ROSE SHOW PROGRAM

May 3, 2023

Academic Program: Biology & Biomedical Engineering

(Table 10) The Gait Cycle Sensing Shorty

Presenter(s): Eryn Castaneda, Lexi Fortuna, Maggie Swank, Newt Ziegler
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Ahmed
Sponsor: Company: Quality of Life+, Client: Rob Jones

Abstract:
The Gait Cycle Sensing Shorty (GCSS) is a foreshortened prosthetic that eliminates the need for the user to swing their hips laterally. This device uses a gyroscope to track the angle of the user's residual limb. Based on the user's current leg angle, the on-board electronics of the prosthetic extend or retract to allow the user to swing their legs beneath their torso. This prevents the need for the user to laterally swing their hips typically associated with foreshortened prosthetics. This allows the user to maintain stability while walking with a more comfortable gait.

(Table 11) Electroencephalogram Pong Game

Presenter(s): Luci Duncan, Grace Hobson, Elliott Whiteside
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Ahmed
Sponsor: Dr. Alan Chiu

Abstract:
Dr. Alan Chiu, of Rose-Hulman Institute of Technology, requested the development of an interactive game for K-8 students to promote the interest of neuroscience. Our design, EEG Pong, is a videogame where a user can play the classic game pong using electroencephalography (EEG). It incorporates electrodes placed on the occipital region of the head and uses steady-state visually evoked potentials (SSVEP) to control the movement of the paddle from an EEG signal. A user focuses on one of two lights that are flashing at different frequencies located above or below the screen to move the paddle.

(Table 12) The Deluxo Sr.

Presenter(s): Noah Woodson, Jacob Meyers, Josh Suslowicz, Camden Ringo
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Ahmed
Sponsor: Dr. Hummer

Abstract:
The Deluxo Sr. is a mechanical load bearing arm designed for use in rTMS therapy, a repetitive treatment that alleviates symptoms of Major Depressive Disorders. The arm stabilizes the magnetic pulse emitting coil on the targeted location of the patient's brain while also allowing the patient to move his/her head in a natural manner. This is useful as in current therapy, the patient is required to remain still which causes discomfort. The arm functions using load bearing springs for weight support and locking ball and socket joints for stabilization and motion.

(Table 13) Multi-Sport Prosthetic Foot

Presenter(s): David Peacock, Conner Coffy, MaKenzie Morgan, Evan DeGroote, Emma Nichols, Prescott Brackett
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Buckley, Chui, Rogge

Abstract:
Team Reds' capstone design project entailed designing and fabricating a prosthetic leg for a Naval Veteran amputee. The project started with the goal of creating a device that would allow the client to lift, cycle, and play baseball. By the end of the project, the focus was on providing resisted dorsiflexion of the ankle to allow for athletic movements. Eventually, a design was chosen that incorporated a leaf spring in the ankle joint to always push the foot towards the neutral position, meeting the requirements and improving our client's quality of life.

(Table 14) The Eazy Rocker

Presenter(s): Danna Carreno, Breanna Rogers, Jia Webb
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Buckley, Rogge
Sponsor: Reach Services

Abstract:
The Easy Rocker is an automated rocking chair designed to mimic the motions of a standard rocking chair. Its purpose is to provide safe and comfortable rocking therapy for our client with DMD and ASD. The device is equipped with a joystick and Arduino which takes input from the user to determine the motor speed. In return, the motor uses a pulley and belt system to rock the chair back and forth, providing assisted rocking. Additionally, the Easy Rocker includes a speech device holder that allows our client to connect their Eyegaze Edge® speech device, holding it steady while rocking.

(Table 15) Lakeland Center Biofeedback Stirrup

Presenter(s): Connor Stapleton, Ed Whetter
Program: Biology & Biomedical Engineering

Faculty Advisor(s): Dr(s). Rogge
Sponsor: Christy Menke

Abstract:
The task for Team RADAR was to make a biofeedback stirrup for Christy Menke at the Lakeland Center. The device measures the force a rider places on each stirrup over time and visualizes the difference between the two stirrups to validate the results of our client's hippotherapy sessions. The design consisted of load cells in series with the stirrups. To collect the data, an electrical housing is strapped to the bottom of the stirrup to house the electronics.

(NDA 97) Reverse Shoulder Implant Locking Mechanism

Presenter(s): Deven Cobb, Blake Deckard, Kiley McKee
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Ahmed, Buckley, Rogge
Sponsor: Zimmer Biomet

Abstract:
The objective of our project was to design an easily manufacturable and effective locking mechanism to lock the Glenosphere to the Baseplate (ball component of ball and socket joint in the Glenoid Cavity) of a reverse total shoulder implant, reducing the risk of fatigue failure in the implant and the need for revision surgery. Zimmer Biomet's current locking mechanism consists of a taper technique that makes use of draft angles to suction the components together. Our design consists of a dual pin path locking system which involves the user rotating a pin located on the inside of the Glenosphere Stem through a locking point to the final seated position on the Baseplate.

(NDA 98) Osteopunch Humeral Stem Removal System

Presenter(s): Chloe Koutsoumpas, Ebony Tyus, Emma Hitchcock
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Buckley, Rogge

Academic Program: Civil & Environmental Engineering

(Table 4) Bluffton Greenway Trail Extension

Presenter(s): Brendan Downey, Julia McGuire, Kenton Pardue
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Aidoo, Mueller
Sponsor: City of Bluffton, IN

Abstract:
The Bluffton Greenway Trail Extension connects the River Greenway Trail and the Interurban Trail and extends northwest along the Wabash River to the Old Bluffton

Cemetery in Bluffton, Indiana. The design includes two observation platforms along the river and a pavilion, parking lot, and kayak launch point at the cemetery trailhead located just south of the Old Bluffton Cemetery. Downey McGuire Pardue, Inc. performed all design work and supporting sampling and testing for this project. Upon completion, the Bluffton Greenway Trail Extension will serve as a vital link in the Indiana Visionary Trails project.

(Table 5) Wabash Valley Railroad Museum Design Project

Presenter(s): Emily Peterson, Charley Bernth, Rachel Becker
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw, Mueller

(Table 6) Camp Sycamore Valley Improvements

Presenter(s): Brianna Camero-Sulak, Caleb Urban, Andrew Calvert, Benjamin Kaufer
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Mueller
Sponsor: Girl Scouts of Central Indiana, Eric Mellinger

Abstract:
Camp Sycamore Valley is a 160-acre camp with operations and facilities conducted by the Girl Scouts of Central Indiana. The site is a rectangular parcel located near Purdue University in Lafayette, Indiana, off IN-26. The entrance of the site is at a plateau above the valley where most of the facilities exist. Much of the infrastructure that exists on-site is used for recreation of the anticipated clients. The terrain has significant changes in elevation, with plotted buildings on top of rolling hills, as well as a large density of trees. The following can be observed in sheet 3.The project objectives are to accomplish the research and design of a new route for the currently existing the access road, the design of the access road's pavement and subgrade, the design for management of storm runoff of parking lot and surrounding roads, the design of a replacement trail bridge over a small ravine, the restoration of the bank of the stream, and the geotechnical work for supporting efforts of all listed.

(Table 7) Silver Cricket Farm

Presenter(s): Alexis Juarez, Daniel Houng, Lily Byrne
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Mueller
Sponsor: Beller Family

Abstract:
For this project, we were tasked with restoring the site's historical barn and dam on the Silver Cricket Farm while respecting Wingdale's policies on historical preservations. Although the building is not registered as a historical building our design focuses on preserving the barn while maintaining the safety required by local code. The farm is a 21-acre plot of land a few miles away from the Appalachian Trail. There is a two-acre pond on

the site as well as a dam in need of repair. The historical barn has two levels to it and needs repairs to the superstructure. The site is along the northwest corner of the intersection between Old Forge Road and State Route 55. The Tenmile River runs along the northern boundary of the property. A stream flows from the river and splits into two branches. One leads to the two-acre pond near the southeast corner of the site. The other stream branches into a smaller pond along the western site boundary.

(Table 8) Riley Spur Trail

Presenter(s): Sean Childers, Logan McLaughlin, Jake Phillips
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Mueller
Sponsor: City of Terre Haute

Abstract:
The Riley Mixed-Use Trail is a proposed trail along a six-mile segment of railroad right-of-way between S Canal Street, in Riley Indiana, and Eldridge Road in Terre Haute. The proposed design for the trail includes a hard-capped pavement, multi-use trail for pedestrians and cyclists. This trail design includes an eight-foot asphalt paved trail, natural screening for the portions that pass near residential neighborhoods, a renewed Honey Creek bridge crossing, safety signage, and room for parking at the trails ends. The design sets the trail up to be expanded in both directions later.

(Table 9) DCAN Academic Campus Project

Presenter(s): Adam Saliu, Zachary Jackson, Lance Shelton, Chris Kossos
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Mueller

Abstract:
The Development Concern Academy of Nepal's (DCAN) objective is to create a training complex for elected, nominated, administrative, and professionals working in the local community. The facility will help that selected group of people learn to develop Nepal and make it a better country for everyone, not just themselves. The site of this training complex is located in western Nepal, north of the city of Dhangadhi, Nepal. The site is currently unused, undeveloped, and is located next to the Mahakali International Highway. Occasionally and temporarily, the site is used for the repair of highway vehicles and storing of construction materials. The land surface is essentially flat and our site sits at an elevation of 358 feet (109 m).

Academic Program: Computer Science & Software Engineering

(Table 1) AllAboutFood: An Interactive Voice for Cooking Recipes

Presenter(s): Samuel Munro, Andrew Sullivan, Zhen Yang, Brock Buczkowski
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Richard Gollhofer

Abstract:
"AllAboutFood" is an interactive system that integrates multiple connected internet systems and grants users the ability to interact with cooking recipes in multiple ways. The backend of the system utilizes many backend services including Firebase and various AWS services, including Lambda, DynamoDB, and S3. These methods are through a Flutter App, which runs on web, Android, and iPhone, and the Amazon Alexa Smart System. The former enables users to create, edit, and fork other users' recipes while the latter allows users to uniquely navigate their recipes hands free!

(Table 2) SimSE Redesign Project

Presenter(s): Isaac Friedman, Lucas Pickens, Kati Jurgens, Michael Webb
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: Shawn Bohner

Abstract:
The SimSE project management game is a tool used in classrooms and workplaces to teach project management styles. The current game is confusing to learn, difficult to use, and overall feels outdated in a modern learning environment. To make the game continually viable for use in a classroom or workplace, our team updated both the visual and interactive elements of the system, as well as the backend frameworks, to fit a modern standard. From this, project management models in wide use today will be able to be implemented through the system as it moves forward to the open-source community.

(Table 3) RetireSimple: Extensible Retirement Modeling Solution

Presenter(s): Alex Westerman, Ryan Nikolic
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). S
Sponsor: Dr. Kim Tracy

Abstract:
RetireSimple is an open-source software framework and application focused on providing financial models of asset values with respect to retirement planning. The project is focused on transparency, user agency, and modularity compared to existing solutions. We include significant documentation of the framework portion of the project, allowing for easy

extension of functionality or integration with other projects. The project also embraces open-source development practices and project management techniques to evolve the project's features and UX through developer contributions and user feedback.

(Table 19) IRPA Chatbot

Presenter(s): Yiqi Zhao, Bowen Ding, Justin Kim, Travis Zheng
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: Dr.Timothy Chow

Abstract:
The Institutional Research, Planning and Assessment (IRPA) office at Rose-Hulman is responsible for providing information about the college to other univerisities and organizations such as US News, through an annual report know as the Common Data Set. This report includes a wide range of data and general information on topics like enrollment, admission, and student life. The IRPA office also receives frequent inquiries seeking this information from the external parties who engage with the information exchange process and also Rose-Hulman staff. Answering the questions manually through emails and phone calls can be a very time-consuming task and tedious task. To provide an interactive way and self-service way for users to access information, a chatbot could be created to answer questions about the Common Data Sets report. The Common Data Set is updated annually in a consistent format and the chatbot could be trained to respond to queries within that domain. With each new report, the chatbot's knowledge base could be expanded, providing users with information on different years. This would save time for both users and the IRPA office, while also allowing the office to track frequently asked questions and potentially uncover any unanswered questions that the chatbot system could be updated to address. Overall, implementing a self-service chatbot would improve the efficiency and effectiveness of the IRPA office's information-sharing processes.

(Table 20) PANDA Studio

Presenter(s): Evan Brill, Steve Finn, Nick von Bulow, Blake Storoe
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: MIT Lincoln Laboratory

Abstract:
PANDA Studio is a web client created for interfacing with PANDA, a tool used for software reverse engineering (SRE). PANDA Studio is capable of creating custom VM images, allows users to define custom interaction programs, and allows users to run programs with a specified image. The result is a full-system recording which logs all calls made during a program's execution, including non-deterministic actions such as user input. This tool has applications in different areas of SRE, such as malware analysis.

(Table 21) Mobile Patient Care Application

Presenter(s): Aidan Mazany, Azzam Turkistani, Yutong Chen, and Rongxin Tian
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Jimmy McKanna from Union Hospital

Abstract:
Our project is a cross-platform mobile application for iOS and Android devices that seeks to personalize remote patient monitoring for Union Hospital. The goal is to allow medical providers to easily observe live patient medical data recorded from Bluetooth devices and facilitate communication between parties in a variety of ways. Patients are given an intuitive way to observe and transmit their readings to the hospital, while providers are given a way to monitor the well-being of their patients through an alert system that notifies them when potentially hazardous readings are recorded.

(Table 37) Remote Monitoring of Robotics

Presenter(s): AJ Yilmaz, Eric Hamilton, Luke Ferderer, Olivia Sexton
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Beckman Coulter

Abstract:
In order to monitor medical sample processing robots, our system connects to 6 cameras placed around the robots. These cameras capture color and depth video of the robots which we encode in real time to stream to a website for remote viewing. When a fault is detected in the system, we save the video surrounding the fault to a database with a note as to what cameras had the best view of the fault. Past fault videos can be viewed on the website. This is all achieved through a tech stack that involves FFMPEG, MongoDB, Redis, OAK-D cameras, Python, and NodeJS.

(Table 38) Celer: Breath of the Wild Speedrunning Engine

Presenter(s): Braden Kattman, Reid Tate, Abhinav Chowdavarapu
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Liou
Sponsor: Michael Zhao

Abstract:
Speedrunning is the process of completing a video game as fast as possible. One of the most popular games for speedrunners is Legend of Zelda: Breath of the Wild. These speedruns can have hundreds or even thousands of steps. We have developed the Celer web app that provides many features that makes the speedrunning process much easier for the Breath of the Wild community. Using Celer, players can easily reference both a numbered list of steps and a map of the game's world showing where each step occurs in the game.

(Table 39) meHive - People Networker

Presenter(s): Brandon Jackson, Hunter Masur, Ian Barthel, Anakin Fry
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Jeff Gilberts

Abstract:
The meHive - People Networker project expands on a previous senior project where they developed a website that allowed users to keep track of the people that they have been in contact with professionally. It keeps track of when the last time you were in contact with these people, and provides a visual indicator of how long it has been since the user last contacted them. This year, our team has worked to add authorization and authentication, importing Salesforce contacts, connecting to an AWS database, and ensuring the website works on mobile browsers.

(Table 55) Real-time Agriculture Data Display

Presenter(s): Srikar Namburi, Liam Hill, Dabin Choi, Emre Otay
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Liou
Sponsor: Zac Hollis, Capacitrac LLC

Abstract:
Capacitrac LLC is a new player in the agricultural sector that uses technology to support farmers. Currently employees spend a considerable amount of time manually converting sensor data into the appropriate format to track the capacity of feed bin usage. The team developed a way to automate this process. To this end, we have also created a full-stack website and Python script that transforms sensor data into usable formats and displays real-time visualization. We have committed ourselves to delivering the best possible solution for Capacitrac and the agricultural industry.

(Table 56) Geospatial Data Catalog and Analytics

Presenter(s): Jared Petrisko, Collin Morris, Max Chaplin, Willie Bowman
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Johns Hopkins Applied Physics Laboratory

Abstract:
This project was submitted by the Johns Hopkins Applied Physics Laboratory. Researchers at the Johns Hopkins APL utilize different types of satellite and geospatial data routinely to support disaster relief efforts, such as wildfire containments or identifying flood zones after a hurricane. Researchers currently have a tough time, however, finding the data they need since it's unstructured, huge, and scattered between different file systems within the

lab. Thus, the purpose of this project is to create a flexible, maintainable, and easy-to-use framework for cataloging and querying large geospatial datasets.

(Table 57) Roommate Budget Helper

Presenter(s): Jason Cramer, Charlie Cryer, Curtiss Davis, David Purdy
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: Donald Sisco, James Edwards, Sam Pastoriza

Abstract:
Roommate Budget Helper is a progressive web app that simplifies household budgeting. Users can create households, invite roommates, and manage shared expenses. The app sends billing reminders and tracks payments, making it easy to split bills and keep track of who owes what. Accessible on mobile and desktop, Roommate Budget Helper is the perfect solution for anyone looking to simplify their shared living expenses.

(Table 73) GLADOS: Automated Science Pipeline

Presenter(s): Rob Budak, Brian Chan, David Sampson, Riley Robinson
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Jason Yoder

Abstract:
Every year progressively more research can be done with computational models. When conducting experiments with such models, researchers must additionally write code to vary sets of input parameters, collect the results of the experiments, and write code to analyze and visualize the results. These 'boilerplate' activities waste time that could be spent directly furthering their research. GLADOS: Automated Science Pipeline allows researchers that have already developed a computational model to automate many of the remaining processes in conducting their research, such as specifying input parameters, offloading computation to powerful shared compute resources, and aggregating and visualizing results.

(Table 74) Reverse execution with persistent data structures

Presenter(s): Omar Roth
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Hollingsworth

Abstract:
Reversible debuggers are useful tools for developing and deploying modern applications. However, due to their high memory requirements and runtime overhead, their functionality is generally reserved for rare cases (e.g., identifying short-term memory corruption). The work included in this poster describes an alternative approach for implementing a low-overhead memory snapshotting mechanism using fully persistent data

structures. Memory usage and performance analyses will be presented and compared against alternative implementations.

(Table 75) Migraine-Aid

Presenter(s): Andre Battle, Kush Bhuwalka, Sam Stieby, Saayeh Siahmakoun
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Hytrina Wang

Abstract:
Migraine-Aid is cross-platform mobile app designed to help individuals suffering from chronic migraines to track their daily habits painlessly. The app allows users to record their sleep patterns, food intake, exercise routine, stress levels, and other relevant factors that could impact their migraine symptoms under two minutes using a personalized daily log based on their preferences and personal information. Users may also record the migraines themselves. The app does not perform any medical analysis based on the user's private information, but instead creates a summarized report that they can view or export (i.e. email/print and take to their designated medical professional).

(Table 88) C Automated Testing System

Presenter(s): Jordan Ansari, Jessica Xiang, Cade Parkhurst, Emily Hart
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Vertex/ V2X - J.D. Hill

Abstract:
The Vertex team wanted to overhaul a legacy testing system used to interface with a specific in-development MIL-STD 1553 device. The newly developed system, C Automated Testing System (CATS), allows users to send and receive data from the hardware-under-test, while also giving them the option to modify the data being sent. The application seeks to accomplish the same tasks the legacy system performed, while being developed with flexibility in mind to allow it to interface with more MIL-STD 1553 devices, thus allowing the Vertex team to validate the expected behavior of more products.

(Table 89) RoseData

Presenter(s): Sal Altobellis, Braxton Lee, Dalton Julian, Andrew Orians
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Rose-Hulman (Jason Yoder)

Abstract:
There are many different ways to access data at Rose-Hulman, but students, faculty, and department heads often have to navigate through many locations (e.g. schedule page, banner, web, emails, etc) to access the data they need. As a result, in many cases, the data is

not readily accessible. The goal of this project is to provide the Rose-Hulman community with a centralized location to find data pertaining to courses, students, and instructors. The current version of the app can be explored at rosedata.csse.rose-hulman.edu. Our team is the fourth team to continue development, and have mainly worked to have a robust backend for the degree planner and frontend for next year.

Academic Program: Electrical & Computer Engineering

(Table 59) 3-D Room Mapping

Presenter(s): Luke Dawdy, Sebastian Huemer, Will Rasp, Trilokshan Vinayagamoorthy
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: Milwaukee Tool

Abstract:
Our project aims to develop a cost-effective 3D mapping system for indoor spaces to enhance the speed and safety of construction while keeping costs reasonable. Our solution uses a combination of sensors and technologies to create a precise and accurate map of the average home's rooms. By focusing on a less expensive approach, our system will be accessible to a larger number of construction sites. We started by rasterizing simpler spaces and gradually built up to more complex spaces, evaluating the accuracy of the system at each stage of development. The outcome is a functional prototype that provides a valuable tool for the industry.

(Table 60) Direction Detection and Modulation Identification of RF Signals

Presenter(s): Logan Ramon, David Mattingly, Jared Englert, Luke Lohman
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: NSWC Crane

Abstract:
The goal of this project is to create a way of detecting and classifying various RF signal sources using Software Defined Radio and Machine Learning. This product will help pilots to detect, identify, and locate a series of RF targets with little interaction for fast communication between themself and the system, especially in the application of warfighters. The project deliverables will include clear documentation of algorithms and models used to detect and locate the RF signals, a user manual that will tell the user how to operate the system as well as include a verification of system requirements, and a working system with a GUI for the user to interact with as well as a display to show the system's outputted information.

(Table 61) Developing Computational Architectures (DeCA)

Presenter(s): Melina Ferner, Zackary Painter, Eliza Romeu, Olivia Sexton, Isabel Wilson
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder
Sponsor: Dr. Mario Simoni and Dr. Daniel Chang

Abstract:
This project is a contribution to ongoing research for our clients, Dr. Simoni and Dr. Chang, to help develop computer architectures optimized for simulating neurons to advance the field of neuroscience. With current technology, it is difficult to simulate neurons efficiently because of the complexities of the math involved in the most widely used and accurate models. Most existing simulations need to be run on expensive, dedicated equipment [1]. We seek to provide the ability to quickly simulate and compute reactions between neurons with an inexpensive, custom-designed architecture optimized for neuron simulation. This is important to the neuro-research community because it will allow for quicker and more in-depth research that is accessible to more people.

(Table 62) PANDA Studio

Presenter(s): Blake Baker, Cooper Brotherton, Mike Bryant
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: MIT-Lincoln Labs

Abstract:
PANDA is an open-source, popular reverse engineering tool widely used in both industry and academia. PANDA has the ability to emulate various computer architectures such as x86 and ARM. Additionally, it can record and replay executions of instructions, enabling iterative, deep, whole system analyses. The overall task of “PANDA Studio” is to design a service around PANDA which eases the creation and sharing of recordings. This is accomplished by the user interacting with a web interface to specify a base virtual disk image and create a list of interactions to produce the desired recording.

(Table 63) Appliance Leakage Current and GFCI Interoperability Meter Design

Presenter(s): Sam Aiello, Aliya Gosdin, Becca Turner, Gaven Williams
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett, Simoni
Sponsor: Schneider Electric

Abstract:
The team has been tasked with creating a device that consist of a precise clamp-on ammeter that takes in the differential leakage current from the wires going to the appliance

and process the data such that it can possibly be seen in both real time using an oscilloscope and store the data for further analysis at a later time in a lab.

(Table 64) Digitally Controlled, High Frequency/Power Density, GaN DC-DC Converter

Presenter(s): Clay Scheurer, Raymond Zhao, Zach Buvalic, William Chong
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett, Simoni, Song, Yoder

(Table 65) Microchip AVR IoT Pollution Monitor Sensor

Presenter(s): Logan Bryant, Eric Hamilton, Maggie Frachioni, Luke Wendel
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Simoni, Yoder
Sponsor: Microchip

Abstract:
The team's goal was to use four Microchip IoT Cellular Mini development boards to implement a pollution and environmental monitoring system consisting of wireless devices that communicate with a user dashboard. The devices and dashboard are to be used by Microchip to demonstrate the capabilities of their IoT Cellular Mini boards at various technical trade shows. The wireless devices were placed around the Rose-Hulman campus to monitor different areas for fluctuation in pollution levels. The devices required enclosures for the sensors and the power supply to protect the electronics from outside actors such as wild animals, strong winds, and precipitation. The devices were fitted with the same set of sensors and configurations to ensure uniformity in the data collection and analysis process. The devices are capable of lasting at least 6 months continuously on the same power supply. As data is read, the devices temporarily cache the data and then periodically, send the data, formatted as an MQTT publish message, wirelessly over a cell network to an application created by the team and running in the Amazon Web Services (AWS) cloud. The cloud application then stores the data for later recall through a user dashboard for display and analysis. Similarly, a machine learning algorithm, adapted by the team, uses the stored data to generate a forecast for the following day's temperature, humidity, and pollution levels.

(Table 66) M18 Battery Combiner

Presenter(s): Sophia Harrison, Abel Keeley, Advait Pandharkar, Michael Earl
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder

(NDA 99) SpaceWire to S-Band Converter with FPGA Compression & QPSK RF Transmission

Presenter(s): Natalija Pumpurs, Josh Mitterling, Donald Hau, Skyler Cleland
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder

(NDA 100) Texas Instruments Battery Management System Demonstration

Presenter(s): Derick Miller, Raf Qian, Taiwo Arojojoye, Marco Saucedo
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder

(NDA 101) NSWC Crane Drone Augmented Reality Tracker (DART)

Presenter(s): Ethan Swallow, Alex Gresock, Triston Hine, Martino Kim
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett, Simoni, Song, Yoder

Academic Program: Engineering Design

(Table 41) Bullseye

Presenter(s): Jeremiah Sweeny, Margo Leone, Daniel Huery
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
Bullseye is a physical game which integrates sensors and signals by challenging two players to compete with each other to accurately throw balls at various targets.

(Table 42) Dr. Brackin Painting

Presenter(s): Kailia James, Sergio Coco, Ryan D'Aquila, Lauren Jaracz
Program: Engineering Design
Faculty Advisor(s): Dr(s). Bhatta, Brackin, House, Mutchler

Abstract:
In the Engineering Design studio, Dr. Brackin's presence ensures that all students are held accountable. When she is not in the studio, our level of focus is reduced. Our project is to allow Dr. Brackin to be always in Studio through a painting of her with eyes that track people walking by. If a student needs some encouragement, they can go up and wave their hand to receive her words of wisdom.

(Table 43) Element Offroad Axle Disconnect System

Presenter(s): Calvin Jorgensen, Connor Luce, Randyn Tarnoff, Michael Wilson
Program: Engineering Design
Faculty Advisor(s): Dr(s). Bhatta, Brackin, House, Mutchler
Sponsor: Element Offroad

Abstract:
Element Offroad Axle Disconnect Abstract Element Offroad's aim is to take side-by-side vehicles to the next level of performance by creating a universal, modular, disconnecting axle shaft, which decreases tire wear, and will allow for future developments in turning brakes and four-wheel steering for side-by-side applications.

(Table 44) AudioLock

Presenter(s): Henry Faris, Ian Frensemeier, Ryan Schmidt, Jaxon Allen
Program: Engineering Design
Faculty Advisor(s): Dr(s). Bhatta, Brackin, House, Mutchler
Sponsor: Engineering Design Department

Abstract:
Introducing AudioLock, an innovative automatic door locking mechanism that ensures the security of your home or workplace. Equipped with advanced sound and IR sensors, AudioLock, when activated, automatically closes and looks any door. It can be remotely activated via voice or IR remote. This product offers convenience and peace of mind, as you no longer have to worry about whether your door is properly locked. AudioLock is easy to install and use, and its sleek design fits seamlessly onto any door frame. Say goodbye to the hassle of manually locking your door with AudioLock.

(Table 45) Biometric Responsive Jewelry

Presenter(s): Skylar Kellogg, Chase Martin, Liz Purintun
Program: Engineering Design
Faculty Advisor(s): Dr(s). Bhatta, Brackin, House, Mutchler, Noffke

Abstract:
The Biometric Responsive Jewelry Project allows users to monitor and display their biometrics using a wearable necklace and wristband. The jewelry provides a visual indication of heart rate through adaptive LED lighting inside the necklace, obtaining data real-time via a Bluetooth connection to the wristband.

(Table 46) Geaux

Presenter(s): DJ Bernard, Rowan Hein, Kyle Chitwood, Palmer Harrell
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
Tracking false start and finish times is difficult in nonregulated races. To solve this problem we designed “Geuax”. Geux is a start and finish time tracker designed for casual races amongst friends. Get Ready, Get Set, Geuax!

(Table 47) TerraFlow

Presenter(s): Prabhat Vadlamani, Quinlan Walinder, Xiaoxi Luo, Cesar Osornio
Program: Engineering Design
Faculty Advisor(s): Dr(s). Bhatta, Brackin, House, Mutchler
Sponsor: Dr. Brackin, Dr. House, Dr. Bhatta, Dr. Mutchler

Abstract:
Terraflow is a device which allows users who have little time or experience with plants to keep their plants happy with little maintenance. Terraflow is inserted into the soil of a plant pot connected to a water reservoir. When Terraflow detects that the soil is dry, it alerts the user and waters the plant autonomously. It will also give the user details regarding the condition of the plant including temperature, humidity, and light level.

(Table 48) Board Game Database

Presenter(s): Austin Clarke, Isaac Johanningsmeier
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin, Chenoweth, Watt

Abstract:
The Board Game Database is a java program that allows users to virtually organize their board game collection. Users can add games to the database and provide information about the number of players that can play, how long it takes to play, what type of game it is, etc. We decided to localize our program’s interface to German culture as part of cross-cultural design requirements.

(Table 49) Stand Mixer Remote

Presenter(s): Mindy Altschul
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin, McCormack, Taylor

Abstract:
The purpose of this project was to explore emotional design through the process of designing a remote. I designed a remote for a KitchenAid stand mixer targeting busy or forgetful bakers. With my remote, users can set a time and power level for their stand mixer to run then automatically stop.

(Table 50) SCOUT - The DIY Submarine

Presenter(s): Jacob Gray, Ruben Jevremovic, Jacob Kandel
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin, Noffke, Watt

Abstract:
Scout is a submarine kit that allows budding STEM (Science, Technology, Engineering, and Math) enthusiasts to build their own RC submarine with a built-in live camera system. The idea is that with a kit, the user can gain educational value by assembling the submarine. After assembly, the users can use the sub to explore nearby underwater areas, such as the bottom of a lake.

(Table 51) AquaPack

Presenter(s): Aaron Greve, Austin Perry, Chase Strother, Gavin Meier, Madeleine Klee, Richard Barker
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin, Watt
Sponsor: Sawyer

Abstract:
The AquaPack is a portable and compact water filtration system that uses advanced filtration methods to filter out nearly all contaminants found in water. The system is concealed within a backpack, making it ideal for Red Cross responders, hikers, and natural disaster victims who require a reliable source of clean water in remote locations. The backpack filtration system combines several filtration methods, including a Sawyer filter, resin beads, purifying tablets, and a UV-C light, to ensure effective and holistic filtration. The AquaPack is designed for ease of use, and the system can filter up to two liters of water at a time. The unique features of the AquaPack, including its portable design, elevated filtration rate, and comprehensive filtration methods, make it stand out from other water filtration systems.

(Table 52) MathMonster

Presenter(s): Richelle Elkes, Isabel Haut, Sebastien Hughes
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin, Watt

Abstract:
MathMonster was inspired by the desire to help elementary school students who are struggling with basic arithmetic. At the same time, the National Academy of Engineering's (NAE) advance personalized learning grand challenge encouraged us to develop an innovative solution that meets the diverse learning needs of students. By using physical tiles and visual feedback, students can create and solve equations while receiving

immediate feedback on their accuracy. Overall, the product is designed to reinforce the user's understanding of addition, subtraction, multiplication, and division.

(Table 53) Lucha Legend

Presenter(s): Dylan Settles, Jester Moya
Program: Engineering Design
Faculty Advisor(s): Dr(s). Chenoweth, Watt

Abstract:
Introducing the Lucha Legend, a fun and interactive way to discover which wrestler's personality best matches your own. This quiz features ten popular wrestlers from different eras and regions of professional lucha libre, each with their unique wrestling style, attire, and persona. Answer a series of questions about your preferences, traits, and reactions in the ring to find out which wrestler and wrestling style you align with the most. Whether you prefer high-flying moves like Rey Mysterio and Mistico, or powerhouse tactics like Mil Mascaras, the Wrestling Personality Quiz has got you covered. Take the quiz and find out which wrestler you are today!

Academic Program: Extracurricular Competition Team

(Table 85) ChemE Car

Presenter(s): Caspar Freeze, Christian Schneider, Cliff Baker, Sophia Gospodinova, Jonathan Vanderlyn, Nathan King, James Franke, Anna Thomas, Gwynneth Menzie, Natalie Green
Program: Extracurricular Competition Team
Faculty Advisor(s): Dr(s). Reizman

Abstract:
ChemE Car builds a shoe-box sized car entirely powered by a chemical reaction. The car competes in an accuracy-based competition at the regional AIChE student conference. The design this year features a zinc-air battery to power a motor, and a vitamin C Iodine Clock as a stopping mechanism.

(Table 86) Human Powered Vehicles

Presenter(s): Briggs Fultz, Riley Lopian, Ray Bates, Brandon Taylor, Conner Tasik, Nithin Saravanapandian, Darshan Patel, Kevin Cotellesso
Program: Extracurricular Competition Team
Faculty Advisor(s): Dr(s). McSweeney

Abstract:
We design, build, and race a bike for the ASME e-Human-Powered Vehicle Competition. This year we built for straight line speed, manufacturability and we put in a lot of time into looks. This was the first year with an electrical component, and we designed and

implemented a friction mount motor with our own code. This was an ambitious goal with a lot of learning and a lot of explored mechanical mechanisms. We ended up finishing 3rd for the endurance race and hope for more in next year's senior design.

(Table 87) Rocketry Club – Project Kirkpatrick

Presenter(s): David Meisinger, Peter Tselekis, Jake Armstrong
Program: Extracurricular Competition Team
Faculty Advisor(s): Dr(s). Kirkpatrick
Sponsor: SGA, BIC, and Kologan

Abstract:
While participation in the NADA University Student Launch Initiative comes high technical expectations on our competition team on par with those in industry. The goal of the competition is to launch a rocker to 4,000-6,000 ft equipped with a payload that, upon landing, can receive RF commands to take pictures with some kind of rotation-enabled camera. The strict documentation requirements ensure that the rocket is safe and meticulously designed. Our rocket stands 8 ft tall, achieves an altitude of 5000 ft, and is fitted with custom 3D printed bearings and a bay door that deploys a small camera upon landing. The payload motherboard was designed by our students and fitted with a Raspberry Pi, altimeters, a receiver and transmitter. While the team didn't make it to the competition due to all the bumps along the road (and bad weather), the team has built an incredible system worthy of showcasing.

Academic Program: Humanities, Social Sciences, and the Arts

(Table 92-96) Art Exhibition

Presenter(s): Vance Allen, David Kovar, David Peacock Jr., Lily Schoenewolff, Elliya Sorenson, Zoe Sterr
Program: Humanities, Social Sciences, and the Arts
Faculty Advisor(s): Dr(s). Abas

Abstract:
As part of the Watercolor Painting class (ARTS H360), students are presented with opportunities to explore various techniques and approaches to the medium. The work you see here is a combination of different projects we do in class:
Recreating Masters' Work: Students select an artist and explore their unique style then recreate the same composition based on the visual analysis. The objective is to adopt a master painter's approach to their work, and attempt to construct the painting in the same way the artist did.
Painting from observation: In observational painting projects, students work on a single object and explore visual problems such as depth, mass, compositional balance, texture and color accuracy.

The relief print included in the show is from a project in Art History class (ATRS H442) where students explored carving and printing a linoleum block and had the opportunity to use a printing press.

Academic Program: Mathematics

(Table 22) Simulation of Lizard Scale Patterns with Cellular Automata

Presenter(s): Rikako Shimizu
Program: Mathematics
Faculty Advisor(s): Dr(s). Rickert

Abstract:
Natural patterns of some seashells, snowflakes, and animal coat patterns can be modeled by cellular automata. Similarly, the skin pattern on an ocellated lizard can be generated using cellular automata to simulate the behavior of the skin pattern with age. Throughout the development of the lizard from the juvenile to adult phase, individual scales. Parameters of cellular automata were varied in simulations to conduct and observe the changes in lizard scale patterns to the predicted pattern.

(Table 40) Mathematics of PET image reconstruction

Presenter(s): Pierce Ellingson
Program: Mathematics
Faculty Advisor(s): Dr(s). Holder

Abstract:
Positron Emission Tomography (PET) is a medical imaging technique used to image physiological activity within a patient's body by detection of nuclear decay events occurring in the body from a radiopharmaceutical. We investigate methods of image reconstruction from detector data using a maximum likelihood methodology.

(Table 58) Stochastic Volatility Model for Assessing Pricing

Presenter(s): James Guan
Program: Mathematics
Faculty Advisor(s): Dr(s). McSweeney

(Table 76) An Investigation Into Lagrangian and Hamiltonian Mechanics

Presenter(s): Jared Poston
Program: Mathematics
Faculty Advisor(s): Dr(s). Finn
Sponsor: Mathematics Department, Dr. David Finn

Abstract:
When physics is first learned in the classroom, Newton's laws, namely the 2nd law, stating that the time derivative of momentum is equal to the mass times to acceleration, are used to solve mechanics problems. For more complicated systems, however, this method turns out to be unwieldy, so we turn to Lagrangian mechanics, which utilizes calculus of variations and minimizing total energy, and Hamiltonian mechanics, which uses differential forms. Having various frameworks to employ allows for a diverse number of mechanics problems to be solved, and that is something this project explores.

(Table 90) What Effect do Fake Reviews Have on Product Ratings?

Presenter(s): Jayden Foshee
Program: Mathematics
Faculty Advisor(s): Dr(s). Shibberu

Abstract:
As the e-commerce market is a multibillion dollar industry, the impact fake reviews have on consumer decisions is vital knowledge. Advancements in AI bot technology and the intent for human deception make fake review identification complex. Due to identification difficulties, minimal labeled datasets for fake review detection are accessible on online data platforms. Thus, a set of seven self-defined labeling rules were used to hand label 2,011 reviews to generate a unique and valuable dataset. Utilizing Naive Bayes, LSA, Logistic Regression, and PCA, label prediction accuracies neared the baseline and no significant disparities in the product rating were observed.

(Table 91) Major Events Affecting the Lebanese Economic Crisis

Presenter(s): Tretter Lyons
Program: Mathematics
Faculty Advisor(s): Dr(s). Tarrant

Abstract:
This research investigates the Lebanese liquidity crisis by analyzing the black market exchange rates of the Lebanese pound (lira). Black market exchange rate data were collected daily from December 1, 2018 until March 14, 2023 in order to determine events that contributed to its large increases. We performed change point analyses on the data to determine the dates where pivotal shifts in the exchange rate were found. We were able to analyze the dates and tie them back to events that occurred in Lebanon around that time. We used the R changepoint package to perform two change point analyses; one identifying changes in mean and one identifying changes in mean and variance. The change point analyses were performed on the daily exchange rate as well as the natural log of the daily exchange rate due to the exponential nature of the exchange rate near the end of the data. We found that there were many events in Lebanon that affected the exchange rate of the currency. Some of these events include the COVID19 pandemic, the prime ministers resignation, and even natural events such as a wildfire. Often times the exchange rate increased considerably prior to the event occurring often in anticipation of the event.

Academic Program: Mechanical Engineering

(Table 16) EV Cab-Over

Presenter(s): Rashard Brown, Ryan Foster, Robby Gunn, Madison Lindfelt
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Marion Body Works

Abstract:
Marion Body Works is an engineering and manufacturing-based company which specializes in commercial truck bodies and custom engineered vehicles. Marion is known for their use of aluminum frames and taking full advantage of aluminum's ability to be easily manufactured, while maintaining its strength and flexibility. The opportunity presented to our team by Marion included a full design and outfitting of an all-electric light-duty cabover. As the commercial trucking market begins to shift from diesel towards EV, a pre-built, customizable cabover, gives Marion the ability to be prepared for this new market opportunity.

(Table 17) RECLAIM: RECycling Low-cost Automated Injection Molder

Presenter(s): Emily Bartling, Annalise Gant, Bryson Halsey, Tommy Welch
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Tom Rogge

Abstract:
The purpose of this project was to create an interactive injection molding machine that molds recycled PLA plastic from Rose-Hulman facilities into a final product for users to take home with them. The client, Tom Rogge with the Rose-Hulman Branam and Kramer Innovation Centers (BIC and KIC), wanted this machine to not only recycle the waste PLA from the 3D printer farm, but also serve as an advertisement of student capabilities for prospective students. Currently, the KIC throws away over one hundred pounds of waste PLA per quarter. This waste can now be recycled and used in the injection molding machine, thus making the 3D printing operations in the KIC more sustainable.

(Table 18) Engineering a Community for Homeless Opportunity

Presenter(s): Therese Jaeger, Garrett Janning, Pat Kelly, Lane Lawrence
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Garri Knezevich

Abstract:
Team ECHO (Engineering a Community for Homeless Opportunity) is focused on aiding the homeless population in Vigo County. Countywide, the homeless population has increased

by over 200 individuals in the last year alone. Current resources for these individuals lack security and stability. Our mission is to provide a safe, secure, and comfortable living environment in the form of an affordable bicycle trailer for individuals who are lacking a stable living environment. We have worked closely with our client Garri Knezevich who aims to expand this project to other communities around the country.

(Table 23) Psyche Landing System

Presenter(s): John Blessinger, Caige Comstock, George Smiljanich, Bryon Williamson
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar
Sponsor: Arizona State University, in association with the National Aeronautics and Space Administration

Abstract:
A project to design a landing mechanism to land a spacecraft on the metallic asteroid Psyche. The proposed landing gear is designed to absorb the shock of landing on the asteroid and to support the craft in a variety of different surface conditions and landing scenarios. The design was created by seniors John Blessinger, Caige Comstock, George Smiljanich, and Bryon Williamson.

(Table 24) Automatic Potato Slicer

Presenter(s): Bryce Stull, Andy Jiang
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Bon Appétit

Abstract:
Bon Appétit serves hundreds of students every day for breakfast, lunch, and dinner. At each meal, they go through 400-600 potatoes worth of french fries. Currently, Bon Appétit buys pre-cut fries in bulk to keep up with this high demand because their manual slicer is too slow and labor-intensive. However, buying pre-cut fries is much more expensive than buying potatoes in bulk. Buying potatoes in bulk rather than pre-cut fries would save $1850.24 each week and allow Bon Appétit to buy locally sourced potatoes. To help Bon Appétit save a lot of money and allow them to buy locally, we are tasked with providing them with an automatic potato-slicing solution. Our potato slicer will be automatic, fast, cheap, efficient, effective, and easy to store.

(Table 25) The Clamp-on Trash Compactor

Presenter(s): Desmond Dunson
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal
Sponsor: Chambers

Abstract:
The majority of existing trash compactors are very expensive to purchase, install and repair. This unfortunately makes home trash compactors a luxury product that is not available to most average homes. If they were more easily obtainable, it would provide the convenience of not having to take the trash out as often as well as make each home more environmentally friendly. The clip-on trash compactor provides a cheaper alternative that can be attached to a typical large trash can that a consumer may own. This eliminates the need for installation which makes the compactor significantly more versatile. The mechanism meets necessary requirements to compact trash enough to aid in decomposition while only requiring a simple operating procedure by the user.

(Table 26) Tri-Leveled Billiards Table Ball Lift System

Presenter(s): Mason Wetz, Elon Wang
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal
Sponsor: Mr. Brian Brackee

Abstract:
Our Pool Ball Lift System helps to elevate the classic game to a whole new level. The client's objective is to design and build a new type of billiards table which allows players to create up and down vertical ball movement. This movement will be achieved by using a lift system between the levels of the table. Currently in its third year as a Rose-Hulman Capstone project, the table's base internal mechanisms are all completely functional for downward gameplay movement. This year, our group's main objective is to design and implement a functional ball lift system in order to finalize and send the completed project to the client.

(Table 27) Metallic Asteroid Sampling System (MASS)

Presenter(s): Jim Goulding, Douglas Dillion, Greg Ballen, Andrew Hubbard
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar
Sponsor: Arizona State University in association with NASA

Abstract:
A future unmanned mission to the metallic-type asteroid Psyche is planned to launch as early as 2029. Little is known about the surface of this asteroid, but it is hypothesized to be the core of a dead planet and thus more metallic than previously examined asteroids. The goal of this mission is to return samples from the surface of the asteroid, to determine its origin. We have designed a system capable of extracting and collecting samples from the surface of Psyche onboard the mission rover. Our system uses a steel crusher wheel to impact the surface and then a three scoop system is used to collect the dislodged sample.

(Table 28) reTHink Environmental Composter

Presenter(s): Rose Burnham, Sarah Cunniff, Tyler Smith, Chaikou Sow, Tish Youndt
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: reTHink

Abstract:
The goal of this project was to design and build a log roller composter for reTHink, a local non-profit organization dedicated to creating a more sustainable Terre Haute. reTHink accomplishes this with community gardens, educational classes, a zero-waste store, as well as a community composting program – which is where this project comes into play. The log roller will replace their current composters, as they are inoperable or smell incredibly bad. It will be used as a fun teaching tool to educate children about composting, allowing them to see the process over time with the clear window into the barrel.

(Table 29) GSI Self Cleaning Boot - Team 14

Presenter(s): Connor Dowden, Devin Palmer, Angus McKee, Reece Lewis, John Sluys
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Dr. Randy Turner from Grain Systems Inc.

Abstract:
Capstone Team Fourteen was approached by Grain Systems Inc. (GSI) to create a self-cleaning boot for a grain elevator. GSI is a manufacturer of commercial storage bins, grain silos, and processing facilities for the transportation and storage of various grains, located in Paris, Illinois. The proposed solution minimizes the grain that accumulates in the bottom of the grain boot, acting as a catcher to store any grain not picked up by the scoops that travel up the elevator. The solution also succeeds in not impeding the functionality of the elevator or heavily modifying the footprint of the original design.

(Table 30) GSI Uberboot

Presenter(s): Trevor Fagin, Julia Morales, Riley Randall
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: GSI (Grain Systems Inc)

Abstract:
Grain Systems Inc. is the world's largest manufacturer of steel farm bins, commercial storage grain bins, and grain silos. GSI acquired Intersystems a few years ago and, since this acquisition, GSI has been manufacturing both a GSI boot and an Intersystems boot system. The logistics of manufacturing two different products to accomplish the same task is unnecessary. This project aims to resolve this issue by comparing the current models,

choosing the best features, and integrating them into one hybrid or "uber" boot, maximizing operability and manufacturability while minimizing cost.

(Table 31) Reduce Nacelle Senior Design Team

Presenter(s): Andrew Edge, Nicholas Kiefer, Will Steuerwald
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar
Sponsor: Dr. Mertz

Abstract:
The Reduce Nacelle Senior Design Project is the third senior design team to focus on developing a small-scale wind turbine. This turbine will be used in the Collegiate Wind Competition (CWC). The CWC is a once-a-year student competition aimed at preparing students to enter the green energy field and revolutionize the industry. Dr. Mertz, the client of our senior design project, has been developing this competition wind turbine over the past two years with the help of two other senior design teams. By the end of the school year, we intend to deliver a nacelle with a much higher power output and a smaller nacelle size.

(Table 32) Skateboard for Jack

Presenter(s): Claire Smithers, Hayden Walter, Seth Frey
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal
Sponsor: Jack

Abstract:
Jack is a two-year-old child diagnosed with spina bifida, resulting in paralysis from the waist down. Despite his physical limitations, Jack has a keen interest in skateboarding, scootering, surfing, and playing the guitar. As he grows older, Jack has become increasingly aware of his inability to participate in these activities alongside his peers. In response, Jack's mother, Sierra, has requested our assistance in creating a skateboard-like device that provides lumbar support and comfort, enabling Jack to engage in these activities to the fullest extent possible. Our objective is to design a product that empowers Jack to ride skateboards with his friends, promoting inclusivity and fostering a sense of belonging.

(Table 33) Off Grid Refrigerator

Presenter(s): Brendon Crabtree, Nicole Lang, Michael Johnson, Sam Johnson
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: reTHink, Inc.

Abstract:
reTHink, a nonprofit with the goal of creating a cleaner Wabash valley, has several programs including community gardens to educate the public and provide fresh, free

produce. The purpose of this project is to design a non-electric refrigerator to sit outside and keep the produce from the gardens fresh during hot summer months. The design is based off of zeer pot technology and evaporative cooling to keep the inside of the fridge cooler than the outside environment.

(Table 34) Neoteric Hovercraft Cooling System

Presenter(s): Vance Allen, Kiera Chapuis, Jay Jochheim, Meagan Peavler, Justin Turner
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Neoteric Hovercraft Inc.

Abstract:
Neoteric Hovercraft Inc. required an improvement for their 100 hp hovercraft cooling system. This project was intended to generate an alternative solution to mitigate overheating issues on previously manufactured hovercrafts, instead of switching over to a newer system. A solution was constructed via experimental testing, computer simulation, and modeling. In addition to addressing overheating issues on previously manufactured hovercrafts, concepts were generated that can be applied to new hovercrafts.

(Table 35) AIAA Design Build Fly Competition Plane

Presenter(s): Preston Boling, Patrick Hottle, Madi Johnson, JJ Lay, Jordan Massey, Sam Quick
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers, Riley
Sponsor: AIAA, Raytheon

Abstract:
Design Build Fly (DBF) is a competition team, club, and ME Capstone project. They compete annually in the AIAA DBF competition, where they design and test a specialized airplane. This year's unique challenge was "Electronic Warfare." They were faced with the challenges of being able to carry a payload over 30% of the plane's gross weight and flying with a simulated jamming antenna mounted to the wingtip. The plane also had to be able to be rapidly assembled and disassembled into an airline-compliant shipping container.

(Table 36) Rose GPE Team

Presenter(s): Ben Christiansen, Chris Hanus, Nohom Kibrom, Bryce Kiesel, Jared Miller, Owen Campbell, Darshan Patel
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Constans, Rogge
Sponsor: The Branam and Kremer Innovation Center

Abstract:
The Rose Grand Prix Engineering (RoseGPE) is a student technical competition team that competes annually in Formula SAE (FSAE) competitions. RoseGPE is one of the largest

competition teams on campus and represents Rose-Hulman on an international stage in front of industry leaders. The competition requires building a new iteration of the vehicle each year. The goal is to improve each iteration through extensive research, development, and testing. The senior design team provides the foundation and primary driving force development of RoseGPE each year.

(Table 54) Diesel-Powered Porta-John Parade Vehicle

Presenter(s): J.D. Spiceland, David Kovar, Evan Cruse, Jack Kovacs, Zach Junker, Lukas Jones
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Dr. Zac Chambers

Abstract:
This Diesel-Powered Porta-John Parade Vehicle is a product for Dr. Zac Chambers, who is a member of the Zorah Shrine in Terre Haute, IN. Dr. Chambers and his Shriner brothers participate in summer parades, riding the parade route on small go-kart like cars aimed at engaging the children viewing the parade. When his go-kart proved to be unreliable, Dr. Chambers tasked this team with replacing it with a diesel-powered vehicle disguised as a painted Porta-John, grabbing the attention of each parade spectator on the route.

Knezevich who aims to expand this project to other communities around the country.

(Table 69) Collapsible Wind Tunnel

Presenter(s): Natalie Dillon, Nathan Benchley, Tyce Miller, Varun Jukareddy
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar
Sponsor: Dr. Stoecklein and Dr. Danesh-Yazdi (Rose-Hulman Faculty)

Abstract:
The current Rose-Hulman wind tunnels have limited testing space and cannot be moved from the Wind Tunnel Lab. There is also not enough space for another permanent wind tunnel in the lab. The KIC has storage space for temporary use, but not enough for a fully assembled wind tunnel. The current wind tunnels are rigid and bolted to the ground making them very difficult to move. The purpose of this project is to design an air-tight wind tunnel that can be stowed and has a larger test area than the current wind tunnels.

(Table 70) Electric Hovercraft Design Project

Presenter(s): Avery Lewman, Phil Theryan, Jackson Todd, Schuyler Wilcox
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Ted Leszczynski

Abstract:
The team was tasked by their client with designing an electrically powered hovercraft capable of carrying 5 people and their luggage. The craft must be able to fit on a standard 8' x 24' trailer and must be primarily constructed from sheet metal. The deliverables at the end of the project will be a detailed SolidWorks model and a drawing package of all sheet metal parts. Due to the large scope of this project, the team has prioritized the design of the chassis and interior. The client plans to use the design to garner investment for further development and future commercial production.

(Table 71) Jesse and JJ Powered Wheelchair

Presenter(s): Alex Chen, Pete Cross, Aidan Moulder, Bingshuo Kang
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Jessica Bird

Abstract:
Jesse and JJ are two boys who both suffer from Pelizaeus-Merzbacher Disease. PMD is a rare central nervous system disorder that renders the afflicted unable to walk due to reduced mental and physical development. In order to give the boys mobility where they otherwise have none, a safe, lightweight, and cost-effective motorized wheelchair has been designed and developed.

(Table 72) Dog Bath Assist

Presenter(s): Curtis Bedwell, Kyzer Bowen, Phillip Noblitt, Kyle Hoyng
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Angela's Pet Spa

Abstract:
Angela, a pet groomer based in Riley, Indiana, is unable to accept larger dogs due to some health concerns. As a result, she has lost some of her clients. Our project aims to create a device that eliminates the need for manual lifting of large dogs into the tub. The device must meet three key requirements: it must be safe for the animal, able to support the weight of a large dog, and elevate the dog to the tub height of 39". To meet these requirements, we designed a telescoping ramp that securely attaches to the tub.

(NDA 102) thyssenkrupp Predictive Response Tool

Presenter(s): Adam Gipson, Chris Adrowski, Michelle Wong
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar

(NDA 103) Milwaukee Tool New Product Design NDA.

Presenter(s): Jeremy Grubb, Erin McClain, Trevor Maynard, Nathan Smith
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar

(NDA 104) Wheelchair Smart Cushion

Presenter(s): Christian Cseri, Ryan Cuda, Alex Paul, Ved Wadmark
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal

(NDA 105) Ejector Pump Cooling Cycle (Cummins)

Presenter(s): Ethan Jones, Weiting Ju, Chenghao Qian
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Sangelkar

(NDA 106) Long Ball Labs

Presenter(s): Katrina Agustin, Thomas Butler, Winston Amankwah, Jerritt Gutierrez, Gage Smith, Brendan Labensky
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Client Names: Kennan Long (CEO, Co-founder) and Koby Close (Head of Data, Co-founder) Sponsor Name: LongBall Labs

Abstract:
LongBall Labs provides a competitive edge to Major League Baseball players by identifying the most optimal bats for each individual client. Due to the inherent natural variation in wood, manufacturing complications, and variations in swing dynamics, there are bat-to-bat performance discrepancies in shipments of identically labeled bats. Through a series of proprietary tests, LongBall Labs can quantify the performance potential of individual bats and indicate which bats are best for their clients. Due to an increase in demand for their services, it is crucial for LongBall Labs to increase throughput by boosting their procedural efficiency. Our team has built next-generation measurement systems and designed a new protocol that improves efficiency and increases the capacity while maintaining their status as the world's most precise bat analysis service.

Academic Program: Multi-Disciplinary

(Table 77) Engineering Emotions: Capturing the Rose-Hulman Student Experience

Presenter(s): Ahmed Balubaid, Kyle Brownell, Bryson Halsey, Bingshuo Kang, Veronica Kleinschmidt, Jared Miller, Mary Mulroy, Byron Williamson, Michelle Wong, Xuanyu Zhou
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). Bundza, Holden

Abstract:
Students have created a project inspired by Rube Goldberg concepts, incorporating their technical and artistic knowledge to express five primary emotions - excitement, overwhelming, frustration, fatigue, and relief - that represent their experience at Rose-Hulman. Each emotion is represented by two students who utilize environmental aspects to convey the intended feelings. The five teams work together to create transitions between each stage, leading to a return to excitement. The project creatively captures the emotions commonly experienced by students, offering a unique perspective on the Rose-Hulman experience.

(Table 78) Color Meter Traversing Mechanism

Presenter(s): Grace Allman, Ahmed Balubaid, Payton Gryniewicz, Edward Huang, Renee Momot, T.J. Rutan, Caleb Yankey, Aria Ziegler
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). Bercich, Yoder
Sponsor: Steel Dynamics Incorporated

Abstract:
Steel Dynamics Incorporated (SDI) is currently building a paint line and needs to ensure that the painted steel meet their desired quality. To do this, SDI needs a traversing mechanism that will allow a color meter to scan the full width of a steel sheet and to move off the line for calibration and maintenance. Our team built a system that holds the color meter and spans 10 ft to accommodate the maximum width of a steel sheet. The system moves at 2 in/sec to achieve the desired number of samples as well as move off the line quickly enough to meet the client's constraints.

(Table 79) Good Vibes

Presenter(s): Nathan Atkinson, Sophie Baer, Jackson Costa, Sage Dooley
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: This was a student-proposed project, funded by Engineering Design and the Dean's Office

Abstract:
Good Vibes is a product that enhances the music listening experience and allows its users to “feel” the music through strategically placed haptic feedback and other systems. This wearable device turns audio into a full body experience, creating better immersion and enables music to be more assessable to those with auditory impairments. The motors sync to the rhythms of songs and other audio experiences. This jacket is lightweight and breathable allowing the user a full range of motion. Good vibes can be used at any time, whether you are at a concert or on a run.

(Table 80) Office Robot

Presenter(s): Natalie Koenig, Lauren McCarthy, Jesús Capó, Nithin Saravanapandian
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: Rose-Hulman Institute of Technology - Career Services

Abstract:
The project provides a solution for remotely-working Rose-Hulman Career Services faculty who seek a physical presence while collaborating with on-campus colleagues. A robot-based system has been designed to enable remote faculty to navigate the Career Services office via teleoperation, using a user-friendly interface. The robot is equipped with a Microsoft Surface to facilitate real-time video and audio communication with on-campus faculty, thereby promoting collaboration and communication via a cross-platform app. With this solution, remote faculty will have the opportunity to interact with their colleagues and students, without being constrained by their physical location.

(Table 81) intTellogence

Presenter(s): Kirk Preston, Ruth Hammond, Arvind Krishnan, Joseph Lahmann
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: This was a student-proposed project, funded by Engineering Design and the Dean’s Office

Abstract:
Drones are quickly becoming utilized in the public sphere for entertainment, photography, surveillance, high-speed delivery, and remote healthcare. inTellogence is an open-source codebase made to supplement self-education for university students and hobbyists exploring drone control topics, using the low-cost DJI Tello Edu. It integrates multi-drone centralized control, computer vision, functional safety, and a custom Graphical User Interface (GUI). Written in Python, it is powered by popular packages such as OpenCV, FLET, and NVIDIA’s CUDA. inTellogence ultimately lowers the barrier of entry to drone robotics through detailed documentation and easily modified design.

(Table 82) Liquid Propellant Rocket Engine and Test Stand

Presenter(s): Jacob Oblazny, Jessica Russell, Chirag Sirigere, Ryan St. Clair
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: This was a student-proposed project, funded by Engineering Design and the Dean's Office

Abstract:
The Rose Propulsion Laboratory is designing and testing a liquid propulsion system for competition. Today's aerospace industry calls for students with experience in developing controllable rocket systems. Our response is a testbed for undergraduate students to iteratively develop rocket engines. Our MDS capstone team designed and instrumented a feed system that delivers pressurized fuel and oxidizer to a subscale thruster mounted on a test stand. The test stand monitors performance with a data acquisition and valve control system, enabling students to safely perform and analyze test fires.

(Table 83) Keep Close

Presenter(s): Grace Eggers, Emily Guajardo, Jairyq Underwood
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: This was a student-proposed project, funded by Engineering Design and the Dean's Office

Abstract:
Keep Close is a device that reminds people in the immediate moment for an object they left behind or a task they need to complete. It is designed for people with medical conditions in mind as a solution for forgetfulness. It consists of two components, a reminder and a tag. Once the tag is out of range, the reminder will notify the user.

(Table 84) Machine Garden

Presenter(s): Caleb Boutell, Kieya McClung, Desirae Webster
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar
Sponsor: Rose-Hulman Office of Student Affairs

Abstract:
Our project remembers Rose student, Erin Canning, through a social space in the Myer's Hall courtyard. This Machine Garden is filled with benches, which represent the shapes in a machine shop, blending a familiar STEM environment with a comfortable student social space. The garden also tells the story of creating a spinning top, a project which Erin—and all engineering design students—have completed, to familiarize themselves with the shop. The center of the garden points to our Woman on Campus, an abstract representation of Erin, who speaks to our diversity and student spirit.

(NDA 107) MDS Capstone: Solar Panel Origami

Presenter(s): Matthew Supp, John Chung, Brendan Cassidy, Noble Jones
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Sangelkar

Academic Program: Physics & Optical Engineering

(Table 67) EP/OE Junior Design Projectile Launcher

Presenter(s): Peyton D. Miller, Trevor Ley, Emma McMillan
Program: Physics & Optical Engineering
Faculty Advisor(s): Dr(s). Marincel, Pfiester, Reza
Sponsor: PHOE Department

Abstract:
Our group was tasked with constructing a projectile launcher capable of hitting targets ten and twenty feet away for EP/OE Junior Design. We began through concept development and need identification, parsing through different designs (catapults, trebuchets, canons, etc…) and landed on a canon cylinder setup. We then proceeded to create a detailed design on SolidWorks and identified failure modes, performing error analysis. Finally, we created a second draft of our CAD using instructor feedback and our failure modes, and we sent our parts to department technicians for processing.

(Table 68) Front Tension Powered Projectile Launcher

Presenter(s): Ben Wright, Alfred Moore, Sam Sheeder
Program: Physics & Optical Engineering
Faculty Advisor(s): Dr(s). Reza
Sponsor: PHOE Department

Abstract:
We designed a projectile launcher using 3d printed parts and rubber bands. Our catapult can hit a 3 in target at 10 feet and 20 feet. This project was intended to teach us the principals of product design such as Ghant Charts, prototyping, tolerancing, and consumer needs.