ROSE SHOW PROGRAM

May 4, 2022

Academic Program: Biology & Biomedical Engineering

(Table 5) DArt: The Digital Art Device

Presenter(s): Carla Archuleta, Veronica Gawarecki, Keely Stevenson
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Chiu
Sponsor: EasterSeals Crossroads

Abstract:
EasterSeals Crossroads is a non-profit organization that is dedicated to helping individuals with disabilities achieve their greatest levels of independence. Individual expression through art therapy helps to establish and maintain independence and improve mobility over time. Our team has developed an adaptable solution that enables individuals with mobility challenges to express themselves through art. The DArt device consists of two ways for the user to create digital art. A paint program downloaded onto a Raspberry Pi computer allows the user to create pictures on a monitor by either using a trackball or their head movement captured by a web camera as a computer mouse cursor.

(Table 6) Lid Lift & Dryer Chute: Assistive Devices for Aid in Laundry Process

Presenter(s): Dalton Andrew, Rachael Enrici, Jacey Goin
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Chiu
Sponsor: Happiness Bag

Abstract:
Happiness Bag is Wabash Valley's only educational and recreation-oriented facility that is designed for children and adults with intellectual or developmental disabilities. Friends may have various forms of abilities that make them unique, including the use of an assistive device such as a walker, wheelchair, or motorized wheelchair. One activity that most friends like to participate in outside of their normal schedule is doing chores around the facility, specifically laundry. WheeLee Clean was tasked with providing a solution that would aid in one or more steps of the laundry process.

(Table 7) The Motorized Leg Crane

Presenter(s): Abi Clayton, Gabby Davidson, Logan Jilek
Program: Biology & Biomedical Engineering

Faculty Advisor(s): Dr(s). Chiu
Sponsor: Jarid Clapp

Abstract:
The Motorized Leg Crane is an assistive device designed to help an individual with Primary Progressive Multiple Sclerosis (PPMS) get on and off his motorcycle independently. The client's PPMS reduces his neurologic function, preventing him from participating in hobbies he previously enjoyed. The device consists of a winch and a steel frame that can rotate across his motorcycle seat. The device is operated independently, is powered by the client's motorcycle, reduces the vertical distance the client must lift his leg to almost nothing, and reduces the effort he must exert to move his leg horizontally. The device ensures that the client can continue traveling on his motorcycle, improving his quality of life.

(Table 8) Pulse Oximeter Housing

Presenter(s): Krista Manche, Max Jacobs, Liam Groom
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Chiu
Sponsor: Dr. Charles Umeh

Abstract:
The client of this project, Dr. Charles Umeh, operates a mobile clinic in Nigeria. He has requested a wireless pulse oximeter device that will allow him to monitor his patients' blood-oxygen levels from an external display. The design of the device was a collaboration between this BE design team, responsible for the housing, and an ECE design team, responsible for the electronic components. The housing of this device must be durable, sterilizable, resistant to water and chemicals, and manufactured for under $5 per unit. The presented product is the final housing design that meets these criteria.

(Table 9) Assistive Walking Device

Presenter(s): Kaden Weddle, Jacob Bowman
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Chiu, Hamilton
Sponsor: Reach Therapy Clinic

Abstract:
Introduction One of the best ways to encourage walking for children with poor lower motor control is for them to practice and simulate walking. However, due to the poor lower motor control, it can be difficult for such children to practice their gait without external assistance from an assistive walking device. The purpose of this project was to design and manufacture an assistive walking device that allows for children with poor motor control of their legs to practice walking. The targeted age range of the device for the children was five to twelve years old, meaning a weight limit of 150 pounds and a height limit of 65 inches. To determine the best solution to the design problem, various existing products were looked at that are currently available on the market. While these existing products acted as a great starting point, one common issue among them was the high price. Therefore, it was

also determined that the device should remain relatively cheap in cost as compared to the existing market products. Summary of Impact The assistive walking device was designed for Reach Services, which offers therapy services for family's in need. The device will be used for various children will low motor control of their legs with the assistance of a physical therapist. While the device is designed for children specifically with low motor control of their legs, it can be used for with children with other assistance needs, such as assistance with balancing. The device helps to prevent a child from falling, meaning that the child can perform therapy with fewer worries or complications. Furthermore, the device can be used with a Horizon T101 treadmill, roam freely in an open space, and offers an adjustable handlebar for additional stability assistance. Technical Description The assistive walking device consists of a frame, handlebar, and harness (Figure 1). The frame acts as the skeleton and the primary weight supporter of the device. The frame was manufactured using two-inch steel square tubing that was welded together at connection points. Additional supports were welded to connecting to corners to minimize the deflection of the device when experiencing a load. The height of the frame is adjustable using a crank and rail system, as to allow for children of different heights to use the device. The frame includes lockable casters that allow the entire device to move freely or remain stationary depending on the desired use. The handlebar connects to the frame via a pin and a series of holes along the frames central post. The handlebar includes grip tape to allow for a comfortable hold on both the transverse crossbar and two sides. The harness connects to the frame via two carabiner clips that attach to eyebolts on the overhanging arm of the frame. The harness is adjustable via metal sliders to allow for children of various age ranges to fit. The harness also includes six metal buckles to allow the harness to fully open, making the process of putting on and taking off the harness much easier for a single therapist. There are foam pads on the legs and armpits of the harness to decrease possible discomfort that could result in wearing the harness. The cost to manufacture the assistive walking device was estimated at $500.

(NDA B) Semi-Automated Syringe Loading Mechanism

Presenter(s): Michael Stevens, Brett Tuttle, Elle Vuotto
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Dr(s). Chiu

Academic Program: Civil & Environmental Engineering

(Table 10) Design of a New Fire Substation in Llaves, NM

Presenter(s): Luke Greenwood, Caitlin Parz, Kaitlin Weik
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw
Sponsor: Lindrith-Llaves Volunteer Fire Department

Abstract:
Our project was to design a new fire substation for the Lindrith-Llaves Volunteer Fire

Department in Llaves, NM. Our main goal was to improve the overall safety for community members by designing the substation in such a way that the volunteer fire-fighter response times will be reduced. Since the current communities are experiencing delayed responses, our overall vision is an effective and reliable fire department that can provide faster and more equal response times to community emergencies.To complete this, we created the following goals: • Increase the reliability and effectiveness of the station.• Provide a safe work environment at the substation.• Minimize costs for the fire department in the use of building materials.• Minimize disruption to the natural environment.

(Table 11) The Mill Terre Haute

Presenter(s): Nick Katchur, James Poinsette, Corey Martin, Colin Featherby
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw
Sponsor: The Mill Terre Haute

(Table 12) Golden Hills Mixed City Development Enclave, Ghana

Presenter(s): Addie Collier, Sam Nystrom, Jack Reifeis, Jackie Renn
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw
Sponsor: Mr. Kwaku Boampong of ABP Consult LTD

(Table 13) Carmel Pedestrian Connectivity Project

Presenter(s): Jacob Lauteri, Jeremy Rusk, Sarah Shoemaker
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw

Abstract:
Our project was to connect parts of Carmel, Indiana by designing a 10-foot-wide multi-use trail where there are currently missing segments. We encountered water crossings, narrow sections of land, and an elementary school in the process of designing the multi-use trail.

(NDA C) Design of Multi-Sport Complex

Presenter(s): Landen Berlin, Tyrell Cockroft, Shane Garner, John Hruska, Josh Mesenbrink
Program: Civil & Environmental Engineering
Faculty Advisor(s): Dr(s). Kershaw

Academic Program: Computer Science & Software Engineering

(Table 1) Computational Experiment Pipeline

Presenter(s): Omar Fayoumi, Pavani Ravella, Russel Staples, Elijah Williams
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner

(Table 2) RoseData

Presenter(s): Darren Zhu, Wenze Ma, Sybil Chen, Henry Yang
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner

Abstract:
Rose Data is a web-based software application that provides the Rose-Hulman community with a centralized location to find data pertaining to courses, students, and instructors. Rose Data allows users to view their schedules within the Rose Data website directly, instead of navigating between Banner Web and the Schedule Lookup page. Rose Data also allows users to form groups. The group members can view their combined schedule so that they can easily figure out the time slot that works for everyone. By changing the privacy settings, the user can make their schedule available to nobody, members from certain groups, or everyone. Each individual's schedule can be edited by marking a specific time slot as unavailable. Rose Data can retrieve data from the Degree Planner Database, which provides the data for features related to the course section planner. With this information, the department head can optimize the arrangement of the following quarter's schedules.

(Table 3) Robotic Vision and Video Streaming

Presenter(s): Nick Hall, Arudrra Krishnan, Travis Bednarek, Alec Polster
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth

(Table 4) Beckman TubeScan Vision

Presenter(s): Aditya Burle, Rachel Harness, Jeremiah Wooten, Will Yelton
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Beckman Coulter

Abstract:
The white blood cell count in a patient's blood can help indicate the strength of their immune system and whether or not they are immunocompromised. Blood vials are put through a centrifuge in order to separate them into layers, after which we use image processing techniques to find the heights of the plasma, white blood cell, and red blood cell layers. Through image processing and detecting changes in color, we were able to reliably

find the heights and essentially locate the middle white blood cell layer, automating the gathering of this information for Beckman Coulter.

(Table 16) Red Panda

Presenter(s): Andrew Meng, Jake Milanowski, Simon Snider, Danielle Villa
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: Luke Craig - MIT Lincoln Labs

Abstract:
Taint analysis is a technique for determining how information flows through a system. PANDA is used for dynamic system analysis, performing taint analysis based on theoretical output for assembly instructions and determining dependencies between instructions. Our project was to create a system that uses randomized testing to determine empirical rules for a given instruction in an arbitrary instruction set architecture. Red Panda does accomplish this for the MIPS32 and x86_64 architecture sets, with a design focus on extensibility.

(Table 17) Even Better

Presenter(s): Jamari Morrison, Ainsley Liu, Doris Chen, Seth Lakstins
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Bohner
Sponsor: Steve Chenoweth

Abstract:
Even Better is a cross-platform social app for professors to engage with Rose-Hulman alumni to provide insight into the real-world application of technologies taught across current curricula. The app aims to act as a tie between CSSE alumni and the CSSE department, allowing alumni to communicate with one another and with the department in a more convenient and productive manner.

(Table 18) Prospective Student Welcome Project

Presenter(s): Keith Condray-Raderstorf, Jordan Hayes, Michael Nixon, Shamus Sparling
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Rose-Hulman Institute of Technology Office of Admissions

Abstract:
The Prospective Student Welcome Project is used by the Rose-Hulman Office of Admissions to provide prospective students with information about their upcoming visit. For each visit, the prospective student receives an SMS message with a link to view the dashboard for their visit. From here, the student can view information for their visit such as arrival times, directions, scheduled meetings, meal passes, and more. This system was designed to give

the clients flexibility in customizing what information is displayed to prospective students as well as track views of the dashboard for each visit.

(Table 31) Magic The Gathering Vitality Mobile Tracker

Presenter(s): Alexander Harris, Brett Zonick, Joey Hatfield, Nick Pisciotta
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Noah Miller

Abstract:
The Magic the Gathering (MTG) Vitality Mobile Tracker is an application dedicated to helping the online and offline card gaming ecosystem. With this application, users can set up game sessions to keep track of their character's statistics and vitality numbers in various categories related to the game. This includes character templates which contain the health, poison counter, and experience. This simple, easy to use application allows users to connect to sessions from their phone or through the web application and share these sessions with friends when starting a game. Users can also add additional players at any point, so more people can join on the fly. Our app allowed users to modify numerical values using simple buttons and each player and observer see all modifications in real time, to keep a low latency and high quality experience for all connected parties. This application is targeted to both the casual players and the most seasoned MTG players. The users can use the application anonymously, or log in with a Google account to enjoy the experience how they see fit. Users can close the application at any time, and all of their game sessions are saved as they play. Those sessions can be rejoined at any time from the Recent Sessions tab, allowing for the most ease-of-use experience with the app. We hope that our application offers MTG players, both veterans and casuals, an easy method of tracking their statistics in their game in a simple-to-use format on their phone or desktop.

(Table 32) Union Health Remote Patient Care System

Presenter(s): Michael Kuznicki, Jasmine Scott, Abizer Naseem, Yiju Hao
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Jimmy McKanna (Union Hospital)

Abstract:
Amid many difficulties of limited resources, hospitals have been exploring ways to treat certain patients from home to improve their care and efficiently use resources. Our team has been working with Union Hospital to explore this option. We have worked on a system that allows a patient to measure vitals with a Bluetooth device that syncs with an Android application and reports the information to a web application within the hospital. We have also explored the possibilities of patients being able to call, with video, someone at the hospital if they are experiencing issues or have questions.

(Table 33) Reference Point Navigation

Presenter(s): Alex Iasso, Jonathan Moyers, Sean Xia, Will Thesken
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Zackery Hurtz

Abstract:
Reference Point Navigation is working to improve campus accessibility for the visually impaired by developing a mobile application to provide information about and assist in the navigation of campus environments. With the ubiquity of mobile devices today, the visually impaired should no longer need to rely on braille signage, when all the information anybody could need can be made available at the swipe of a finger. With Reference Point Navigation, all of the information a user could need will be made available and accessible to all.

(Table 47) Rose IRPA Chatbot

Presenter(s): Joseph Peters, Rachel Zhang, Luis Ye, Timothy Ren
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth
Sponsor: Timothy Chow

Abstract:
The Rose IRPA Chatbot was built on the Microsoft Azure platform for the purposes of answering common questions often posed to the Rose-Hulman Institutional Research Planning and Assessment office. It was created in the hope that clients could get a more informative and intuitive interaction with the office in a timely manner.

(Table 48) Power Ranking Poll

Presenter(s): Ray Fang, Mashengjun Li, Ao Liu, Jiadi Wang
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth

Abstract:
Currently, there are no good tools for sports or eSports fans and organizers to conduct power ranking-style polls on their favorite teams. Traditional online voting tools are for one-time and do not specifically support the creation and verification of leagues. It has been a common solution to use Google Forms to collect voting information for many leagues, but it has very low efficiency and voter retention. We want to develop a web-based software that allows users to create and vote in power ranking polls in leagues that recur weekly.

(Table 49) meHive Contact Manager

Presenter(s): Tom Ahmed, Griffin Annis, Ricardo Hernandez, Thomas Nandola
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Jeff Gilbert

Abstract:
meHive provides users with a relationship management tool, which aims to strengthen their business and personal connections. The purpose of this project is to take the existing functionality of the original meHive iPad application and transform it into a responsive web application. meHive uses a proprietary algorithm to help users know when they should interact with contacts in order to maintain their relationships. The ultimate goal of the project is to create a website that replicates and expands upon the original functionality but in a more easily portable web format.

(Table 64) Scored Games

Presenter(s): Lucus Bendzsa, Alan Bruner, Will Feldman, Elvis Morales Campoverde
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Jonathon Jungck, Sanggoo Kang

Abstract:
With many board games, the process of calculating a score at the end of the game can be long and time consuming, taking away from the enjoyment of the game. The Scored Games iOS app solves this by using the device's camera along with machine learning algorithms to recognize the board and all the pieces and to generate a score. Scores are stored in a popular board game database, BoardGameGeeks. Although the application currently only supports a few games, with our easy to use framework additional games can easily be added in the future.

(Table 65) Self Interpreter

Presenter(s): Jacob Pinney, Luke McNeil, Achintya Gupta, Nathaniel Blanco
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Michael Hewner

Abstract:
Self is an object-oriented programming language designed around the use of prototypes, objects that are reused to derive behavior for other objects. It comes with its own environment, virtual machine, and GUI to execute in, the latter of which is defined in Self code. At the moment, the Self environment cannot be executed on most modern operating systems.We have developed a system that parses and interprets Self inputs in a similar

manner to the Self environment and VM. Our system is built in Python, which is compatible with any modern platform (e.g. Windows, Linux, macOS)

(Table 66) Smart Garden

Presenter(s): Sam Dickinson, Ben Goldstein, Alex Ketcham, Thomas Hoevener
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Heliponix

Abstract:
Internet of Things (IoT) devices are becoming more and more prevalent in daily life. In collaboration with Heliponix, the Smart Garden team developed two systems to assist with the data collection and analysis process. Dolos, the first system, generates realistic IoT device data. Designed to quickly add new emulated devices and output locations, Dolos can be used for stress testing or non-production database population. The second system is an anomaly detection pipeline for IoT devices. As data comes in, filters analyze the data in real-time to quickly determine anomalous activity. Data sources, filters, and anomaly warning output locations can be configured at runtime.

(Table 79) MapMyHerd

Presenter(s): Susan Harmet, Shannon (Mengming) Jin, Trey Kline, Matthew Rouse
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Roper Solutions, CEO Maeve Garigan and COO Dana De Coster

Abstract:
Currently, in the agriculture field, there is no software to manage and monitor cattle location and activity data for cattle ranches. While there are tools for managing animal records, they are cumbersome to use. MapMyHerd provides actionable information to enable ranchers to prioritize their most precious resource–their time–while improving operational efficiency. Data-collecting sensors on a cattle ear tag provides information to the comprehensive web app “herd map” with an intuitive, easy-to-understand design and user flow that provides a one-stop-shop for a rancher to see where all their cattle are and how they are doing - quite literally “where’s the beef?”

(Table 80) PBC Linear AI Powered WebChat

Presenter(s): Connor Schulte, Cody Steiner, Zeyu Laio, Jiafan Lin
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: PBC Linear

Abstract:
PBC Linear currently uses their website as the main intermediary between them and their customers. However, there is still a large number of interactions between their customers

and the engineers. The purpose of this project is to create an AI powered chatbot that is to reduce the amount of interaction between the engineers at PBC Linear and their customers. The chatbot is able to respond to any frequently asked question defined by the client's website or Application Engineers to reduce time engineers spend communicating with customers. The chatbot is also able to, route the chat to an agent within the company, save all chatlogs into the client's internal system, and show analytics derived from the chat. The chatbot was built using AWS as a backend with Amazon Lex being used for the base AI and Amazon Connect being used to route customers to agents and drive the conversation flow. The chatbot is currently deployed on the PBC Linear development website and is scheduled to be deployed on their live website before the Rose Show.

(Table 81) RoseQuarry: Senior Capstone Projects System - Phase 3

Presenter(s): Jiacheng Qiu, Nigel Nie, Didi Chai, Chet Zhang
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Tracy
Sponsor: Bohner, Shawn

Abstract:
Every year, internal and external clients submit senior project proposals to the CSSE department. RoseQuarry is an administrative platform for Program Directors to manage those proposals, and for students to choose proposals and teammates. RoseQuarry Proposals is a separate platform that serves as the entry point for project proposers. Proposers can create accounts and can create, view, update, and delete their proposals. Program directors can manage proposals and can choose to send those to the main RoseQuarry system.

(NDA A) Capacitrac

Presenter(s): Zane Blair, Aditya Desai, Nick Bohner
Program: Computer Science & Software Engineering
Faculty Advisor(s): Dr(s). Chenoweth

Academic Program: Electrical & Computer Engineering

(Table 52) Low-Cost Pulse Oximeter

Presenter(s): Nikhil Ladi, Jonah Egertson
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: Dr. Deborah Walter

Abstract:
This is a device that is used to find the pulse and blood oxygen level. It shines light onto the finger and gets back the light to find out the oxygen level.

(Table 53) Attacking a CAN Bus Using Sub-Bit Pulses from a Custom Driver and FPGA

Presenter(s): John Bass, Brendan Boewe, Cory Snyder, Sam VanDenburgh
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Song
Sponsor: Dr. Zachary Estrada

Abstract:
The Controller Area Network (CAN) protocol is a communication standard implemented in all modern vehicles. Sensors and controllers within the vehicle transmit and receive messages on a single bus. We have developed a sub-bit timing attack that exploits devices' differing sample points. The attack uses an FPGA and custom CAN driver to allow an attacker to transmit messages, which devices interpret differently depending on their sample points. Testing the attack on a four-device CAN network yielded a 100% success rate at 100 kbps, but success rates dropped significantly at higher baud rates.

(Table 54) Accelerating Neuron Simulations

Presenter(s): Matthew Callahan, Jack Davidson, Nathan Greiner, Jake Nickel, Wojciech Zacherek
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Chang, Simoni, Song

Abstract:
Neurological research depends on the ability to experiment with actual neurons and understand the interactions between them. However, neurological signals are difficult to measure due to the number of chemicals involved and the small size of the neurons in many animals. With these limitations, models become more important to predict the responses of neurons to different stimuli. The current most biologically accurate method used by researchers to simulate networks of biological neurons is the Hodgkin-Huxley equation, a series of highly coupled differential equations that model the motion of different ions across the cellular membrane; thus, Hodgkin-Huxley trades computation complexity for accuracy. Teams in previous years have produced hardware accelerators to make solving these differential equations more efficient. This year our team looked into porting a simulation into Cuda, interfacing two FPGAs, and providing an automated verification of the accuracy of the acceleration methods.

(Table 55) Multitone Test Board

Presenter(s): Zachary Kelly, Chen Li, Audrey Walters, Daniel Su
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Estrada
Sponsor: Dr. Tina Hudson

Abstract:
Integrated Circuit Testing is a key element of releasing a product into the market, but there are not enough students with relevant backgrounds to fill available positions. For our senior design project, we created an additional testing board for the Testing Certification Program that will provide students with a more diverse background in testing different types of devices. The goal of this project was to create a dual-site daughter board that can support production level tests for an LTC1063 analog filter chip, including multi-tone AC gain and total harmonic distortion.

(Table 56) Real-Time Vehicle Identification by Embedded TPMS Demodulation

Presenter(s): Scott Busche, Ethan Carter, Brendan King, James Werne
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: Nate Goergen

Abstract:
Tire pressure monitoring systems (TPMS) are sensors located on the valve stems of vehicle tires; their purpose is to communicate tire pressure data wirelessly to the vehicle. Each transmission includes a unique tire ID. This project provides a proof of concept for a drive-through application where a device intercepts TPMS signals and identifies the vehicle. Our device uses a software-defined radio and a Raspberry Pi to trigger TPMS sensors, receive TPMS signals, then demodulate and extract the ID. A datalog stores the ID, which can be used to provide food order suggestions.

(Table 57) Specific Gravity Fermentation Sensor

Presenter(s): Tom Kirchhoffer, James Brandewie, Kaiyuan Jin, Derrick Swart
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett
Sponsor: Dr. Nate Goergen

Abstract:
One aspect of any successful homebrewing system is the ability to successfully monitor the progression of the extensive & lengthy fermentation process, which deals with the conversion of sugar to alcohol and carbon dioxide. The current fermentation sensor market struggles with difficulties of fragile components, inability to measure ongoing results of the process, and lack of convenience. Our project delves into creating a wireless, low-power, easy-to-use, long-term sensor to monitor the progression of the process by periodically recording the ratio of alcohol to sugar for the user. The device will be encapsulated in a water-tight container, which will be weighted to one side. As the sugar to alcohol ratio changes, the tilt angle of the tube will also change over time. This tilt angle will be measured with an accelerometer, whose readings will be converted into an accurate measure of the sugar to water ratio and subsequently be transmitted wirelessly outside of the fermentation tank. This signal will then be sent to an online server, giving the user a

precise and conveniently available image of the well-being of their fermentation process. Our project fulfilled all requirements given to us, including transmission range of 10 meters, accuracy with 0.5% alcohol by volume, power lifetime extending past 10 weeks, high level of ease of access, and consistency of transmission. In order to meet these requirements, we had to change multiple components of the project including capsule type, microchips, and presence of the RTC. In the future, this project could be extended to include other types of sensors including temperature and pressure transmission. However, the most critical extension of this project would be to move from the development boards to the actual microchips, drastically reducing the size and cost of the device, making it much more viable in a consumer setting.

(Table 58) Custom Zynq Ultrascale+ Board Schematic Redesign and 100MHz Board to Board Communication and Signal Integrity Testing

Presenter(s): Nicholas Snow, Joshua Giambattista, Justin Heinz, Anthony Sparks
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Song
Sponsor: Huntington Ingalls Industries

Abstract:
In this project, Hangar 4F from Dayton, Ohio tasked us to redesign the schematics for a custom Field Programmable Gate Array (FPGA) Printed Circuit Board (PCB) that has the same form, fit, and function as a current system that our clients are currently using. Our goal was to replace a Xilinx Spartan-3an FPGA and embedded MicroBlaze processor with a new Xilinx Zynq Ultrascale+ FPGA with a hardware ARM core as well as provide hardware and software examples for the new platform for signal integrity testing.

(Table 59) Solar District Cup Challenge 2022

Presenter(s): Rebekah Erin, John Neill, Kayleigh Doyle, Ben Hawkins, Luke Spannan
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Walter
Sponsor: Sponsor: Solar District Cup NREL, Clients: Ben Huckaba, Chris Ware, Drew Hintz

Abstract:
The overall goal of the design is to develop a solar energy generation and storage system for The Ohio State University that maximizes energy offset and customer financial savings. Through a variety of disciplines including, but not limited to: electrical engineering, civil engineering, urban planning, finance, and business, the project deliverables will encompass an inclusive system design. For such a diverse project, our group will be collaborating with a team of civil engineers to complete our sustainable and strategic design. As a measure of design success, our project will be submitted to the yearly collegiate Solar District Cup competition. The provided competition requirements for the renewable solar energy system will guide our measurable model goals of solar generation and energy storage based on The Ohio State University's measured energy usage and current climate action plan. Feedback from various competition reviews will be incorporated to further develop

our design plan while our overall design quality will determine continued participation in additional competition stages.

(Table 60) 3-D Localization using Time Reversal Operator Decomposition (DORT)

Presenter(s): Jack Franey, Aaryan Khatri, Alex Wolfe, Carl Yan
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Walter
Sponsor: Dr. Wheeler, Dr. Song

Abstract:
The DORT system uses an antenna array to locate electromagnetic reflectors in a 3D space. The system sends an amplified signal into space, and listens for reflections. An algorithm is then employed to differentiate between linear and nonlinear scatterers. This means the system can differentiate between scrap metal and electronic devices like cell phones. Finally, another algorithm is used to guess the most likely location of the target(s) in 3D coordinates. In future work, this information could be used to beam steer the antenna array towards the target improving transmission efficiency.

(Table 61) BVI Disc Golf

Presenter(s): Lucas D'Alesio, Tyler Thenell, Aidan Moss, Nasser Hegar
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder
Sponsor: Client: Dr. Steven Mannheimer and the Indiana School for the Blind and Visually Impaired, Sponsor: Rose-Hulman

Abstract:
The Indiana School for the Blind and Visually Impaired (ISBVI) has had an issue with Physical Education and exercise as part of the school curriculum. The students have had problems exercising as they are unable to play a lot of games that sighted kids are able to enjoy. In addition to this, each student has a different level of visual impairment, making it challenging for a game to be engaging for all levels of disability. To enhance the experience and physical involvement of these students, there is a need for an electronic system to implement a game or activity to benefit their health.

(Table 62) Machine Learning Acceleration using Train-by-Weight

Presenter(s): Valeria Paiz, Sam Hedrick, Carlos Feng, Xingheng Lin
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder
Sponsor: Dr. Michael Jo

Abstract:
Machine learning is a fast-growing field, including object detection, medical

diagnosis, and image classification. For most classification models, a significant number of images input with a large amount of computational power is required for high accuracy. Train-by-weight is an algorithmic approach to reduce the size of the input data while keeping the essential information. We applied it to existing models and tested it on different computer architectures. A user-friendly GUI was implemented which performs the training of the model and outputs an executable file for the image classification task.

(Table 63) Bluetooth Remote Creation and Design<U+200B><U+200B>

Presenter(s): Cleo Barmes, James Kelley, Shengze Li, Deng Zou
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Estrada

(NDA D) Drone Augmented Reality Tracker Phase II

Presenter(s): Andrew Weger, Haiden Smith, Marcus Hughes-Oliver, Geoffrey Tomlinson
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Padgett

(NDA E) Smart sensor wear prediction (Data Analytics)

Presenter(s): Alexander Hinojosa, Tanner Brammeier, Bobby Liu, Jason Ims
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Estrada

(NDA F) Audio Alert System with 2.5kHz Tone and Ambient Based Volume for Milwaukee

Presenter(s): Nathaniel Craan, Hannah Phipps, Jacob Tebbe
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Song

(NDA G) Activity Sensor

Presenter(s): Dylan Bugos, Joseph Law, Carter Myers, Christina Rogers
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Walter

(NDA H) Milwaukee Tool Parallel Battery Discharge (NDA)

Presenter(s): Haley Braker, Joseph Conrad, Alex Tabuyo, Jack Wilson
Program: Electrical & Computer Engineering
Faculty Advisor(s): Dr(s). Yoder

Academic Program: Engineering Design

(Table 35) Red Light Green Light Bot

Presenter(s): Isabel Haut, Jester Moya, Mindy Altschul, Zara Burns
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
For this project, we are using our python coding knowledge along with our knowledge of sensors and circuits to create a robot that will be able to play the classic game of red light, green light. During this project, we are gaining experience in the fields of robotics and design appeal by creating a robot aimed at children. Our robot will be able to take the place of a human calling out the colors red or green and telling people if they moved when red was called. Using a Lego Mindstorm's EV3 robot as a base, we will design and code our robot before implementing new modes.

(Table 36) Rotor-Shelf

Presenter(s): Alec O'Connor, Sebastien Hughes, Jacob Kandel
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
The Rotor-Shelf provides a unique way of displaying your belongings by utilizing lights and sensors. To highlight your items, the shelf will take the general color of the objects and shine an LED light of the matching color to emphasize the object's presence. It also features a revolving, Ferris-wheel like mechanism that will allow for different display orientations, giving you more freedom for creativity.

(Table 37) Backboard Bully

Presenter(s): Anya Cook, Aaron Greve, Gavin Meier
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
The Back Board Bully offers basketball players a unique way to efficiently practice their shots. By modeling in-game situations, the user is able to play basketball, like normal, with feedback. Sensors in the back board and basket will detect if a shot was attempted and whether or not it was successful. The Board will provide a statement based on the overall statistics (Shots made / Shots missed) of the session. As the ratio grows larger, the responses will grow in "niceness" and excitement. Inversely, as the number of missed shots grows, the feedback becomes more negative and eventually "roasts" the user.

(Table 38) Lights Out

Presenter(s): Austin Perry, Thomas Galletti, Richelle Elkes
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
Life can be stressful in the busiest of times. People may become impatient, burdened, or overworked. Lights Out is an entertaining way to relieve stress, while receiving feedback on how hard you hit. Lights out, being an adaptation on the common punching bag, registers the force that you hit with, and outputs data about how strong you may be! Compete with friends, or set your own record with the displayed force diagrams after every impact! Enjoy this product whenever you feel like you need a good release, whether it be in the morning, afternoon, or right before you turn the lights out.

(Table 39) DorBrick - The Online Coloring Book

Presenter(s): Jackson Kabrick, Dylan Dorman
Program: Engineering Design
Faculty Advisor(s): Dr(s). Chenoweth, Watt

Abstract:
We were given the opportunity to create a project that integrates a specific culture to a software application. Dylan and I have created a computer application that works as an online coloring book that targets the culture of India. The application contains an assortment of buttons and frames that allow the user to choose between culture-specific images and two separate color palettes. Along with the online coloring experience, the user also gets a look at an informational excerpt corresponding to an image. DorBrick - The Online Coloring Book gives young individuals from Indian culture a chance to express themselves and learn fun information about popular images.

(Table 40) Recipe Desktop App that Integrates Culture in Coding

Presenter(s): Zara Burns, Andi Fiani, Shelby Schipper
Program: Engineering Design
Faculty Advisor(s): Dr(s). Chenoweth, Watt

Abstract:
For this project, we are applying our java coding knowledge by creating a desktop app. We are gaining experience in UX design as we are developing a software interface that is aimed towards use by a specific culture. We have chosen to focus on Lebanon and make an app that features Lebanese food recipes. Our app allows users to select ingredients and “cook” their dish. Essentially, it lets the user customize their recipes due to dietary restrictions and personal preference. Starting with a wireframe at the beginning of the quarter, we will code the initial screens before implementing additional features.

(Table 41) Automated Greenhouse

Presenter(s): Madeleine Klee, Brandon Marcus, Grace Eggers, Chase Strother
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
This project will consist of building an automated indoor greenhouse that will take the daily stress of watering plants and making sure that they have the proper temperature to thrive in. This greenhouse will be made of acrylic pieces and the bottom base will be made of laser-cut plywood in order to provide economic and environmentally conscious products. The product will include a door that automatically opens to ventilate the greenhouse when temperatures run too high and a sprinkler system that activates when soil moisture is too low. These automations of the product will make it easier for people to take care of and manage their plants.

(Table 42) Nerf Security System (NSS)

Presenter(s): Isaac Johanningsmeier, Ruben Jevremovic, Jacob Gray
Program: Engineering Design
Faculty Advisor(s): Dr(s). Brackin

Abstract:
The NSS is an exciting way to defend your room from unwanted guests or to have fun pranking your roommate with an exhilarating surprise. This security system can be set up on any inward swinging door and upon sensing the door opening, it will send an alert to your computer and activate a Nerf gun to fire upon the intruder. A few key components of our design are an ultrasonic sensor to detect intruders, connection to the internet to transmit data, and a motor to control the rate of fire of the Nerf blaster.

(Table 43) Culture Coding Project

Presenter(s): Grace Eggers
Program: Engineering Design
Faculty Advisor(s): Dr(s). Chenoweth, Watt

Abstract:
An app that focuses on adapting middle-eastern students transitioning into American education.

Academic Program: Extracurricular Competition Team

(Table 76) ChemE Car

Presenter(s): Alex Kyser, Lauren Copland, Ben Kahles, Caspar Freeze, Shane Myszka, Natalie Green, Lily Schoenewolff, Sophia Gospodinova, Gwynneth Menzie
Program: Extracurricular Competition Team
Faculty Advisor(s): Dr(s). Anastasio

Abstract:
Chem-E Car is a multidisciplinary team that builds a small (unmanned) car that must be powered and stopped by chemical mechanisms. The team competes in the AIChE regional Chem-E-Car competition. This year, the car is propelled by the buildup and controlled release of carbon dioxide. The gas is produced by reacting citric acid and sodium bicarbonate which then powers a pneumatic motor.

(Table 77) Full-scale Rocket for the NASA USLI Competition From Rose Rocketry

Presenter(s): Sam Betts, Gabriel Woller, Chirag Sirigere, Jessica Russell, Kerith Thomas
Program: Extracurricular Competition Team
Faculty Advisor(s): Dr(s). Kirkpatrick

Abstract:
Rose-Rocketry provides an opportunity for students with an interest in aerospace to gain experience through participation in High Power Rocketry launches, the NASA USLI Competition, and the Rose Propulsion Laboratory. For this year's NASA University Student Launch Initiative (USLI) Competition, the team built a 13-foot-tall rocket capable of flying to 5000 feet at speeds of up to 450 mph as well as a payload that could autonomously locate the rocket without GPS. The competition provided students with experience using the design process through three main reports, in which engineers from NASA reviewed the design and provided feedback in preparation for the competition launch in April 2022.

Academic Program: Mathematics

(Table 19) OMP-BASED DATA TRAINING: A SUPERVISED MACHINE LEARNING SOLUTION FOR DICTION

Presenter(s): Ruixin (Steven) Feng
Program: Mathematics
Faculty Advisor(s): Dr(s). Bryan

Abstract:
The paper mainly discusses how the OMP algorithm can be applied to classification

problems in the area of machine learning. It introduces the rationale behind the algorithm and methods to improve the dictionary with examples, including real image data of hand-written digits collected from MNIST.

(Table 34) Building a CAS in Lua for Use in LaTeX

Presenter(s): Evan Cochrane
Program: Mathematics
Faculty Advisor(s): Dr(s). All

(Table 50) Optimal Control Theory and its Application to Differential Games

Presenter(s): Joshua Bressman
Program: Mathematics
Faculty Advisor(s): Dr(s). Claassen

Abstract:
This project discusses optimal control theory, a branch of mathematics that determines the optimal control, which is an input function that affects the current state of a system. The state of such a system is described by a differential equation subject to an initial condition. Using the Maximum Principle one can determine the optimal control for a system that maximizes a given objective function. Game theory is also a branch of mathematics in which rational players make decisions in scenarios where each other's decisions affect each other's payouts. Rational players are assumed to make objective maximizing decisions, so in optimal control theory, a rational player would be assumed to select control that would maximize their respective objective functions. As such, we can apply optimal control theory and numerical methods to help solve differential games that are much more complex than games with discrete decisions.

(Table 51) The Topology of Bubbles and Foams

Presenter(s): Margaret Luffman
Program: Mathematics
Faculty Advisor(s): Dr(s). Finn

Abstract:
We investigate the topological changes that occur when an interior "bubble" disappears inside a "foam" (a collection of bubbles). We primarily consider bubbles shaped like prisms. Experiments were performed with frames made from Zometool kits that were then dipped in a soap solution. The experiments lead to the identification of two major types of different configurations as a bubble vanishes in a foam. These two configuration types were thoroughly defined, and full examples are provided. Further directions of possible work are identified.

(Table 67) Image Processing

Presenter(s): Chengyu Qian
Program: Mathematics
Faculty Advisor(s): Dr(s). Finn

Abstract:
It is common for an image to contain noise and blurring. In order to remove the noise and blurring on the image, we use the idea of heat equation. By using the idea that heat can be spread out to the surrounding, we can smooth out the noise on the noisy pixels to their surrounding pixels. To remove blurred pixels, we can run the heat equation backward. After the noise has been removed on the image, we can sharpen the blurred pixels while avoid the noisy pixels coming back.

(Table 68) Classifying Stocks with Uncertain Efficiency

Presenter(s): Liam Enneking
Program: Mathematics
Faculty Advisor(s): Dr(s). Holder

Abstract:
When classifying stocks, the metric implemented to select stocks for different classification groups traditionally has to do with qualitative measures of efficiency concerning the stock itself. However, the data collected to represent these qualitative measures is often subject to uncertainty due to either epistemic or aleatory reasons. Rather than classifying stocks based on their individual qualitative measures, we instead classify stocks based upon the level of uncertainty in those qualitative measures required for all stocks to have equivalent efficiency. For our classification algorithm, we employ the use of uncertain data envelopment analysis (uDEA) to classify stocks into clusters. These clusters are defined by the level of uncertainty in a stock's measures of return and risk, such that the efficiency of each stock is equivalent to all other stocks in any given cluster.

(Table 82) Investment Strategy of the Forex Market by Using the Black-Scholes Model

Presenter(s): Zitian (Catherine) Wang
Program: Mathematics
Faculty Advisor(s): Dr(s). McSweeney

Abstract:
The purpose of this thesis is to help the investors who use U.S. dollars to buy Chinese Yuan to make profits to get investment strategies in the foreign exchange rate market, which is typicallycalled Forex Market, by analyzing and predicting the future exchange rate between the U.S. dollar and the Chinese Yuan in one-year maturity time by using stochastic process models. TheThe European option is the call option type used in the trade, and the Black-Scholes Model is used to get the final predicted price that the investors could earn at the

maturity time. Before getting the final predicted value, the future currency exchange rate will be calculated through the Vasicek Model, and the maximum likelihood estimation is used to get the three key parameters of the Vasicek Model with the cleaned data collected from the Federal Reserve website.

(Table 83) Effect of Major League Baseball's Substance Ban on Pitcher Effectiveness

Presenter(s): Landon Bundy
Program: Mathematics
Faculty Advisor(s): Dr(s). Rickert

Abstract:
In 2021, Major League Baseball significantly increased its enforcement of a ban on the application of foreign substances to baseball. This change limited the amount of force pitchers could place on a baseball which affected the spin rate. We studied the effects of the change on the 14 pitchers with significant playing time from 2018 to 2021 by studying the spin rate of their pitches and their level of performance. We found that the increased enforcement of the ban led to pitchers being able to put less force on the baseball which led to decreases in pitchers' average spin rate and performance.

(NDA I) Assessing Varying Definitions of Metabolic Syndrome in African Americans

Presenter(s): Lizzie Rhoads
Program: Mathematics
Faculty Advisor(s): Dr(s). Reyes

Academic Program: Mechanical Engineering

(Table 14) Neoteric Hovercraft Engine Mount

Presenter(s): Tom Hostetler, Jacob Jagger, David Ardy, Jake Zhang
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Neoteric Hovercraft

Abstract:
Neoteric Hovercraft is a company dedicated to manufacturing hovercrafts for mainly recreational use as well as search and rescue. While common belief is that a hovercraft is similar to a boat or a car, a hovercraft is more relatable to an aircraft. An engine located near the back of hovercraft provides power to the hovercraft's fans or propellers. It was determined that their current mounts had to be uniquely manufactured for each specific engine type. The team's task is to design a universal hovercraft engine mount suitable for various engine types and is adjustable on a 2D plane.

(Table 15) ReTHink Greenhouse

Presenter(s): Brannon Russell, Byron Michl, Theo Guetig, Justin Sands
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: reTHink, Inc.

(Table 20) Rainwater Collection System

Presenter(s): Evan Clark, Skylar Ferguson, Elle Nowakowski, Sydney Williams
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: reTHink, Inc.

(Table 21) Interactive PLA Recycling

Presenter(s): Jordan Asman, Justin Guilfoyle, Cam Hudspeth, Matthew Kadnar
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Tom Rogge

Abstract:
Every quarter, 15kg of scrap PLA is produced by the KIC. This PLA comes from 3D printed supports and bad 3D prints. Our project recycles the PLA scrap through a process similar to extrusion molding.

(Table 22) Handcycle Transfer Station

Presenter(s): Lucas Foote, Jared Brown, Andrew Romano, Daniel Willey
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Dr. Don Rogers of ISU, for use at Griffin Bike Park

Abstract:
A handcycle is a device that can be used by individuals with certain disabilities, such as individuals who use wheelchairs or walkers. The goal of this project was to design an intermediate station to facilitate transfer into and out of a handcycle. Several project needs were identified for an effective design, including safety of the user and assistant, adjustability for various handcycle and wheelchair sizes, etc. The design was chosen to operate safely, quickly, and easily while adhering to the technical specifications defined at the onset of the project. This design includes an electronic lifting system, a levelling wheelbase, and a weatherproof exterior.

(Table 23) Ivy Tech Cabinet

Presenter(s): Garrett Beauprez, Luke Burke, Abby Holloway, Tyler Santee
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Karson Harris, Ivy Tech Community College Terre Haute - Precision Agriculture Department

Abstract:
At Ivy Tech Community College in Terre Haute, students can procure a drone pilot license. The client, Karson Harris, was appointed the head of this department and recognized the storage cabinet containing the delicate expensive equipment was in disarray and did not charge any batteries inside the cabinet. The possibility of damage and corresponding expense of both time and money when batteries are not charged properly (or at all) presented a challenge of designing and building a storage unit that not only stores the equipment properly and in an organized fashion but also charges all the required batteries. The top three needs to evade this danger are the organization, electrical capacity, and user safety. Harris's main issue was the lack of organization inside the preexisting cabinet– outdated manuals, and erroneous electronics. The 5S system solved the issue of unorganized equipment. The next important need is safe electrical capacity. The cabinet needed enough outlets to power all required devices while safely supplying enough volts from a wall outlet. The third most important need is maintaining overall client safety while using the final product, namely in transportation.

(Table 24) Powder Coating Furnace - ME Capstone Team 46

Presenter(s): Jonathan Anstett, Christopher Jaeger, Addison White, Ray Pasco, Harrison Finch
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: Butch Marion - Patricksburg Powder Coating

Abstract:
The client for this project, Butch Marion part-owner of Patricksburg Powder Coating (PPC), desires to expand his powder coating capabilities with a larger powder coating oven enabling him to service larger parts such as truck frames. The problem statement is defined as: Create a powder coating oven with temperature and time controls that reduce overall cost compared to stock solutions. In the fall quarter, client needs were identified and transitioned into technical specifications and benchmarking. These metrics focused on the price of the final product, as well as performance parameters required for successful powder coating cycles (temperature, time, even heating profile, etc.). The client chose a concept to move forward with - natural gas oven burner tubes, 16 in total, to provide approximately 560,000 BTU/hr heating power to the oven. Ventilation and automatic temperature controls were also part of this chosen concept, with rubber gasket thermal closeouts for the door. A prototype was developed and successfully tested during the winter quarter containing two burner tubes, an igniter, and full controls including a

thermal couple, and multiple relays to control gas flow as well as power controls for various electrical components. With successful final product implementation, we are confident to meet all client needs and succeed in with all technical specifications, providing a sufficient powder coating oven to PPC.

(Table 25) GSI Angled Grain Discharge

Presenter(s): Marie Guerin, Nate Kaffenberger, Jay Kwak, Ji Qi
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers
Sponsor: GSI - Grain Systems Incorporated

Abstract:
Grain Systems Incorporated (GSI) is a major manufacturer of agricultural equipment and systems. GSI uses a horizontal grain discharge for their grain transport systems. However, when they attempted to install it at an angle for more versatility, the grain got stuck and clogged. The goal of this project was to design, optimize, and CAD an angled grain discharge. A physical proof of concept and numerical simulation were used to optimize the parameters of the design. These were then implemented into a CAD model from which engineering drawings can be made.

(Table 26) Design-Build-Fly Competition Plane

Presenter(s): Ian Quick, Grayson Nemets, Taylor Lueking, Madeleine Hamon, Zheyuan Zheng, Will Jordan, Connor Chambers
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers, Riley
Sponsor: American Institute of Aeronautics and Astronautics

Abstract:
Our goal was to design and build a competitive aircraft for this year's AIAA Design Build Fly competition. This year's missions are modeled after COVID vaccine distribution to otherwise inaccessible regions. The aircraft must carry vaccine vials and deploy fragile packages without breaking them. We designed a high lift, low-speed, short-takeoff aircraft able to safely transport 60 syringes and 6 vaccine vials packages to the designated drop zone, with a detachable payload bay for efficient loading and unloading.

(Table 27) Veggie Loader

Presenter(s): Yihu Zhai, Hassan Alhassan, Scott McPherson, Phen Yoder
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers, Sangelkar

(Table 28) Kodiak Aircraft Company - Flammability Test Cabinet

Presenter(s): Arrick Harbaugh, Gabriel Gunning, Sallyana Stangebye, Tom Piazza, Robert Romeo, Jacob Doll
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich, Mayhew, Sangelkar
Sponsor: Kodiak Aircraft Company

Abstract:
Flammability test cabinets are important for aircraft companies to test materials before they use them in their aircraft. These test cabinets can be very expensive which is why Kodiak Aircraft Company (KAC) allowed Grove City College and Rose-Hulman Institute of Technology to design a draft-free, flammability test cabinet capable of smoke evacuation and automatic burner movement that meets FAA guidelines and regulations.

(Table 29) Mechanical Engineering Puzzle

Presenter(s): Gage Latham, Daniel Morford, Riley Roberts, Ben Salak
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich, Winck
Sponsor: Rose-Hulman Mechanical Engineering Department

Abstract:
The group is to create a puzzle using mechanical engineering concepts that could be given alumni donors of Rose-Hulman as a gift in the form of a brain teaser puzzle. The task given to the team assigned was to make a fun, elaborate, challenging, and artistic puzzle that alumni donors of Rose-Hulman would love to interact with and talk about.

(Table 30) Billiard Ball Lift

Presenter(s): Jayla Campbell, Desmond Dunson, Samvit Ram, Alyssa Taylor
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal
Sponsor: Brian Brackee

Abstract:
Our client has a personal project for a new generation billiards game. The idea of the project is to transfer billiard balls bidirectionally between the different levels of a three tiered billiards table. This project is intended for bar locations and geared to draw in bar clientele for a new game play.

(Table 44) Surplus DoD Equipment Removal Device<U+200B>

Presenter(s): Clay Ealey, Paul Maicher, Nick Moglia, Ben Wilfong
Program: Mechanical Engineering

Faculty Advisor(s): Dr(s). Chambers
Sponsor: Vermillion Rise Mega Park

Abstract:
Design a solution that can be used to safely remove surplus DOD equipment from a basement with no elevator.<U+200B>

(Table 45) Solar Desalination Project

Presenter(s): Todd Kuebelbeck and Maya Sears
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers

Abstract:
Salt and water, two substances commonly paired together since our world was formed. This coupling has been an element of progress and industrialization, preserving food longer to preserving safe ice-free roads. However this powerful pairing necessitates a divorce. Like nutritional consumption of salt, it should be consumed in moderation. Regions around the world are experiencing salt as a pollutant, not a supplement. Salt in excessive concentration as a pollutant is known as effluent. This effluent can result in water being non-potable, and hazardous for vegetation. Separating salt from the water is not a new concept, however it has been historically energy and financially intensive and not suitable for many applications. For stakeholders of the Lower Rio Grande River (LRGR) agriculture industry, this issue is their reality: harming their crops and income. Water is already scarce in this region, the hypersalinized soil demands more water than normal to dilute it—resulting in the region needing to utilize inefficient irrigation techniques. Without desalination, this issue will continue to grow. People's income, a $400M economy, water preservation, and healthy biosystems are all at stake unless the issue is resolved. With a massive problem in-mind, this project embarks on developing and evaluating a scaled system, that affordably converts hypersalinated water to irrigation suitable freshwater and concentrate. Due to limitations established by the scope of the project, a scale prototype that is capable of supporting a 1/10th of an acre will be designed and evaluated. This prototype will establish bounds that represent the stakeholders of the LRGR, although actual systems developed may not use the exact techniques that would be implemented in a full-scale model.

(Table 46) Power Chair for Jessie and JJ

Presenter(s): Charlie Hahm, Josiah Hasegawa, Conner Ozatalar, Maxwell Sage
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich
Sponsor: Jessica Fisher

Abstract:
Jesse and JJ Fisher are two local Terre Haute children suffering from Pelizaeus-Merzbacher Disease. Due to this condition they are unable to move around on their own. Our group designed a power chair that both of the boys could use that allows them to move

around independently. It contains on-board power, speed control, and the ability to switch out the seat to make the chair viable to use by the family for years to come

(Table 78) ASME Design Class

Presenter(s): Ethan Rogers, Mason Wykes, Cameron Buckmaster, David Kanowitz, DJ Liveris, Alejandro Marcenido, Natalie Olic, Carter Lindfelt, Hammond Law, Liv Aspholm, Jayden Gibson, Madison Lindfelt, Ryan Foster
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). McCormack
Sponsor: Marion Body Works

(NDA J) Hydraulic Valve

Presenter(s): Chenhang Yuan, Yunpu Zhang, Shane Yan
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Chambers,Sangelkar

(NDA K) EMT Cutting Tool

Presenter(s): Elijah Huff, Ben Warrick
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bercich, Sangelkar

(NDA L) Kalogon Back Relief

Presenter(s): Ethan Ellis, Aditya Mehra, Tianyi Xu, Xiaoze Sun
Program: Mechanical Engineering
Faculty Advisor(s): Dr(s). Bernal
Sponsor: Tim Balz

Abstract:
The Kalogon Smart Cushion is a cushion designed for wheelchair users, which can automatically adjust and change shape to prevent pressure injuries. The goal of this project is to implement this technology into other seating surfaces as a new product for Kalogon. The product will be able to automatically move and adjust to the user's position, to prevent back pain and remain comfortable for long periods of time.

Academic Program: Multi-Disciplinary

(Table 69) Career Services Office Robot

Presenter(s): Mark Slaninka, Matthew Fix, Ganesh Gajavelli, Jixi Wang
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack
Sponsor: Rose-Hulman Career Services

Abstract:
Rose-Hulman Career Services faculty that are working remotely want the opportunity to have a physical presence and interact with on-campus faculty. The project is to create a robot that can be controlled remotely to navigate the Career Service Office. Remote faculty will be able to log into the robot remotely and click on destinations on a digital map of Career Services or take manual control of the robot. The user will also be able to video call via a Microsoft Surface mounted on top of the robot to facilitate communication with on-campus faculty.

(Table 70) REACH Services Treadmill Modification

Presenter(s): Lauren Hart, Zariyah Robinson, Billy Davignon, Colin Balitewicz
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). Dosmar, McCormack
Sponsor: REACH Services

(Table 71) Six DOF Robot Arm

Presenter(s): Michael Hall, Matthew Hummel, Colton McKay, Nathan Lee
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack
Sponsor: Rose-Hulman Rover Robotics Team

Abstract:
The purpose of this project is to design a new iteration of the Rose-Hulman Rover Team's Robotic arm. The Rover Team competes in the University Rover Challenge (URC). Neccesary tasks include such things as lifting heavy objects, typing on a keyboard and plugging in a USB stick while operated remotely. Our design builds upon the previous two years of experience in competition by improving targeted issues from previous designs including rigidity, dexterity and ease of operation. In order to complete these tasks, we have undergone complete redesigns of all previous joints and the end effector, as well as the addition of a 6th joint while preserving our original weight restraint. The end result is an arm that is capable of consistently completing the wide variety of required tasks.

(Table 72) Drying Solution and Damage Inspection for Waterjet Parts

Presenter(s): Joseph Brandewie, Jiangnan (Steven) Xia, Robert Hairston, Braden Smith
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack
Sponsor: Damping Technologies Inc.

Abstract:
Damping Technologies Inc. (DTI) approached Dr. McCormack's multidisciplinary capstone class for assistance with improving the effectiveness and reducing the noise volume of their parts drying system. Additionally, they would like to add a system to flag parts with cutting defects and count parts as they are dried. Currently, each part's perimeter is custom-cut with a waterjet, rinsed with a hose to remove leftover abrasive material, dried with a loud air knife, then manually inspected for defects. The key role of the Dry team is to design a system that is quieter, dries more effectively, and incorporates a cursory defect detection system.

(NDA M) Milwaukee Tool Chainsaw Kickback Team

Presenter(s): Nathan Turner, Cove Schwitters, Artemis Ely, Timothy Beuchel
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack

(NDA N) Capacitrac Grain Monitoring

Presenter(s): Robert Kreft, Zhu Qingjun, Wyatt Morris
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack, Simoni

(NDA O) Drain Cable Connector Assembly Automation

Presenter(s): Kaia Johnson, Emily Macak, Ethan Mahn, Elizabeth Stutz
Program: Multi-Disciplinary
Faculty Advisor(s): Dr(s). McCormack
Sponsor: Milwaukee Tool

Abstract:
Milwaukee Tool (MT) is a producer of power tools across many fields and a long-standing partner of Rose-Hulman. Some of their products use long springs with machined interlocking connectors that are produced from raw materials. The springs come in a variety of sizes up to 100lbs and varying diameters with matching connectors. The connectors are inserted into the cable, manually welded in place, and then the assembly is bundled and shipped. The goal of this project was to reduce production time of the connectors and springs by simplifying and automating the assembly and welding process.

Academic Program: Physics & Optical Engineering

(Table 73) Junior Design Projectile Launcher

Presenter(s): Aerin King, Andy Krajecki, Pierce Lonergan
Program: Physics & Optical Engineering
Faculty Advisor(s): Dr(s). Alisafaee, Marincel

Abstract:
No products, physical or otherwise, would exist had they not been designed by someone. Therefore, the design process is a fundamental part of all industries. This presentation describes the design process as we applied it to the planning and building of a miniature projectile launcher, capable of launching its ammunition up to twenty feet.

(Table 74) Projectile Launcher - Junior Design

Presenter(s): Jiaqi Shen, Andy June, Katelynn Myers, Brenden Harris
Program: Physics & Optical Engineering
Faculty Advisor(s): Dr(s). Alisafaee, Marincel

Abstract:
We were assigned in our junior design class to design and construct a 3-D printed device. The device had to be accurate. In addition, the device was required to be capable of firing three consecutive shots. The device needed to be readily operable by any user. A constraint set upon the project was to be able to shoot within the dimensions of our Physics Lab. The device also had to be decently light and easily portable.

(Table 75) Ballista Projectile Launcher

Presenter(s): Cody Brelage, Brody Moore, Shawn Troike, Jenna Voticke
Program: Physics & Optical Engineering
Faculty Advisor(s): Dr(s). Alisafaee, Marincel
Sponsor: OE/EP415 The Knights Who Previously Said “Ni”

Abstract:
In this project, a ballista-style projectile launcher was designed, fabricated, and tested over a 5-week period. Using an iterative process, a lightweight, portable design with dowel rods as the primary material and 3D printed parts to supplement was created. The design featured characteristics that both improved the device’s performance, as well as maximized user safety. Throughout the process, the team was able to gain a profound understanding of the iterative design process. This allowed the application of what was learned to this project and those that will be accomplished in the future.