitored space, data on surrounding conditions of the space for better insight, long battery life, wireless communication between sensor system and user, extensive storage capacity and real time processing.

93 – Capacitive Discharge Tab and Thermocouple Welder

Jason Curtis, Hau "Henry" Kieu, Rachael Watson,
Advisor: David Wetz
Electrical Engineering Department

The Capacitive Discharge Tab and Thermocouple Welder combines the thermocouple welder and the tab welder into one device with interchangeable leads. The CDTTW can weld nickel tabs on aluminum battery terminals with energy output between 200-700W*s. The CDTTW can fuse wires together via resistance weld, with energy output between 10-50W*s.

94 – Electronic Cornhole Game

John Perales
Advisor: David Wetz
Electrical Engineering Department

The electronic cornhole game is a lawn game that will wirelessly detect bags upon landing on the board and keep track of the score for the player. The bags will contain passive devices so the bags will not require batteries. The score will be shown to the user wirelessly and will allow the user to edit the score and view previous scores for past games.

95 – Interactive Table-Top Gaming System

Suleiman Barakat, Alexander Dinh, Duy Nguyen, Damien Tranh
Advisor: David Wetz
Electrical Engineering Department

This is a table-top gaming system that can recognize the placement of a variety of pieces on a 2D playing surface, while simultaneously projecting HD graphics onto the same surface.

96 – Pulse Gauntlet

Gabriel Whites, Aaron Black, Festo Pierrick, Quinton Webb
Advisor: David Wetz
Electrical Engineering Department

A wearable device that transforms sound into sensations of touch.

97 – Wireless Body Balance Measurement System for Telemedicine

Ishrat Durdana, Nhan Pham, Prashant Rayamajhi, Robert Wood
Advisor: David Wetz
Electrical Engineering Department

In the emerging technology of telemedicine, physician and client contacts are further simplified through platform Wi-Fi communication. One common indication for tracking a patient's recovery is by postural stability. The implementation of the medical device will track the condition by a postural stability sensor unit (PSSU). In addition, clinical tests can be performed outside of laboratory or any remote location as an alternative option. The expected benefits are to reduce time spent visiting clinics, transportation costs, and providing test access for patients with physical difficulties. For further convenience, the device is simple to mount and has a user-friendly interface. From previous works, the presented concept further enhances performance by implementing a force platform as a wearable device. The PSSU is mainly composed of three components: microcontroller, inertial measuring unit (IMU), and Bluetooth module. New design decisions heavily consider the balance between component dimensions and prices. With supported database, the main communication between the client and physician will be done through a web page. The device can be utilized by general individuals to monitor their postural stability in order to maintain or improve their health.

98 – Decreasing Patient Wait Time at the GIM Clinic at UTSW Medical Center

Puja Bhandari, Vanessa Loah, Viviana Shaw, Tina Townsend
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

The GIM Clinic is experiencing a notable variance in patient waiting time. The check-in/check-out process is a major contributor to the long wait time and has been identified as the bottleneck for the entire process. For the check-in process, there is a central location, but changes were made to the check-out process and it

is now controlled by staff members at individual 'pods'. Unfortunately, after the changes were made in the check-out process, it was confusing for patients. These two areas are causing inefficiency for the clinic and patient dissatisfaction and complaints.

99 – DFW Luggage Arrival Optimization

Taylor Elkins, Courtney Jaekal, Jana Kolbeck, Valeria Velazco-Chavez
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

The team's goal is to establish a standard time for luggage transfer from an arriving aircraft to the baggage claim carousel at the request of DFW's Customer Experience Team. External and internal factors are analyzed for determination of sources of variation within the process, and optimization efforts will be focused with DFW's internal handling processes.

100 – Improving Wait Time at DFW TSA Checkpoints Through Technology

James Bui
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

Time study at security checkpoint to validate if wait time technology is accurate.

101 – Optimizing Picking for a Distribution Facility

Bridget Head, Shane Potchana, Andrew Schoen, Hannah Sligar
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

This project works with The Crosby Group to decrease their mis-picks, mis-weights, and miscounts within their picking system and increasing their lines per hour per employee.

102 – Traulsen & Co. – Increasing Efficiency in Metal Fabrication Shop

Kayode Awolowo, Aakib Ahmed Saad, Maria Saavedra, Micky Shin
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

To increase the efficiency/output at Traulsen & Co. Inc., an industrial refrigeration equipment manufacturer.

103 – Making Banfield Better

Rashdan Ahmed, Horace Boston, George Gerges, Martin Gomez, Dalton Miles
Advisor: Jamie Rogers
Industrial, Manufacturing and Systems Engineering Department

Banfield Animal Hospital operates in Duncanville. There are over 1,000 of these clinics nationwide and the corporation is owned by Mars. The clinics partner with PetSmart and operate within PetSmart facilities. The Duncanville branch's goal is

to reach the top 100 of all Banfield clinics (top 10%) by the end of 2019. Currently, the clinic is in the top 18%. Their desire to attain the top 10% rank can be managed by improving customer service, schedule optimization and increased sales of wellness plans. Our team will work with them throughout the semester to come up with a plan of action that would improve the overall processes.

104 – Airbus Engine Intake

David Allen, Abram Mendez, Alexander Murillo, Manuel Tovar
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

The intake system on the AS350B3 is wasteful and inefficient, to such an extent that the designed engine for the aircraft under-performs. For the aircraft to meet its specifications, a larger engine had to replace the initial design. In addition to the performance lost and the higher cost, safety is also a concern. Airflow hitting the compressor turbine unevenly increases the wear on the compressor blades. Such wear can result in engine failure. With better airflow into the engine, Airbus can minimize these losses. The team is designing an attachment to improve the flow through the intake in order to increase performance, add safety and extend the life of the aircraft. By the end of the semester Cool-Area will deliver a fully designed model of the attachment that improves flow through the intake and quantify the improvements by showing a better pressure recovery and less distortion on the compressor face.

105 – ASHRAE Student Design Competition 2019

Jose Andino, Bryan Cornell, Saroj Sapkota, Ang Dorje Sherpa, Everardo Soto
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

The Summit Group has been tasked to research, create load calculations and select an HVAC system for a small hospital in Budapest, Hungary. The 70,000 square foot, four-story hospital requires a system with consideration of the cost and impact for the next 50 years and an emphasis on sustainability and green design.

106 – Convolution Spindle

William Anthony, Carter Brown, Lavarris Carter, William McKenna, Mihirkumar Patel
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

Parker Hannifin wants to redesign the convolution spindle that is used in their corrugated tubing manufacturing process. The current spindle has the functionality required, but also has several shortcomings. A staging area is used to load the spindle with the tubing. The loading process can take upwards of 10 minutes and requires a step stool for shorter operators. The tubing is exposed during this process could be damaged and rendered unusable. Our redesign eliminates the need for the staging area and decreases the loading time. Our design also completely encloses the tubing, protecting it. By the end of the semester our team will provide a functioning prototype of our design.

107 – PTFE Preform Knitting Process Improvement

Blake Anderson, Marc Garcia, Andrew Hong, Thong Nguyen, Jarrod Rowlette, Thien Tran
Advisor: Raul Fernandez
Mechanical and Aerospace Engineering Department

Parker Hannifin manufactures polytetrafluoroethylene (PTFE) tubes by loading PTFE preforms, compressed cylinders of PTFE powder, into a ram extruder. During loading, preforms are attached to one another in a process called preform knitting. The process involves operators cutting the preforms by hand using an industrial razor blade, which is unsafe and inefficient, as the tubes fall out of size specifications where the knitting occurs. An actuating cutting mechanism, called the Enhanced Preform Knitter (EPK), was designed and prototyped to improve the knitting process by using a pneumatic actuator to provide cutting motion.

108 – Real Time Clogging Indicator for an Inlet Barrier Filter System

Edgar Cervantes, Elias Mata, Dante Seay,
Advisor: Zhen Han
Mechanical and Aerospace Engineering Department

Helicopters operating near ground and in unprepared areas are susceptible to ingesting dust and particles, reducing turbine engine life. Inlet barrier filters effectively trap the unwanted elements but over time, depending on the operating environment, become increasingly clogged, increase pressure losses and reduce engine power. Unlike vortex-type filters that have a known, fixed installation loss effect, inlet barrier filters have an additional, time-dependent degrading performance effect due to increasing clogging. To maximize filter life and operate at maximum performance, a real-time cockpit clogging indicator is required. Clogging is calculated from the following independent parameters: pressure loss across the medium, airspeed, outside air temperature, pressure altitude, and engine gas generator speed. The clogging indicator provides a scale representing the filter state ranges: clean, dirty, impending blockage. The clogging status requires an exact modeling from the mass flow and flight regimen, including dynamic filtering, based on available test data.

109 – 3D-Printed Aircraft

Salah Abusalah, Bosah Agolua, Zeshan Ahmed, Noor Diya,
Kaushik Iyer, Traevis Joshlin, Matthew Montoro
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

Forward Air is conducting research and development on 3D printing aircraft components. 3D printing, specifically additive manufacturing, is a very promising field for research and fabrication, especially in aerospace applications. From printing small components to designing jet engines, additive manufacturing holds great promise in maximizing the performance and minimizing the weight of aerospace components.

110 – 3D-Printed Aircraft Fuselage

Veronica Harmina, April Horton, Abraham Jimenez, Bijan Niakan, Ethan Scarlett, Shibo Yu
Advisor: Robert Taylor
Mechanical and Aerospace Engineering Department

We will attempt to successfully 3D print a scaled-down aircraft fuselage with a structural design that can withstand applied aerodynamic loads. This project has been worked on by multiple design groups over the past few years, but major printing failures, such as bead layer overlapping and contoured surface bonding failure, have prevented these groups from successfully printing a structurally-sound fuselage. These problems were also enhanced by an overly complex structural topology design. Now that a much simpler topology design has been developed, 3DAF now takes on the task of directly solving these major issues, and any more that may arise, through rough model creation, model refinement, structural analysis, and test printing. Once the fuselage is successfully printed with sound structural integrity, it will be tested with applied loads.

111 – Electric In-Wheel Drive System

Joseph Herring, Jacob Lamotte-Dawaghreh, Logan Pechal,
Tim Pugliese, Matthew Smith
Garrett Tolar, Advisor: Yawen Wang
Mechanical and Aerospace Engineering Department

Electric cars serve as a promising, though partial, solution to the issues facing our global climate. However, problems of range and efficiency have proved to be barriers for mass adoption. In this project, NextGen Drive is developing an alternative, more efficient drivetrain design. Specifically, while most vehicles are powered via a central motor connected to the wheels through a transmission, driveshaft and differential, our design uses motors mounted inside the wheel hub to directly drive each wheel. This eliminates the losses experienced in the various mechanical joints and reduces the overall weight of the vehicle, freeing up the engine compartment for alternative uses and enabling completely adaptive torque vectoring. At this point, the team has developed a preliminary design and is finalizing the suspension and steering geometry, as well as performing a stress analysis, quarter car analysis, and performance analysis for a hypothetical vehicle using this system.

112 – Design of Composite Monocoque for Formula SAE Racecar

Scott Berggren, Andrew Cardamone, Jeffrey Miller, Jason Morin, Taylor Shead, Mohsin Zaveri
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

CM Engineering is designing a carbon fiber chassis to be used by the UTA FSAE team for the 2020 competition year. Borrowing technology from high-tier motor racing, the current steel tube chassis will be replaced by a composite tube which will act as the cockpit and primary structure of the racecar. The project scope involves finite element analysis and physical testing to verify structural integrity, CAD modeling of interfacing components of the car, and a detailed procedure for the production of the chassis.

113 – Electric Scooter

Alejandro Garcia, Travis Malke, Nicholas Navarette, Cooper Rush,
Alexander Smith, Jeremy Smith, Matthew Woods
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

CAGE Consulting has developed a simplified solid model of a three-wheeled scooter prototype. The details in the model will be enhanced as the commercial products purchased arrive and are reverse-engineered. The initial scope of this project was for CAGE Consulting to design or purchase all non-electrical components of the scooter. This scope has since changed and CAGE Consulting will be taking responsibility for both the mechanical aspects of the design as well as electrical aspects. Our client can expect a prototype delivery that is both mechanically and electrically sound.

114 – Variable Displacement Combustion Engine

Jonathan Frederickson, Erica Glidewell, Robert Goller, Peter Hymel
Michael Paradis, Travis Riley
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

The Variable Displacement Combustion Engine is an axial engine design that allows the displacement of the engine to change to suit the load that it is placed under. Lower displacement for cruising and fuel savings; high displacement for times when power is needed. This would also allow the engine to stay in a peak efficiency range as it shifted its displacement from the low end to the high end. We compared the frictional losses in the design that was provided to us to the frictional losses in two comparable traditional internal combustion engines. We also selected bearings for use throughout the engine, refined the solid model design and solved other minor issues to move the design towards production.

115 – Wheelchair Dynamometer

Antonio Araujo, Chad Goodlow, Brandon Griffin,Jason Gulledge,
Matthew McCormick, Matthew Niestroy
Advisor: Robert Woods
Mechanical and Aerospace Engineering Department

The team was tasked to design and build a wheelchair dynamometer for application in research and physical fitness. People who use wheelchairs perform a unique, complex set of motions to move from place to place. A wheelchair user's driving motion is strongly dependent on both physical capability and level of disability. For biomechanists, to better understand a wheelchair user's strength and disability, it is helpful to quantify the output of this motion: the rotation of the main wheels. This rotation can be measured by comparing the rotational velocity of a user's wheels to a predetermined resistance. This information produces a quantifiable torque output which can then be compared from user to user. When the variable resistance electric motors are coupled with an externally mounted variable-weight flywheel, the wheelchair dynamometer can simulate a coasting like effect and serve as a physical fitness device.

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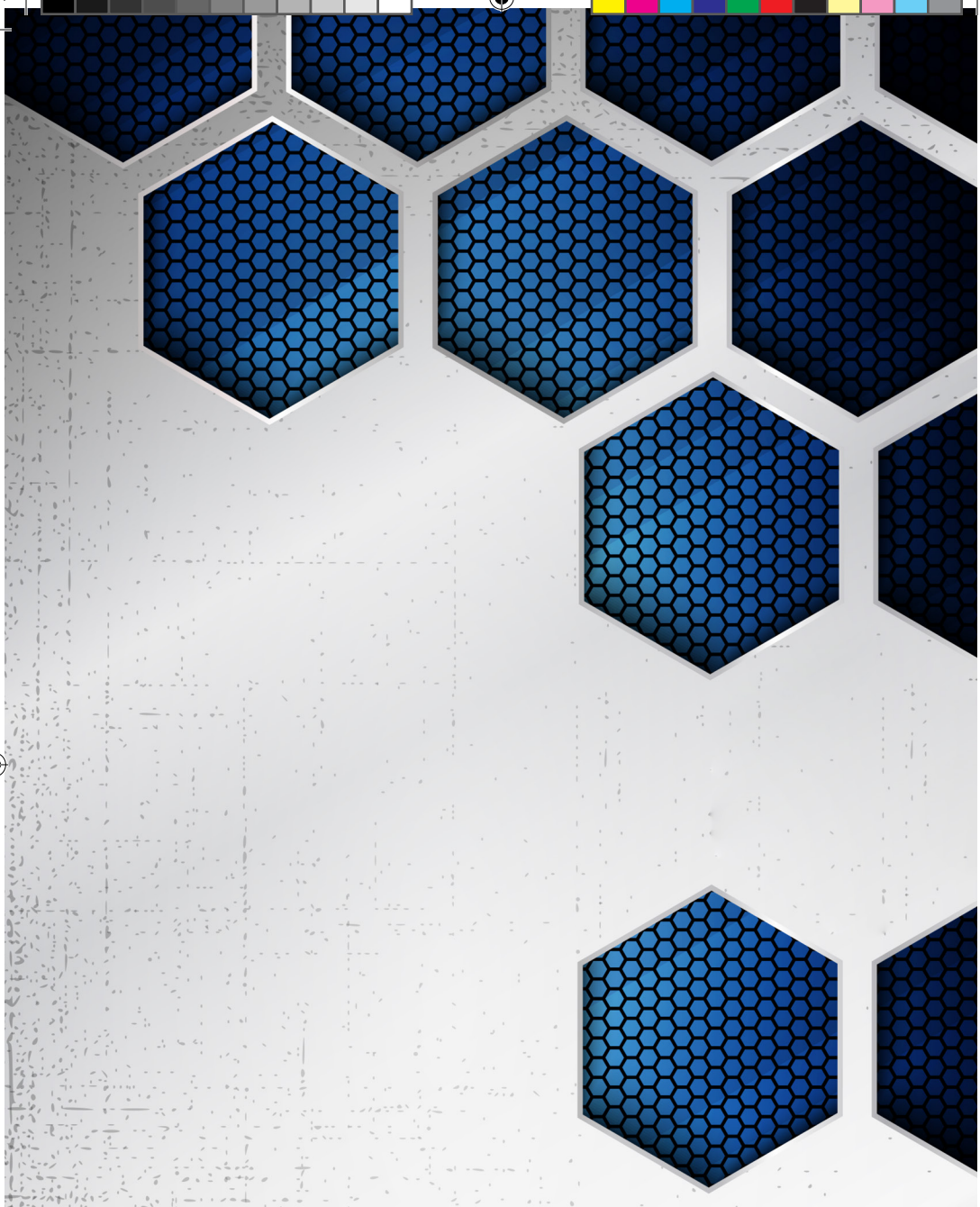

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