ROSE SHOW PROGRAM

May 7, 2025

Academic Program: Biology & Biomedical Engineering

(Table 120) Instrumented Rein Device for Equine Therapy

Presenter(s): Katarina Helmeset, Sophie Rund, Sarah Shibuya
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Prof(s). Alhalawani, Bhatta, Buckley, Chiu, Rogge
Sponsor: The Lakeland Center

Abstract:
The Lakeland Center teaches adults and children with disabilities how to ride horses, but many riders struggle with rein tension. Our team designed a device to monitor and record rein tension during a horse-riding simulation. Immediate feedback is given to the rider through colorful LED lights, and data on rein tension is saved on an SD card. These sessions upload to a digital user interface that displays a graph and statistics of the session. This data will be used for future grant applications for the center, further supporting the development of local equine therapy in Indiana.

(Table 128) Forces on Horses: Instrumented Saddle Pad

Presenter(s): Christian Booth, Natalie Hannum, Amanda Kuhlman, Eliza Steele
Program: Biology & Biomedical Engineering
Faculty Advisor(s): Prof(s). Buckley, Chiu, Rogge
Sponsor: Lakeland Center

Abstract:
The Lakeland Center, a therapeutic riding center in Coatesville, Indiana, has requested an instrumented saddle pad that can measure the pressure distribution along their equine therapy animals' backs. They hope to use this device in their therapeutic riding sessions to guide riders' therapy plans and to monitor the physical forces on the animals to help prevent injury and pain. The instrumented saddle pad uses a series of sensor-filled patches to measure forces in several key locations along the animals' spine and store and interpret that data for future use and analysis.

Academic Program: Chemical Engineering

(Table 111) Analysis of Caffeine Content in Differing Coffee Roasts and Bean Grind Sizes

Presenter(s): Matt C. Gerona, Lillian Heinze
Program: Chemical Engineering
Faculty Advisor(s): Prof(s). Neumann, Nolte

Abstract:
Kenya Nyeri Igutha AB coffee beans were roasted to four different temperatures using a Aillio RoastTime Bullet R1 roaster. A method for determining the caffeine concentration of coffee samples has been developed using high performance liquid chromatography with an acetonitrile water mobile phase. The following presentation evaluates how caffeine content in brewed coffee varies with different roast temperatures. It was determined that a brewed cup of light roast coffee contains more caffeine than a similarly brewed cup of dark roast coffee with a relative decrease of nearly 30%. It was also determined that the grind size affects caffeine levels, with smaller grounds resulting in a cup of coffee with higher caffeine content.

Academic Program: Civil & Environmental Engineering

(Table 35) Logansport Neighborhood Development

Presenter(s): Sam Makowski, Callie Travioli, Baylee Uhrick, Deonisha Wright
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Aidoo, Bryant, Lovell

(Table 36) Terre Town Rehabiltation Project

Presenter(s): Cade Watson, Devin Bredehoft, Jake Gibbs, Eli Silva
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Bryant, Hanson
Sponsor: Marcus Maurer, City Engineer of Terre Haute

Abstract:
The neighborhood of Terre Town has not seen much infrastructure investment over the past couple of decades. The City of Terre Haute would like to reconstruct the roads, which provides the opportunity to implement stormwater management systems and the addition of walkable pathways. Currently, the site has poor roadway conditions and lacks stormwater infrastructure. The client for the Terre Town Rehabilitation Project is Mr. Marcus Maurer, a City Engineer for the City of Terre Haute. The Terre Town Rehabilitation Project is intended to improve the safety and ease of travel for pedestrians in the neighborhood. The project will also provide a plan for updated roadways and stormwater management. The project is located with the streets of E. Haythorne Avenue on

the north side, Lafayette Avenue on the east side, Boston Avenue on the south side, and N 13th Street on the west side of the site (Figures A1-1 and A1-2). The design includes the rehabilitation of roadways that include the addition of shoulders for safety, and stormwater management to reduce the risk of flooding in the area. The purpose of this project is to provide the community of Terre Town with safer modes of travel and the addition of stormwater management measures.

(Table 43) Logansport Riverfront Senior Design

Presenter(s): Colton Brown, Lexie Crawford, Becky Jones, Alex Lefever, Peter Rogers
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Bryant, Kershaw
Sponsor: City of Logansport

Abstract:
The City of Logansport has a master plan with the goal of attracting people to the City and creating a social space. This project will focus on stabilizing the bank of Eel River and creating a boardwalk that provides a scenic view of the river. It also plans to address the traffic design, stormwater management, and overall site layout. The City of Logansport has a Master Plan with several other aspects, such as increasing local business and Riverside Park recreational spaces, that will be considered in this project's design.

(Table 44) Nepal Brick Manufacturing Plant

Presenter(s): Walker Grove, Audrey Hankins, Caleb Potter, Nathan Rosmarin
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Bryant, Shrestha
Sponsor: Bipin Gaire, CEO of UrbanSpace

Abstract:
The Kathmandu Valley Brick Manufacturing Facility Project is in Shreepur Chhatiwan, Nepal, about 40-km (24.9 mi) south of Kathmandu and adjacent to Hetauda-Phaparbari Road. The site is approximately 16-hectares (39.5 acres) along a river. The primary goal for this project is to create a brick manufacturing facility that will foster economic growth in the area. The facility will be a rotary factory and include different workshops on the inside of a circular driving path. A secondary goal of the project is to design river training structures for the river on the project site.

(Table 51) Vigo County Fairgrounds

Presenter(s): Jorge Almaraz, Jacob Mitchell, Gage Knowles, Jansen Biddle
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Collins

Abstract:
The Vigo County Fairgrounds project addresses the current problems that fairgrounds are experiencing. The change of the intersection location to the North has complicated the

entrance and exit to and from the site. The site has also had issues with aging livestock buildings. Our team has designed new roadways on the site to connect with the new intersection, a new multi-purpose building, and the necessary stormwater management and foundation work needed to finalize the project. This project hopes to provide the fairgrounds with a current solution that also allows the opportunity for future growth.

(Table 52) Illinois Railway Museum Expansion

Presenter(s): Chris Schletz, David Lincoln, Darius Jordon, Ty Xu
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Sutterer
Sponsor: Illinois railway museum

Abstract:
The Illinois Railway Museum (IRM), located in Union, IL, has engaged JLSX Engineering, a senior design team from Rose-Hulman Institute of Technology, to develop an expansion plan for the museum. As the largest railway museum in the United States, IRM requires infrastructure improvements to enhance visitor experience, operational efficiency, and site capacity. JLSX Engineering was tasked with designing a railway bridge over a navigable creek, adding a parking lot expansion, incorporating a pedestrian crossing, and implementing stormwater flood control measures. The design objectives focused on ensuring the safety of the visitors, having an economical design, increasing the functionality of the museum and increasing the parking capacity. To meet the needs of our client, JLSX Engineering designed a 108ft span steel truss pony bridge with a timber pile foundation system. On the west side of the site, a gravel overflow parking lot was designed along with a pedestrian crossing that uses railroad crossing lights to enhance the aesthetic of the design. These improvements facilitate increased parking capacity for visitors and more efficient locomotive relocation. Additionally, an infiltration basin and culverts have been designed for conveyance of excess runoff volume from the parking lot. The following report presents the results from a preliminary desk study, field investigation and laboratory report. It presents design options, design recommendations, a sustainability summary, constructability considerations and an erosion/sediment control plan. Individual design component designs are also included. The total cost for this project is estimated to be $650,000, accounting for material cost and labor cost. However, transportation costs, fabrication costs, engineering design cost, and overhead have not been included.

(Table 59) Autumn Greenway Project

Presenter(s): Whitney Shepherd, Nosa Igiehon, Michael Stenger, Lia Potter
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Aidoo, Bryant, Lovell, Payne, Sutterer
Sponsor: Brad Pease, Director of Engineering for the City of Carmel

Abstract:
The Autumn Greenway Project was initiated by the citizens of Carmel through requests to create an east-west running multi-use trail that would connect the existing Monon

Greenway and Old Meridian Street. The City of Carmel narrowed down the connection locations for the trail and a general project site. The proposed project site runs through both residential and commercial properties and crosses two roadways. The Autumn Greenway Project will provide the City of Carmel with a multi-use trail design that safely meets the request of the community and adds value to the existing multi-use trail infrastructure.

(Table 60) KNUST Teaching Hospital Expansion

Presenter(s): Meg Fosnot, Jamie Baum, Elley Adkins
Program: Civil & Environmental Engineering
Faculty Advisor(s): Prof(s). Aidoo
Sponsor: ABP Consult

Abstract:
The Health Enclave Project aims to expand the KNUST Teaching Hospital, located at Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana. This location ensures accessibility to key urban centers and transport infrastructure, facilitating the efficient development and operation of the expanded hospital facilities. The project is designed to enhance healthcare infrastructure through the construction of new facilities, the expansion of existing structures, and the integration of critical support systems such as stormwater management, drainage, and waste treatment. The Master Plan for this expansion is divided into two primary phases. Phase I involves comprehensive infrastructure development on a 58-acre site, with a key component being the construction of a six-story Ward Block. This facility will accommodate patient wards, doctor offices, common rooms, nursing stations, pantries, and other essential spaces. Phase I is currently in progress, with a building located north of Beyond Engineers' scope of work. Phase II focuses on further expanding the teaching and hospital infrastructure, including an additional 6-story hospital and essential infrastructure such as parking areas, roadways, water supply systems, solid and liquid waste management, and stormwater drainage. The timeline for Phase II will depend on funding availability and investment following the completion of Phase I. Beyond Engineers is specifically responsible for the hospital expansion in Phase II, overseeing the design and engineering of the new hospital building, foundation system, and stormwater management solutions. Our recommendations align with sustainability goals while addressing critical healthcare infrastructure needs.

Academic Program: Computer Science & Software Engineering

(Table 10) Student Demand-based Course Planner

Presenter(s): Madeline Kahn, Alex Johnson, Nolan Cales, Macartan Summerville
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: Matt Boutell, Rose-Hulman Institute of Technology

Abstract:
Student Demand-based Course Planner was created to reduce the work required by the CSSE department head during the process of planning courses for a school year. Previously, the CSSE department head was spending multiple hours more than strictly necessary in computing the figures used in the process. Our software takes in information from current student plans and historical sections, then combines it to provide a clear picture of student needs. This allows the CSSE department head to quickly proceed to the creative parts of course planning without needing significant setup on their own part.

(Table 11) RealityLib

Presenter(s): Joshua Lowe, Matthew McClenahan, Tony Martin, V Phillips
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hollingsworth
Sponsor: Steve Hoelle (CS '04)

Abstract:
RealityLib is an open-source virtual, mixed, and augmented reality framework developed as an extension of Raylib with the goal of providing VR developers a fun and simple framework for building games that were built in C. The project maintains Raylib's philosophy as a framework rather than a full game engine, focusing on adding OpenXR support while intentionally avoiding advanced game engine features like state machines or physics. Development took place through an initial series of game-jams that would utilize the Raylib library itself, which then transformed into work on OpenXR demos, and eventually, bringing these core demo functionalities into the Raylib library as a dependency, called RealityLib. The results of our work is a library which allows for the simple creation of 3D objects, input tracking, SFX, and basic collision support in a VR headset environment. (Meta Quest 3)

(Table 12) Web-Based Geospatial Image Viewer

Presenter(s): Josh Brown, Caleb Shoultz, Ethan Wright, Zachary Cao
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: Johns Hopkins Applied Physics Laboratory (JHU/APL)

Abstract:
The Johns Hopkins Applied Physics Laboratory (JHU/APL) researchers employ satellite/geospatial data to facilitate disaster relief operations, such as containing wildfires. This ongoing project is developing a system which will be used to cohesively search, access, and view this geospatial data from a backend database on a web-based image viewer. By using this geospatial image viewer, teams at JHU/APL will have a simple way to share and view data across multiple teams. The system had previously used MongoDB but wanted to transition to GeoServer, the industry standard to ensure flexibility and maintainability in data across the organization.

(Table 13) Healthdata.tools

Presenter(s): Benjamin Adler, Sam Cox, Anthony Campos, Evelyn Gordon
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chennoweth
Sponsor: Carl Myers

Abstract:
HealthData.Tools is an open-source platform designed to aggregate, store, and analyze diverse health data from various devices—smartphones, wearables, and other medical-grade tools. Despite the abundance of these devices, most data remains locked in proprietary formats, making meaningful analysis difficult, if not impossible. HealthData.Tools empowers users to import and visualize their data in one place, enabling them to uncover patterns and insights that individual sources alone cannot provide. By giving users full control over their health data, the platform opens the door to more informed, personalized decision-making.

(Table 14) EXERT

Presenter(s): Aria Seiler, Aidan Frantz, Evan Bestic, Stephanie Morehart
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: MIT Lincoln Laboratory

Abstract:
It's often desired, especially for forensics and security, to know the structure of data on a computer. EXERT provides this data by dynamically analyzing memory offsets for a Linux OS, using rules statically derived from the Linux source code to verify our results. We achieve this via an advanced config-agnostic C parser, a custom predicate system, automatic dependency management, and dynamic hooks into the OS in question.

(Table 18) Worldclass

Presenter(s): Junki Lee, Duy Le, Frank Zhang, Fengrui Lin
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: Eddie Wang

Abstract:
Worldclass provides an all-in-one, customizable software that can be designed to suit any business's needs without any additional overhead. The company primarily works with local gyms, dance studios, and student organizations. The team will be working on features to improve the experience for both business owners and customers.

(Table 19) BracketOdds

Presenter(s): Ariadna Duvall, Abe Gizaw, Kaylee Lane, Canon Maranda
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: Ian Ludden

Abstract:
BracketOdds is an engaging website that utilizes a variety of machine learning models to generate March Madness brackets for the men's and women's Division I NCAA basketball tournaments. It provides tournament tools and resources for fans, academics, and high school educators on both desktop and mobile devices. Users of this website can interact with the tournament by creating accounts, saving brackets, and viewing leaderboard rankings.

(Table 20) GLADOS: General Learning and Automatic Discovery for Operationalizing Science

Presenter(s): Bennett Toftner, Brady Veal, Riley Windsor, Zach Johnson
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chenoweth
Sponsor: Dr. Jason Yoder

Abstract:
GLADOS started when Dr. Jason Yoder, a CSSE Professor at Rose-Hulman Institute of Technology, found himself building the same interface for many different computational research projects over his years of research. Wanting to ease and speed up this repeated process, he created GLADOS, which began in 2021 as a senior capstone project, with continuous iterations done by different senior capstone project teams each academic year. As of 2025, the project has reached basic usability, allowing for multiple experiments to be run on the system in parallel, and giving users ways to organize their experiments within the system.

(Table 21) AllAboutFood

Presenter(s): Josiah McGee, Matt Briscoe, Hart Howard, Elijah Watson
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chenoweth
Sponsor: Rick Golloger

Abstract:
AllAboutFood is a recipe application developed originally by a 2022-2023 senior project for web browsers with the use of the AI voice assistant Alexa. This application has now been extended to android as well with tons of new features! Those include enhancing the searching capabilities with a new algorithm that supports sorting and filtering, handling fractions, and also payment for premium features. With the use of OpenAI, all of your

stored recipe files can be uploaded and parsed at a reasonable cost. So, if you have recipes to share and store, AllAboutFood is here for sure!

(Table 22) AssetAtlas

Presenter(s): Keith Voltmer, Natasa Zupanski, Brennan Satkoski, Theo Berklich
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chenoweth
Sponsor: Rob Budak

Abstract:
AssetAtlas is a personal inventory management solution that makes keeping track of "stuff" as simple as using a computer's file system. Users can enhance their existing physical storage system by recording as much (or as little) information as they care to, enabling searching for items, tracking where they came from, and more while the application maintains a detailed record of current and past locations. With an intuitive UI, arbitrary levels of container nesting, informative item views, multi device support (including mobile), CSV import/export, and more, we hope this open source and self-hosted solution makes managing your stuff easy.

(Table 26) Mutation Testing Capstone

Presenter(s): Jermaine Brown, Christopher Kim, Veronica Kleinschmidt, Dom Spiotta
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: Mark Hays

Abstract:
Our client, Dr. Mark Hays, has requested a software that performs mutation testing on many different coding languages, including Python, R, C++, and others. Mutation testing is a form of software testing to evaluate the quality of the current tests for a specified project. Minor changes in the code are made, where each changed version is called a mutant. An example of a mutant is changing a plus to a minus, or addition to subtraction. The original code's tests are run on the mutated code to see if the tests fail, as expected. This ensures that the tests check all parts of the original code.

(Table 27) JPEG 2000

Presenter(s): Ryan Brown, Ryan Vance, Yelim Shin, Deniz Tasken
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: John Hopkins Applied Physics Laboratory

Abstract:
Some of the NASA missions, such as the Solar Dynamics Observatory (SDO) and Lunar Topography, produce data formatted to the JPEG-2000 image compression standard. Since JPEG-2000 has never been a widely adopted standard and is generally used only by

science communities, the tooling for, and optimization of, open source image decoders is limited. To support working with this file format we seek an optimized image reading capability.

(Table 28) Patent Prosecution Workflow for IP Law Firms

Presenter(s): Alexander Soiefer, Emma Letscher, Luke Tuck Baden, Chuwei Du
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: Staas & Halsey LLP

Abstract:
A legal firm, consisting of attorneys, assistants, and partners, requires a complex infrastructure that includes tracking communications between patent offices and clients, tracking action items for employees based on these correspondences, and maintaining a large legal database of documents related to these tasks. Staas & Halsey LLP, a Washington, D.C.-based Intellectual Property firm, aims to build a web application that can help employees complete these tasks. While it will initially be tested on their firm, we aim to build a customizable application that can be sold by any legal firm.

(Table 29) AI Medical Coding

Presenter(s): Michael Donaghy, Johnathan Rogers, Mathew Leister, Tanush Biswal
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: Grant Ripperda

Abstract:
AI Medical Coding involves designing a system from scratch to assist manual medical coding efforts. To accomplish this, we are prototyping RAG technology on an LLM, and integrating it throughout our website in an intuitive fashion.

(Table 3) Text Animations

Presenter(s): Ryan Dexter Harmon, Abby Smith, Bee Cerasoli, Blaise Swartwood
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: Mike Hewner

Abstract:
Making animations on a computer screen – like in video games – requires giving the computer detailed, complex instructions. Telling the computer exactly how to create animations can be challenging and time-consuming. We designed a new piece of software - a toolkit for text animation designers. The programmer can focus on the overall text animation to animate individual letters while we handle the technical details of efficient animation building. Our framework uses one of the newest programming languages, Rust,

using the fastest graphics animation renderer, OpenGL. Come visit us to see some of our exciting animations!

(Table 30) Chatbot for Psychological Research

Presenter(s): Ian Stedham, Aidan Janc, Damian Dalic, Zeno Day
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: Louis Tay

Abstract:
Psychology researchers currently do not have and need an accessible platform to perform research on human chatbot interactions and their emotional impact. The main purpose of the application will be providing a platform to investigate the utility of different chatbot prompts and roles and their effect on the well-being and possible behavioral changes for users. While there are existing platforms that allow users to communicate with chatbots in a psychotherapy setting, none of the current platforms allow researchers to investigate how effective these methods are. Our project will provide researchers a streamlined way of exploring the emotional effects of chatbot interactions on users.

(Table 37) Beckman Biomek Recipe Book

Presenter(s): Allison Abernathie, Nolan Feeley-Wheeler, Matthew Linerode, Devin Mehringer
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hollingsworth
Sponsor: Beckman Coulter

Abstract:
We were tasked by Beckman to create a system that can allow users of their Biomek device to easily solve machine vision problems that they have, even without well understanding programming. Many of the users of the Biomek are biomedical researchers who may not have a lot of computer experience. We are creating what is essentially a “recipe book,” where each “recipe” explains how to solve a general problem such as identifying where to pipette on a cartridge. The recipe will explain how to solve the problem by using nodes, which are drag and drop style code which do not require any significant coding knowledge in order to use. By simply arranging the nodes and modifying their parameters, the user should be able to solve a myriad of problems. The workflows and nodes exist in a software called KNIME, and the code is largely written in Python with OpenCV, NumPy, and Pandas. The goal of this project is largely to find a way to allow users to easily solve problems without extensive programming or image analysis experience.

(Table 38) GenderFair

Presenter(s): Jason Shao, Ryan Shiraki, Ethan Liu, Harvey Yang
Program: Computer Science & Software Engineering

Faculty Advisor(s): Prof(s). Liou
Sponsor: GenderFair

Abstract:
Our GenderFair project evaluates colleges and universities based on gender equity, providing transparency on institutional fairness through data-driven insights. By integrating national databases and user-friendly filters, we empower prospective students to make informed decisions aligned with their values.

(Table 4) Engineering Management Virtual Reality

Presenter(s): Kelly Xu, Ron Farrell, Xander Good, James Li
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: Amir Momenipour

Abstract:
Manufacturing environments are complex and identifying pain points and potential improvements often requires experience that is difficult to teach. In order to improve access to on-site style trainings, we have been developing a virtual reality based manufacturing training environment that allows a student to explore the facility at their own pace and develop a mindset for improving safety, output and costs. Our program is written in C++ using Unreal Engine 5, and we have utilized Coverage Validator to ensure no extraneous code exists in our workspace.

(Table 45) RoseData

Presenter(s): Dalton Bumb, Aidan Kirk, Dominic Csomos, Grant Wyness
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: Dr. Yoder/Dr. Ludden

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. This project aims to provide the Rose-Hulman community with a centralized location to find data pertaining to courses, students, and instructors.

(Table 46) MO20

Presenter(s): Henry Krzyzewski, Jack Kelly, Michael Olabintan, Evan Chung
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chenoweth

(Table 5) Omniplanner

Presenter(s): Avichal Jadeja, Chase Villeneuve, Ethan Norfleet, Liana Tutt
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: Saayeh Siahmakoun

Abstract:
Omni-Planner is a mobile app designed to help users organize their tasks, projects, and time efficiently. Instead of having separate planning apps for health, meals/food, finance, and calendar event tracking, all these functionalities can be done in one application. The application allows users to link their account to Google calendar, create and delete health, meal/food, finance, and calendar events, view all upcoming events or the upcoming events in a specific category, and take notes in-app.

(Table 53) Cocktail Tracker

Presenter(s): Cameron Watson, Curtis Knaack, Jasmine Labayog
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: David McGinnis

Abstract:
The Cocktail Tracker is a cross-platform app that allows users to create, customize, and track cocktail recipes and their variations. Users can manage an ingredient inventory, rate and favorite drinks, and generate new cocktails and menus. Built with Flutter and Firebase, the app emphasizes ease of use, offline access, and a clean, intuitive interface tailored for cocktail enthusiasts. A built-in social platform lets users share recipes with friends and view their cocktail statistics.

(Table 54) Evidence-Based Support of Rose-Hulman Student Sleep

Presenter(s): Jamison Boykins, Connor Hallam, William Greenlee, Elenaor Brooks
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Chenoweth
Sponsor: Ben Jelen

Abstract:
This project features the development of an app to improve the sleep habits of Rose-Hulman students, initiated by Dr. Ben Jelen in response to his observations of students' fatigue. The app, Sleep360, incorporates evidence-based practices for improved sleep and aims to foster healthier sleep routines. Using Svelte, a Node.js server hosted on the CSSE Department VMs, and Microsoft SQL Server, the project focuses on creating a user-friendly platform to support student well-being and academic success.

(Table 61) Mobile EMR for Street Medicine

Presenter(s): Ethan Huey, Carl Blome, Vishrut Patwari, Jake Grellman
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Stouder
Sponsor: Jimmy McKanna(Union Health)

Abstract:
This project aims to develop a robust Mobile Electronic Medical Record (EMR) system for pop-up clinics around Terre Haute, designed to support street medicine teams in providing consistent, high-quality care to underserved populations. Developed in collaboration with clinical technicians and leaders, the app integrates core healthcare documentation needs into a streamlined, cross-platform solution. Built with React and ASP.NET Core, it enhances continuity of care and bridges gaps in access through intuitive, real-time data management and reporting.

(Table 62) Moodle Ease of Use Tools

Presenter(s): John Hoggatt, Ryan Huang, Dot Stuhlmiller, Thomas Boes
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hays
Sponsor: Amanda Stouder

Abstract:
At RHIT, Moodle is the application of choice for professors to manage and organize courses. However, many of Moodle's existing features are either lacking or poorly optimized, resulting in a frustrating experience for professors. Our team's goal is to create a plugin to streamline the process of modifying Moodle course information in bulk and allow for ease of course export and reuse. Through the use of our plugin, professors will be able to significantly reduce the amount of time spent wrestling with Moodle.

(Table 69) RESOLVE Verifying Compiler

Presenter(s): Ash Collins, William Foss, JL Koenig, Aditya Senthilvel
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hollingsworth
Sponsor: Dr. Murali Sitaraman

Abstract:
This project focuses on a verifying compiler for the RESOLVE programming language. During the compilation process, a verifying compiler attempts to prove that a code implementation meets its formal specification (i.e., contract) as well as generate an executable. This project seeks to improve existing functionality and enhance verification capabilities. We have added error checking systems to the parsing phase, made a command line interface for a subsystem of the prover to allow user experimentation, and made advancements towards selecting and applying theorems to prove correctness. Future work

will involve refining theorem selection and application, as well as potential refactoring of the compiler's codebase.

(Table 70) Inventory Glitch Simulator

Presenter(s): Daniel Gaull, Caleb Mosteller, Andrew Repine, Aidan Sander
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Hollingsworth
Sponsor: Michael Zhao (CSSE 2021)

Abstract:
The Inventory Slot Transfer (IST) glitch in The Legend of Zelda: Breath of the Wild (BOTW) exploits inconsistencies in how the game tracks inventory but understanding and executing the glitch reliably requires deep technical knowledge and is difficult to replicate perfectly. This capstone project introduces a simulator (programmed in Rust) that emulates the game's inventory system by directly executing instructions from the game's binary. This project serves as the core to a web interface intended to aid in expanding upon various speedrunning glitches for BOTW.

(Table 78) reTHink

Presenter(s): Dylan Bostian, Michael Field, Keegan Vorhees, Abby Weinreb
Program: Computer Science & Software Engineering
Faculty Advisor(s): Prof(s). Liou
Sponsor: reTHink, Inc.

Abstract:
reTHink is a nonprofit organization dedicated to sustainability in the Wabash Valley. The reTHink mobile app is developed from scratch and contains features that help reTHink with their mission, such as showing recycling locations in Terre Haute and a point system where users can be rewarded with gift cards for performing green deeds. There is also an admin panel website that allows for easy maintenance of the app without the need for technical knowledge.

Academic Program: Electrical & Computer Engineering

(Table 138B; 1:45 PM) Flight Remote Module for Data Acquisition System

Presenter(s): Lily Dore, Taylor DiSalvo, Pranav Krovvidi
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter

(Table 117) Design, Implementation and Software Verification of a Battery Managment System Targeting a Designed Motorsport Battery

Presenter(s): Kaitlyn Kampwerth, Joshua Brunner, Taha Benmoussa, Jack Cox
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song
Sponsor: Rose Hulman Grand Prix Engineering

Abstract:
Formula SAE is a collegiate competition where students design, manufacture, and race a Formula 1 style racecar. This project is focused on developing the battery of the EV that is needed to deliver power to various modules, primarily the power and drivetrain of the vehicle, as well as developing a battery management system to charge balance the cells safely. The entire system will be a mix of off-the-shelf components complemented by custom hardware. In addition, suites of documentation and simulation components will be developed to sustain it into the future and communicate the design decisions that were made.

(Table 33) ECE Team 18- SDI Printer with Edge Tracker

Presenter(s): Grant Ruschak, Andrew Zamora, Jack Aldworth, Drew Kilner
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter
Sponsor: Steel Dynamics

Abstract:
After a sheet of steel has been coated with paint according to the needs of a customer, the steel must be labeled with information such as the time, date, and location that it was produced using a stenciler. Traditionally, the stenciler is mounted on a rail and is adjusted manually by an operator. This project is to develop an automated system that will detect the edge of the steel sheet, so that the stencilers can be moved to the correct location autonomously. The control system must maintain edge tracking to control the stencil location with ±.25.

(Table 34) HN Cell Model Hardware Acceleration

Presenter(s): Simar Dhillon, Reese Krakora, Ben McDaniel, Josh Schrock, Isaac Towne
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Chang, Simoni, Song

Abstract:
The HN Cell model is a complex set of differential equations used to model the electrical behavior of a network of neurons in the brain. This model, due to its non-linearity, is difficult for traditional computer architectures to simulate, making it hard for researchers to test new theories pertaining to how large neural networks behave. By using custom lookup tables (LUTs), Ethernet communication, and the open-source Caravel harness for

silicon fabrication, we have designed a custom user space leveraging hardware acceleration and parallelization to assist in more efficiently simulating large neural networks.

(Table 41) New MATHCOUNTS Buzzer System – ECE462 Team 13 Final Project

Presenter(s): Jacob Rast, Calvin Hamilton, Linus Wise
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song
Sponsor: Dr. Leanne Holder and Jim Reppell

Abstract:
A game show system intended for use at the Terre Haute and Evansville installments of the annual MATHCOUNTS competition series. The system consists of a center console, controlled by an operator; six red-and-white button box units for contestants to buzz in with; and an external timer unit, which will allow contestants to view the remaining time in a round. The system features light and sound to indicate when a contestant has buzzed in and when the round has ended and has adjustable competition settings, such as the ability to change the length of a round. All operations can also be controlled remotely via a Bluetooth interface.

(Table 42) Cyber Analysis of OT Through Rehosting

Presenter(s): Xander Lewis, Dan Joshwa, Lia Branstetter, Logan Manthey
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Henthorn, Miller
Sponsor: MIT Lincoln Labs

Abstract:
Abstract: Rehosting is the process of porting a physical device to run in software. By rehosting operational technology (OT) devices, we are able to perform cyber analysis on critical infrastructure to protect from cyber attacks. Building upon MIT Lincoln Lab's existing rehosting infrastructure, we were able to demonstrate the feasibility of cyber analysis on two Programmable Logic Controllers (PLCs) to uncover existing and new vulnerabilities.

(Table 49) Box the Beat Up

Presenter(s): Colin Young, Kallen Selby
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song

Abstract:
"Box the Beat Up" is a rhythm boxing game that's easy to get into, but tough to master. It's exactly like "Guitar-Hero," except instead of hitting notes on a toy guitar, you punch sensors on a punching bag. The punching bag is equipped with four force-sensing resistors, and a

controller is placed in each boxing glove to keep track of which hand is punching. By precisely timing the punches, hitting the correct sensors, and hitting the sensors hard, you achieve a better score.

(Table 50) UDP Attenuator Controller

Presenter(s): JJ Henderson, Owen Leonard, Henry Nunns, Lucas Tyson
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Miller
Sponsor: Huntington Ingalls Industries

Abstract:
A device that accepts UDP packet inputs and produces the appropriate control signals for the attenuators on the output. In addition to handling control information, the device has the appropriate physical connections for 8 attenuator channels, up to 16 attenuators total. The device also is capable of physical user input on the controller itself via an 18-key keypad and LCD screen. The device has an appropriate user interface on this screen that is intuitive for the attenuator control parameters. The device has its own power management and distribution systems, accepting either DC benchtop power or standard AC wall power.

(Table 55) Gap Guyz Tesla Coil

Presenter(s): Jack Cooperman, Jasper Halford
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Brooks

Abstract:
The Gap Guyz Tesla Coil is a static spark gap Tesla coil, a device that demonstrates advanced electrical engineering concepts through the production of artificial lightning caused by tremendously large voltages between the toroidal topload and ground. The design features a 12kV neon sign transformer (NST), static spark gap, Terry filter (overvoltage protection), primary capacitor, primary and secondary windings, and a toroidal topload. The team is excited to share their calculations, simulations, tests, final product, and other findings with the Rose Show audience!

(Table 56) Team 1- HAMPOD

Presenter(s): Salik Ahmad, Andrew Mills, Ethan Townsend, Michael Trinh
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Miller
Sponsor: Rob Santello and Wayne Padgett

Abstract:
The HAMPOD controller is a device that allows blind and visually impaired amateur radio enthusiasts to operate their radios. It connects to the radios through serial connections and provides audio feedback for a number of control parameters such as frequency, modulation scheme, etc. The original device worked well and served hundreds of people globally.

However, due to outdated software and hardware for modern radios, a revision was needed. This version of the HAMPOD updates the system to work with modern radios while simultaneously improving user friendliness, robustness, and additional features.

(Table 57) Power-Optimized Environmental Awareness Monitor for Tracking Human Presence and Movement

Presenter(s): Vineet Ranade, Murari Srinivasan
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter
Sponsor: Two Six Technologies

Abstract:
The Environmental Awareness Monitor (EAM) is an ultra-low-power, edge computation device designed to detect human presence through changes in voice, movement, and pressure. It is built around the MAX32660 microcontroller and features a low-power accelerometer, pressure sensor, and microphone. The system performs step and tilt detection, pressure change sensing, and over 81% accuracy voice activity detection, all while running for over 13 days on a coin cell battery. Designed for use in military training, field missions, and facility monitoring, the EAM enables long-term deployment with little maintenance. This project demonstrates how robust environmental monitoring is possible under strict resource constraints.

(Table 58) Temperature Sensing and Data Delivery for EV Battery Management

Presenter(s): Dylan McCain, Ryan Seidel, Alex Herzog, Beckett Jaeger
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song
Sponsor: Greg Romas

Abstract:
The Temperature Sensing and Data Delivery System is designed to provide a comprehensive thermal monitoring solution for the EV battery pack developed by the Battery Workforce Challenge (BWC) Team. The motivation behind this project stems from the critical need for efficient thermal management in electric vehicles (EVs) to prevent thermal runaway, optimize cooling, and extend battery life. The goal was to develop a scalable, accurate, and energy-efficient temperature sensing module capable of seamless integration with the Battery Management System (BMS).

(Table 63) ECE Senior Design Team 03: Ultrasonic Distance Sensor

Presenter(s): Abigail Kurfman, Evelyn Elmer, Jacob Teaney, Luca Acquasaliente
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Miller
Sponsor: Milwaukee Tool

Abstract:
This project aimed to create a high speed and accuracy distance sensor using ultrasound. The goal accuracy was between 1mm, a range of one meter, and an update rate of 200 Hz. These specs are not found in “off the shelf” solutions for ultrasonic distance measurement. This device is a prototype board that will aid development of future tools. The finished device uses dual ultrasound waves, a logarithmic amplifier, and filtering to achieve 17mm accuracy at a 20Hz refresh rate with a full one meter range. The processing is done with a RP2040 microcontroller and communicates via Serial and UART.

(Table 64) AdaCore_SoC Prototyping

Presenter(s): Justin Roberts, Richard Hsin, Kennedy Olson, Blake Shepard
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Miller
Sponsor: Olivier Henley, AdaCore

Abstract:
This project develops a flexible SoC prototyping board designed to fuel Ada development in embedded systems. The board features high IO availability, DDR memory, cost-effective FPGA, multiple voltage rails, configurable clocks, and IO rails with flexible pin routing. The project ensures compatibility with open-source tools for FPGA bitstream creation and builds an infrastructure for deploying SoCs. A simple extension board has been designed to demonstrate capabilities, in addition to thorough documentation, including templates and a pinout sharing system.

(Table 66) Matrix-Vector Multiplication Library for AMD/Xilinx AI Engine

Presenter(s): Shaina Freeland, Emily Maxwell, Aidan Pappas, Ziyu Xie
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter
Sponsor: Luca Scomparin

Abstract:
This project aims to develop an optimized matrix-vector multiplication library for AMD/Xilinx AI Engines to enable low-latency reinforcement learning (RL) control of particle accelerators. The library will be implemented in C++20 and optimized to perform calculations faster than the existing solution, with a focus on matrices of at least 256x256 in size. This library is a necessary step for enabling real-time RL control of particle accelerator dynamics. For RL to run in real-time, large matrix multiplications need to be performed to do the neural network calculations, as most RL implementations use neural networks, and these calculations must have a microsecond-latency for the RL to respond quickly enough to the real-time changes in dynamics. Successful completion will represent an important step toward autonomous systems for tailoring terahertz radiation generation in accelerators.

(Table 71) Inductor-Based Modular Active Cell Charge Balancing

Presenter(s): Nikita Egorov, Jasper Halford, Ian Lemons, Ishaan Tamarapalli
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song
Sponsor: Greg Romas

Abstract:
Battery modules in electric vehicles (EVs) consist of multiple cell banks connected in series, but natural variations in impedance, capacity, and temperature among individual cells lead to imbalance. Our team designed, simulated, and prototyped an inductor-based active balancing system utilizing the ADBMS6830 battery management IC. We explored multiple balancing architectures, conducted PLECS and PSpice simulations, and developed a custom PCB for real-world testing. The final prototype successfully demonstrated energy transfer between cells, validating the effectiveness of active balancing.

(Table 72) Common Mode Filtering

Presenter(s): Ethan Ockwig, Heath Thomas, Megan Weber, Rick Easterwood
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Song
Sponsor: Dr Cracraft, Dr Wheeler

Abstract:
The broadside coupled coplanar waveguide common mode step impedance low pass filter provides a unique filtering approach to common mode filtering by using a low pass filter design, as opposed to the much more common band stop filters that are currently dominating differential mode signaling. In this project we were able to create simulations, develop a model that accurately predicts the behavior of the circuit, and measure both a prototype board as well as a professionally made board. Our end result is a filter that can stop common mode signals while passing through differential mode signals.

(Table 79) Affordable Electrosurgical Unit Solutions for Developing Countries

Presenter(s): Manav Ahuja, Liz Francois, Evelyn Utley, Zico Youash
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter
Sponsor: Drs. Richard Davis and Nathan Peterson, Surgeons at Kijabe Hospital

Abstract:
Electrosurgery is the process of using a high-frequency, alternating current (AC) signal to produce heat in human tissue; this can result in coagulating blood, cutting tissue, or removing tissue—all without inducing bleeding. Electrosurgery is standard in operating rooms for many disciplines: laparoscopic surgery, cardiothoracic surgery, ophthalmic surgery, dental surgery, and more. Because of their high price and complexity, hospitals in

low-income countries face barriers to buying and maintaining electrosurgical units. Our project aimed to build a low-cost electrosurgical unit that is simpler to maintain while preserving essential functionality for surgeons.

(Table 80) Range Asset Tracking System (RATS) for RF-Contested Environments using Ultra-Wideband Technology

Presenter(s): Isaac Koontz, Ethan Miller, John Maheras, Matthew Hart
Program: Electrical & Computer Engineering
Faculty Advisor(s): Prof(s). Walter
Sponsor: Todd Kuebelbeck & NSWC – Crane Division

Abstract:
Our Range Asset Tracking System is designed to use ultra wide band signals to communicate effectively in contested environments. An array of a centeral server node and multiple fixed point anchor nodes uses triangulation to approximate the location of cooperative roaming nodes in the area. These approximations are then displayed on a WinTAK visual display along with data about the node's current status, team, and location.

Academic Program: Engineering Design

(Table 139D; 2:00 PM) OdessaConnect - Senior Living Video Game Controller

Presenter(s): Ryan Schmidt, Cameron Dorsey, Austin Perry, Daniel Huery, Isaac Johanningsmeier
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin

(Table 101) Math on the Move

Presenter(s): Neesa Bonham, Caledonia Coleman, Emilia Diaz, Kali Hurst, Karsyn Kikta, Jayden O'Dell
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Ingram, Jelen
Sponsor: N/A

Abstract:
Rising amounts of elementary students are struggling in school since the Covid-19 pandemic. To help solve this, we decided to make Math on the Move - an interactive math game that can be used on the move as well as in the classroom. Math on the Move focuses on personalized learning and gamification by helping third grade students improve their math skills. When all four answers are put in the correct place, the lights on the top will light up to show the student that they got the questions right. Let's improve with Math on the Move!

(Table 103) SunFlower

Presenter(s): Owen Smith, Ryan D'Aquila, Tristan Stephens, Jacob Tuck
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Ingram, Jelen

Abstract:
The SunFlower is a portable, sun-tracking solar generator designed to efficiently capture solar energy while maintaining an aesthetic, nature-inspired form factor. It provides clean, renewable energy for outdoor enthusiasts, environmentally conscious individuals, and others in need of off-the-grid power. With its automated tracking system, the SunFlower follows the sun's movement throughout the day, maximizing energy efficiency.

(Table 109) Grea Plant Tower

Presenter(s): Jeremy Bergman, Schuyler Chew, Vanessa Hood, Kayla Kissoondial
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Ingram, Jelen

Abstract:
The Grea Plant Tower addresses the growing field of urban agriculture and gardening by providing an easy-to-use hydroponic plant growth system that is compact, quick to assemble, cost-effective, and self-monitoring. It allows users with limited budgets, restrictive spaces, and busy lives to engage with sustainability and create a positive impact on their own health.

(Table 67) Slippery Little Suckers

Presenter(s): Quinn O'Brien, David Wonderlich, Brooklyn Kiefer, Hayden Rogstad
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
Current slide games on the market lack interesting gameplay mechanics. People need a new game to play that provides for an infinite gameplay loop, this would involve creating a new take on a board game to provide unique experiences and entertainment throughout the whole playthrough. Combining game boards and automation everything moves on its own leaving the action up to a push of a button.

(Table 68) Dance Dance Twister

Presenter(s): Brian Yamada, Jack Wang, Carter Werkema
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
We created a game to bring a cooperative timed twister game where participants race against the clock to try and set the highest score.

(Table 75) Mole-Whack-Ya

Presenter(s): Grace Trask, Madilyn Steiger, Cameron Dorsey, Zach Easter
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta,Mutchler,House

Abstract:
You have heard of Whack-A-Mole: get ready for Mole-Whack-Ya! It's like Whack-A-Mole, but the opposite; instead of hitting the moles, the mole hits you. This is a fun reaction test game where the moles get revenge for the decades of mistreatment and pesky humans stealing their snacks. Play to see how well you stack up against others on another mission to annoy the moles, this time on (mostly) even playing field.

(Table 76) Skee-YEE Tabletop Game

Presenter(s): Carolyn Clore, Logan Fiorito-Zendejas, Boone Gibson, Will Heil
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
We were tasked with making a fun game, and so we made a tabletop Skee-ball machine that launches balls from a launcher rather than having the player roll the ball. We chose to do this because arcade games are cool, but also impractical anywhere outside of an arcade, so our goal was to fix this problem while preserving the fun spirit of the original game. We also chose this project because making miniaturized games is fun.

(Table 77) MagRep

Presenter(s): Aaron Altman, Quinn Johnson, Steven Johnson, Deven Wells
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Ingram, Jelen

Abstract:
MagRep is a modular device that attaches to cable-weight gym machines to track reps, range of motion, and weight used. Using infrared and time-of-flight sensors, it collects workout data and sends it to a Raspberry Pi, and can be viewed on multiple devices. Users get real-time feedback to help workout tracking and monitor progress. Designed to be affordable, compact, and compatible with any machine, MagRep helps everyday gym-goers and trainers bring data-driven insights to their workouts.

(Table 85) The Empowering Flower

Presenter(s): Mary Sclafani, Abbey Hileman, Molly Townsend, and Benjamin Gleason
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
We've noticed that Rose-Hulman students spend lots of time indoors, glued to their homework and studies, not always realizing how nice it is outside. The Empowering Flower is a visual indicator designed for students to inform them of appropriate times to get some sunshine! It utilizes Raspberry Pi Picos to communicate outside temperature and UV data to an indoor computer and mechanical flower. When the temperature and UV index are both within a user-specified comfort range, the flower opens, signaling that conditions outside are comfortable and encouraging the owner to head outside and enjoy the outdoors!

(Table 86) Rock'em Sock'em Fencing Robots

Presenter(s): Scott Papasin, Than Mather, Jayne McCormack, Airin Price
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
Rock'em Sock'em Fencing Robots is a game inspired by the original Rock'em Sock'em Robots, with the robots fencing with one another instead of boxing. The robots move on a slider and are able to swing their swords at each other. The game will also track when a sword swing connects and keep track of the score.

(Table 87) Jenga Avalanche

Presenter(s): Jason Chung, Andrew Cowlin, Isaiah Rohrs
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler

Abstract:
Our project is based on game players' feeling that the popular game Jenga is too linear and needs more variables to increase engagement. Our solution to this problem is Jenga Avalanche, a game where you have to stay quiet, or the game could end early from the 'avalanche' you triggered by being too loud. It adds a fun extra dimension to Jenga based on a microphone and a Raspberry Pi Pico microcontroller, which allows it to quantify sound levels, then trigger a vibration motor under the Jenga tower to shake it, with the motor increasing in strength each time the sound level is too high.

(Table 93) Dreadnought

Presenter(s): Brahm Cole, Ethan Moen, Jeremiah Wenke, Travis Zinzer
Program: Engineering Design
Faculty Advisor(s): Prof(s). Bhatta, House, Mutchler
Sponsor: N/A

Abstract:
If you've enjoyed the game Battleship from Hasbro, you'd be delighted to play Dreadnought. Using circuits, sensors and a GUI, Dreadnought allows players to enjoy the original game physically and electronically. Instead of inserting, plucking, and losing little red and white pegs, users can enjoy the ease of placing their ships magnetically and begin the game quickly with little clean-up. As you place a ship on the board, a reed switch will detect the magnet inside a player's vessel. Using python and circuits, the boats are processed into the game system for play. From there, the GUI will guide the player either to their glorious victory or ultimate demise.

(Table 94) The Modular Moss

Presenter(s): Clover Watson, Tayte Turner, Kyle McDuffie
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Ingram, Jelen

Abstract:
The Modular Moss was created as a hybrid approach to two of the Dyson Grand Challenges–Improving Urban Infrastructure and Developing Carbon Sequestration Methods. During our brainstorming phase, we noticed that one of the great challenges of refining modern cities was finding a way to make them more environmentally conscious without the costly renovations required to add trees or parks. Our solution is a low-cost 'modular garden', almost entirely self-sustaining and configurable in either standing or hanging form. Though originally designed with an eye towards commercial use, feedback obtained during Usability Testing indicated considerable traction in the personal market as well.

(Table 95) Wheely Good Dispenser

Presenter(s): Owen Chaffin, Maxwell Danielson, Harrison Boerner
Program: Engineering Design
Faculty Advisor(s): Prof(s). Brackin, Jelen

Abstract:
The Wheely Good Dispenser provides an accessible medication distribution method for seniors and others who take medication on a regular basis. It solves the problems of reliability and affordability found in current medication dispensers and uses a new mechanical approach that allows for scalability and manufacture through a variety of end-user and industrial methods.

Academic Program: Engineering Management

(Table 119) Generative AI in CS Education: Navigating the Intersection of Student Usage and Faculty Vision (Graduate Thesis Project)

Presenter(s): Matthew McClenahan
Program: Engineering Management
Faculty Advisor(s): Prof(s). Momenipour

Abstract:
This study explores the use of generative AI (GenAI) tools, such as ChatGPT, by STEM students, focusing on Computer Science, Software Engineering, and Data Science (CS/SE/DS) majors at a small private STEM institution during the 2023-2024 academic year. Through surveys of 40 CS/SE/DS students, 156 non-CS/SE/DS students, and 29 faculty, plus interviews with 10 faculty, we identified six key GenAI use categories among 196 student use cases: Productivity and Efficiency (28.1%), Learning Enhancement (29.2%), Research and Information Processing (15.7%), Creativity and Ideation (13.9%), Problem-Solving (8.2%), and Accessibility and Supplementary Support (4.9%). Students value GenAI for efficiency and tailored learning, while faculty see both potential and risks like over-reliance. This research offers insights for integrating GenAI into CS education while addressing opportunities and challenges.

Academic Program: Extracurricular Competition Team

(Table 118) Robomasters Competition Robotics Team

Presenter(s): Peter Morrison, Luci Battershell, Anthony Mui, Alex Stedman, Mateo Fernandez-Tyson, Evan O'Brian, Brooklyn Jennings
Program: Extracurricular Competition Team
Faculty Advisor(s): Prof(s) Song and Mr. Rogge

Abstract:
We are a non-destructive combat robotics team that combines strategic first person shooter gameplay with real life robotics. We compete with 3 robots that shoot projectiles at pressure sensitive armor panels to 'eliminate' the opposing team and win the game. Our mechanical team designs, manufactures, builds, and tests all of our robot chassis. Our electrical team designs and programs custom PCBs for a super capacitor to give our robots a power boost. Our software team develops AI computer vision and ROS for path following for an autonomous robot and command based controls for

(Table 126) Rose Rocketry Showcase

Presenter(s): Thomas Gormley, Reilly Laine, Alex Anisimov
Program: Extracurricular Competition Team
Faculty Advisor(s): Prof(s). Terlep,Kirkpatrick

Abstract:
Rose Rocketry lowers the barrier of entry into aerospace for students by providing opportunities in research projects and competition teams. Members engage with high power rocketry by obtaining their NAR Level 1 and 2 certifications and participating in the annual NASA University Student Launch Initiative. Rose Propulsion Laboratory competes in the Collegiate Propulsive Lander Challenge and is actively building infrastructure to test a liquid rocket engine. Members of Rose Rocketry often land internships at premier aerospace companies and enjoy ample professional opportunity upon graduation.

(Table 127) 30LB Combat Robot

Presenter(s): Zachary Szymkowski, Tristan Heartt, Ethan Harris
Program: Extracurricular Competition Team
Faculty Advisor(s): Prof(s). Canino
Sponsor: Rose-Hulman Combat Robotics, Rose-Hulman Department of Mechanical Engineering

Abstract:
Combat robotics is a field of competition robotics where remotely controlled robots destructively fight in 3 minute matches in an enclosed arena. This combat robotics capstone project involves the design and fabrication of Rose-Hulman's first ever 30LB robot with the goal of competing at RoboBrawl, UIUC on April 4th on behalf of the Rose-Hulman Combat Robotics team. Our robot, named "Gored", uses a kinetic energy spinner weapon in order to damage the opponent, and is designed for the weapon to outreach competitors and to maintain high mobility throughout the match. Upon completion of the project, Gored will continue to compete under the direction of future combat robotics team members.

(Table 134) Powered Swing

Presenter(s): Joey Denison, Owen Smith, Stevie Irvine, James Lambe, Madilyn Steiger, Egan Walsh
Program: Extracurricular Competition Team
Faculty Advisor(s): Prof(s). Bernal
Sponsor: Make it Happen.

Abstract:
A local client reached out to Make It Happen wanting an accessible swing for her children. After considering their needs, we created a fully self powered swing so that they can enjoy the autonomy of swinging by themselves without the necessity of someone else pushing them.

(Table 135) Porsche 914 Cooling Systems Improvement

Presenter(s): Briley Schodlatz, Conner Vinyard, Jordan Welch
Program: Extracurricular Competition Team

Faculty Advisor(s): Prof(s). Chambers, Wilkin
Sponsor: Team Rose Motorsports

Abstract:
We are improving the cooling systems on TRM's 1974 Porsche 914 that has a Mazda 13B engine. From the factory, 914's had an air-cooled engine. The 13B is a liquid-cooled engine and requires a radiator and oil cooler. These two components were not mounted in a way that allowed for adequate air flow through them. We have relocated the radiator and oil cooler so that a large carbon fiber duct can be installed to allow for more than enough airflow to keep the engine cool.

Academic Program: Humanities, Social Sciences, and the Arts

(Table 137) Beanie at Home

Presenter(s): Jester Moya
Program: Humanities, Social Sciences, and the Arts
Faculty Advisor(s): Prof(s). Abas

Abstract:
A portrait of Beanie relaxing at home done in graphite. Created as part of the Introduction to Drawing class conducted winter quarter.

(Table 137) Recreation of "Chepstow Castle on the river Wye, Monmouthshire"

Presenter(s): Jester Moya
Program: Humanities, Social Sciences, and the Arts
Faculty Advisor(s): Prof(s). Abas

Abstract:
A recreation study of Joseph Mallord William Turner's Chepstow Castle on the river Wye, Monmouthshire painting from 1794. This watercolor painting was completed as part of the Watercolor class of Spring 2025.

Academic Program: MDS

(Table 104) 3D-GANs as Priors for Inverse Problem Solving via Bayesian Inference

Presenter(s): Kai-Chun Lin
Program: MDS
Faculty Advisor(s): Prof(s). Stoecklein
Sponsor: Rose Research Fellow Project

(Table 112) Rover Robotic Arm Capstone

Presenter(s): Megan Howell, Rachel Kelly, Matthew Luci, Lily Schoenewolff
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: Rover Robotics Team

Abstract:
We were tasked with designing and creating a new arm design that would replace the current arm on the Rover. The old design was bulky, had poor wire management, had no documentation, and did not function as desired for the competition. Our new design keeps the six degrees of freedom and uses an Xbox controller for movement, but also has a sleeker design, is more lightweight, and will have smoother control due to the motors and servos that were chosen.

(Table 65) ROCKO

Presenter(s): Benjamin Williams, Elizabeth Ziemer, Emily Lopane, Zoe Edgington, Katie Collins, Kiana Fan
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: Bryson Halsey

Abstract:
ROCKO is a bipedal robotics platform developed with the goal of bridging the gap between introductory robotics educations and graduate-level applications. It is a multi-modal, open-source, and highly expandible device intended to cater to hobbyists, students, and educators. The platform seeks to position itself as an option capable of delivering a flexible experience applicable to undergraduate robotics studies. ROCKO successfully caters to this niche by providing a reliable mechanical system with high-performance electrical hardware, an extensible and production-like software architecture, and capacity for advanced robotics research: bipedal locomotion, vision, and autonomous navigation, all at the attainable price point of 750 USD.

(Table 73) Oxygen Tube Management System

Presenter(s): Abbi Stewart, Isabel Taylor, Reilly Mooney, Jester Moya, Jacob Kandel
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: Michelle Walden

Abstract:
The Oxygen Tube Management System is a product designed to be used by the elderly population in need of oxygen therapy to enhance safety and organization of oxygen tubing. This motorized system automatically retracts and extends the tubing, preventing tangling and reducing tripping hazards. The tubing is neatly stored within an enclosed housing,

ensuring a clean and organized environment. A user interface displays real-time information, including retraction speed, direction of movement, and errors, allowing users to monitor and adjust the system as needed. By improving accessibility and ease of use, the system enhances mobility and safety for users relying on oxygen therapy.

(Table 74) DrinkBot by 5 O'Clock Somewhere

Presenter(s): Mindy Altschul, Chase Bilodeau, Lauren Jaracz, Anthony Napreev, Mark Worden
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: DMC Inc.

Abstract:
DrinkBot is a drink making robot that our client, DMC, brings to trade shows as a demo machine showcasing their Siemens PLC control capabilities. DrinkBot has an Italian soda mode as well as a cocktail mode, perfect for all types of events and venues. Our team primarily focused on revamping the mechanical design improve efficiency, portability, user experience, compatibility with their existing PLC code, and ease of assembly.

(Table 81) Chef's Accessible Cooking Equipment (CAKE)

Presenter(s): Aiden Cermak, Max Hansen, Sergio Coco, Amelia Hoffman, Thomas Thullius
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: Rose-Hulman Institute of Technology Department of Multidisciplinary Studies

Abstract:
Chef's Accessible Kitchen Equipment (CAKE) is a student-led, student-initiated capstone project that has designed and developed an open-source kitchen scale with audio cues that integrates with an external recipe app to improve measuring experiences of visually impaired individuals in the kitchen. CAKE conducted market research, cooking observations, and meetings with subject matter experts to determine user needs, both latent and primary. The final design utilizes integrating purchasable off the shelf bowls to increase accessibility for future open source use.

(Table 82) LOME-AI, LLC

Presenter(s): Christian Beadling, Cole Perry, Charles Yang
Program: MDS
Faculty Advisor(s): Prof(s). McCormack
Sponsor: Christian Beadling

Abstract:
LOME transforms your ideas into captivating visual stories with just a few clicks. This AI-powered creative studio generates stunning images, dynamic 3D videos, and narrated content from simple text prompts. Build your media portfolio effortlessly—describe your

vision and watch as LOME brings it to life with professional quality and artistic flair. Share your creations in our vibrant community or keep them private for personal projects. With an intuitive token system, create when inspiration strikes and showcase your imagination without technical skills or expensive equipment. LOME: where your words become worlds.

(Table 88) Milwaukee Tool: Pipe Stand

Presenter(s): Ruben Jevremovic, Stacia Brooks, Isabel Haut, Jacob Gray, Austin Clarke
Program: MDS
Faculty Advisor(s): Prof(s). Brackin, McCormack
Sponsor: Ryan Denissen, VP of Engineering for Plumbing and Electrical at Milwaukee Tool Company

Abstract:
Welders and pipefitters need a way to reliably support and work around the heavy and unwieldy pipes. One tool that is used in this process is called a pipe stand, which traditionally is a rigid metal tripod with a V-shaped attachment which will support and stabilize a pipe that is set onto it. Many stands also incorporate height adjustment features which allow fabricators to level and support pipes at an ergonomic working height. Our client, Milwaukee tool, currently has several specialized tools for use in the pipefitting industry, but does not have a general-purpose pipe stand.

(Table 89) Drive Dynamics

Presenter(s): Anya Cook, Richelle Elkes, Winston de Jong, Ben Graham
Program: MDS
Faculty Advisor(s): Prof(s). McCormack, Momenipour
Sponsor: Amir Momenipour

Abstract:
“Drive Dynamics” is a VR based driving simulation system designed to test the safety and effectiveness of new traffic infrastructure before real world implementation. The system integrates both hardware and software components to create an immersive driving environment while capturing real time biometric and performance data from user testers. The data gathered is then used to evaluate driver awareness, reaction times, stress levels/readings from sensors, and interactions with proposed traffic changes.

(Table 96) Technifab Process Improvement

Presenter(s): Gavin Meier, Mikko Shaia, Liz Purintun
Program: MDS
Faculty Advisor(s): Prof(s). Brackin, McCormack
Sponsor: Technifab Products

Abstract:
Cryogenic company Technifab tasked the team with finding opportunities to improve their expansion joint banding, pipe fitting, and vacuum-jacketed pipe (VJP) system design

processes. The team conducted user surveys, mapped out process flow diagrams, and performed time studies to best understand the current processes. After identifying new machinery to save time and reduce worker fatigue and CAD software with 3D capabilities to address the opportunities, cost analyses were conducted and a business case was presented to Technifab with recommendations.

Academic Program: Mathematics

(Table 15) The Moon's Birth: Exploring the Giant Impact Hypothesis

Presenter(s): Muyao Zhong
Program: Mathematics
Faculty Advisor(s): Prof(s). Finn

Abstract:
The Giant Impact Theory proposes that the Moon is formed from debris of a Mars-sized body that collided with the Earth. My research focuses on the origin and trajectory of the impactor that can avoid early impact for millions of years. The current convincing theory induces that the impactor originated around the stable L4 or L5 Lagrange point, doing a co-orbital motion with the Earth. Then it transfers into a tadpole orbit near the Lagrange point over time. Gravitational perturbation from environment causes the object's orbital energy to gradually increase, which further causes the impactor to expand its oscillation and goes into a horseshoe orbit. Cumulative gravitational influences destabilized the horseshoe orbit. Long time, it will actually impact to the earth.

(Table 16) Dispersive Estimates for Dirac Operators in Dimension Four with Obstructions at Threshold Energies

Presenter(s): Benjamin Lyons
Program: Mathematics
Faculty Advisor(s): Prof(s). Green

Abstract:
In this work, we study the Dirac equation, which models quantum mechanical particles and accounts for relativistic effects. The Dirac equation contains parameters that account for the mass of the particle and the number of spatial dimensions. We obtain time decay bounds for solutions to the Dirac equation describing massive particles in four-dimensional space. From our result, it follows that the amplitude of the wave function of such a particle (projected away from bound states) must decay towards zero over time. This is joint work with Dr. William Green and Connor Lane.

(Table 23) Association of Anxiety and Financial Stress Among Rose-Hulman Students

Presenter(s): Ethan Bernstein, Josh Norris
Program: Mathematics
Faculty Advisor(s): Prof(s). Heyman, Reyes

Abstract:
Mental health concerns among college students have escalated significantly over the past decade, with studies showing a 134 percent increase in anxiety and a 106 percent increase in depression from 2010 to 2019. Students in science, technology, engineering, and mathematics fields have been disproportionately affected, yet existing literature lacks focused attention on their mental well-being. We conducted a survey of the Rose-Hulman student body using the generalized anxiety disorder-7 (GAD-7) questionnaire and other demographic questions to assess whether Rose-Hulman students experiencing financial stress are more likely to report higher anxiety levels. Using a survey weighted linear regression model, our analysis found that students who reported having difficulty concentrating on schoolwork due to financial stress had GAD-7 scores that were 2.15 times higher [95% CI = (1.61, 2.89)], on average, than those who do not report such difficulties. Furthermore, students who only sometimes have access to a car reported GAD-7 scores that were 1.74 times higher [95% CI = (1.08, 2.80)], on average, than those with no access at all. These results suggest that financial stress, both direct and indirect, is a key contributor to higher anxiety levels among Rose-Hulman students.

(Table 24) Insight into the Florida Stock Market during Hurricanes

Presenter(s): Lucas Czarnecki, Avery Wagner, Grace Sheridan
Program: Mathematics
Faculty Advisor(s): Prof(s). Heyman, Reyes

Abstract:
This study investigates the impact of major hurricanes on the stock prices of Florida-based companies in the finance and insurance sectors from 2004 through 2023. Using data from National Oceanic and Atmospheric Administration's hurricane databases and Yahoo Finance, we analyze market responses to several major hurricanes that made landfall in Florida. The analysis considers three different approaches exploring stock performance over several time periods focusing on changes in adjusted closing prices. We employ time series modeling techniques, including ARIMA, Bayesian analysis, and support vector regression, to determine whether stock prices exhibit significant changes associated with hurricanes.

(Table 31) Analyzing Batter Performance in Major League Baseball

Presenter(s): Austin Frisk
Program: Mathematics
Faculty Advisor(s): Prof(s). Heyman, Reyes

Abstract:
With the introduction of Statcast in 2015, analytics in Major League Baseball are more prominent than ever before. Historically, batting average was viewed as the best statistic to evaluate hitter performance, but it does not incorporate information regarding how well a player can hit for extra bases. Another candidate statistic for measuring at bat performance is slugging percent since it measures the total bases a player records per at bat. However, a statistic like batting average on balls in play (BABIP) accounts for batting average for only balls that were put in play, which combines ideas of batting average and slugging percent. BABIP depends heavily on factors that the hitter cannot necessarily control which we call luck factors, like the stadium they play in and the ability of the opposing defenders. It has been shown that 34% of variability in BABIP is accounted for by the hitter's eye, the hitter's fly ball and ground ball ratios, and their contact rate, so this statistic is not purely based on luck factors. Our statistical model, a general linear model, attempts to answer whether BABIP describes slugging percentage after accounting for other factors such as year and player, where we conclude BABIP is statistically significant with a p-value of 3.5443 * 10^-11.

(Table 32) On the SOMA Cube

Presenter(s): Corwin Jones
Program: Mathematics
Faculty Advisor(s): Prof(s). Holden

Abstract:
The SOMA Cube is a puzzle toy from the early 20th century whose solutions were first enumerated by Conway and Guy in 1961 with the SOMAp graph. Further research focused on creating numeric solvers for the puzzle and on analyzing the SOMAp's graph and group theoretic properties. We present a 2-dimensional puzzle, the HEX Game, that preserves key aspects of the SOMA Cube, with the aim of predicting solution sets to SOMA-like puzzles without the need for explicit solving.

(Table 39) TBA

Presenter(s): Brody Magee
Program: Mathematics
Faculty Advisor(s): Prof(s). Leader

(Table 40) Portfolio Optimization and Asset Allocation

Presenter(s): Karlee Malone
Program: Mathematics
Faculty Advisor(s): Prof(s). McSweeney

Abstract:
This senior thesis explores modern portfolio theory through mathematical modeling and computational analysis of portfolio optimization and asset allocation. We construct an

efficient frontier to identify optimal portfolios that maximize expected returns for given levels of risk and determine asset weights for specific risk-return objectives. We also identify the most optimally diversified portfolio in the presence of a risk-free asset. The findings demonstrate how changing asset allocations allows us to tailor portfolios based on individual preferences for maximizing returns or minimizing risk. To deepen the analysis, we assess each portfolio's sensitivity to overall market movements, which enables us to break down total risk into components driven by market-wide factors and those specific to individual assets. Parameters such as asset returns, variances, and correlations are estimated from actual data to ensure the realism and applicability of the model to practical investment scenarios.

(Table 47) Diagonal Forms over Finite Fields

Presenter(s): Nathan Chen
Program: Mathematics
Faculty Advisor(s): Prof(s). Petrik

Abstract:
The Chevalley-Warning Theorems imply that a polynomial over a fixed finite field will always have a nontrivial zero given that the polynomial has sufficiently many variables. In particular, the number of variables must exceed the degree of the polynomial. While this bound is sharp in general, this result can be improved for diagonal forms. We investigate the number of variables that a diagonal form of degree 15 must have to guarantee a nontrivial zero, and provide algorithms that assisted in computations, as well as some discussion on the computational complexity that arises.

(Table 48) unbounded p-adic distributions arising from cyclotomic units and Volkenborn integration

Presenter(s): Connor Lane
Program: Mathematics
Faculty Advisor(s): Prof(s). All
Sponsor: NA

Abstract:
Given a finite abelian unramified at p extension F/Q we let K=F(mu_p) and consider the cyclotomic Z_p extension K_infty/K. We give a construction that maps norm-compatible sequences of semilocal units to unbounded distributions on Gal(K_/Q). Despite being unbounded, we can integrate against these distributions using Volkenborn integration and obtain associated power series. We relate this construction to special values of p-adic L-functions.

(Table 6) Cellular Automata

Presenter(s): Atul Odhayamangalam
Program: Mathematics

Faculty Advisor(s): Prof(s). Rickert
Sponsor: Rickert

Abstract:
A survey of cellular automata with examples.

(Table 7) Mathematical Foundations of Classical Electromagnetism: Maxwell's Equations, Potentials, and Field Theory

Presenter(s): Wynesakia Akamah
Program: Mathematics
Faculty Advisor(s): Prof(s). Finn

Abstract:
Maxwell's unification revolutionized physics by revealing the unity of electricity and magnetism. Building on that legacy, this work explores classical electrodynamics using partial differential equations, differential forms, and variational methods. We introduce the electromagnetic two-form, highlight the geometric structure of Maxwell's equations, and derive wave solutions. Finally, a Lagrangian formulation unifies these perspectives, demonstrating how electromagnetic laws emerge from the principle of stationary action.

(Table 8) Accessibility on Modified NK Fitness Landscapes

Presenter(s): Henry Nunns
Program: Mathematics
Faculty Advisor(s): Prof(s). Riehl

Abstract:
The evolutionary fitness of organisms can be related to their genotype by a fitness landscape, often modeled in a simplified form so that properties like the number of local optima can be studied. The most classic model, called NK, imposes many assumptions, such as the independence of all interactions from each other and that all genes are always active. In this project, we have loosened those assumptions and studied how more complex modified NK landscapes affect evolutionary patterns, particularly how correlated interactions and gene regulation increase access to the global optimum genotype.

Academic Program: Mechanical Engineering

(Table 138A; 1:15 PM) Longball Labs

Presenter(s): Alec Lewandowski, Mark Serdinak, Kade Kline, Jimmy Hall, Andres Aguado, Collin VanDerHulst
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers

(Table 138E; 2:15 PM) New Product Design

Presenter(s): Paul Cleary, Gabriel Latham, Isaiah Strong, TianXiang Zheng
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar

(Table 139C; 1:30 PM) Biomass Reclaimer

Presenter(s): Matthew Carlisle, Onur Dorduncu, Matthew Fruin, Michael Meunier, Eddie Simon
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bernal

(Table 1) Concept Design for Arctic Amphibious All-Terrain Vehicle

Presenter(s): Michael Carrabba, Kerry Fox, Jadon Lopez, Jules McDougall
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: SERC Capstone Marketplace

Abstract:
Anticipating increased military interest in Arctic operations, SERC's Capstone Marketplace seeks a conceptual design for an arctic amphibious all-terrain vehicle that transports 1300 pounds of payload consisting of 4 crew and cargo. The vehicle should be able to travel across arctic tundra and other soft terrain found in marshes, beaches, and deserts. Additionally, the design of a prototype with new and innovative subsystems that address weaknesses in previous amphibious vehicles is of interest, especially vehicle transitions between water and land operations.

(Table 100) Design Build Fly

Presenter(s): Luke Prentice, Apollo Picot, Gabriel Woller, Tanner DeKreuter, Jonathan Hsing
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers, Riley
Sponsor: Dr. Matthew Riley

Abstract:
The objective of the 2025 Design Build Fly team is to design, build, and test a remote-controlled airplane capable of carrying two weighted plastic fuel tank analogs and a smaller aircraft designated the X-1 test glider. The airplane carrying the glider will participate in three flight missions and a single ground mission, where it will be scored on its fuel and glider weight, number of completed laps, and accuracy in landing the glider.

(Table 102) Using Open Source Finite Element Solver to Solve Viscous Flow Problems

Presenter(s): Caleb Munger
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Stoecklein

Abstract:
Dual extrusion flow through shaped nozzles is used to create 3D microparticles for use in bioengineering applications. Current approaches to designing these particles utilize standard Computational Fluid Dynamics (CFD) software, which is expensive and/or challenging to use. This research developed end-to-end open source software in Python that creates meshes for arbitrary nozzle geometry, uses the Finite Element Method (FEM) to solve the incompressible Navier-Stokes equations, and streamtraces the resulting velocity field to determine the extruded flow shape. The software can predict shapes for Reynolds number 0 – 20, enabling a simple method for microparticle shape design.

(Table 106) Wire Basket Manufacturing - All State Manufacturing

Presenter(s): Will Phillips, Nolan Verdun, Nathan Overstreet, Tucker Martin
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bernal
Sponsor: Madison Muncie, All State Manufacturing

Abstract:
Our capstone design project focuses on developing a wire basket and hook manufacturing line for All State Manufacturing. Currently, the wire baskets and hooks are imported from China, and due to a long lead time, our client would like to shift production in house. The system will streamline production by integrating cleaning, cutting, bending, welding, and powder coating processes into a cohesive workflow. By evaluating both manual and automatic manufacturing methods, the design aims to maximize efficiency and minimize cost. The final solution will include proof of concept models, financial analysis, and selection of suppliers.

(Table 107) NASA Psyche Cable Deployment

Presenter(s): Alex Bilodeau, Simon Blair, Reid Morris, Devlen Spradlin
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Dr. Bowman is our individual client and NASAProject is the company

Abstract:
Our project is to develop a mechanism that can deploy a fiberoptic cable array on the 16 Psyche Asteroid. Our developed solution to this problem is to use a trailer that is pulled behind a rover and utilizes the torque of the wheels to rotate a drivetrain that turns the spool that holds the cable at a rate that deploys the cable at the same linear velocity as the

trailer itself. The subsystems we have developed for our project are the spool, cable cross-section, connections to the body, anchors holding the cable's initial position, anchor deployment, and the drivetrain

(Table 108) The Bristle Box Cable Bath for Pipeline Inspection Systems

Presenter(s): Peter De Falco, Evan Gass, Ryland Hixon, Kameron Keyser
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Milwaukee Tool

Abstract:
Our Bristle Box cleaner is designed to clean the debris of all pipeline inspection devices. The team performed finite element analysis and crude testing of a prototype to develop a rugged design that can withstand harsh environmental conditions. The proposed design allows for effective cleaning of the different pipeline inspection tooling with an innovative bristle box while maintaining an ergonomic design. The bristle box is attached to a piping system that guides the inspection cable through a solution bath, removing debris captured during the inspection process.

(Table 110) Accessible Bus Map Capstone Project

Presenter(s): Cassie Domke, Peter Morrison, Natalie Olic, Theo Souris
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bernal
Sponsor: Delilah Rixner - Arc of the Wabash Valley

Abstract:
Current maps of the Terre Haute bus system are inadequate, online only, and somewhat confusing, especially for users with visual, hearing, or intellectual disabilities. We are developing a physical, highly accessible map with visual, auditory, and tactile components, to be placed at the most frequented stops throughout the city, with the goal of helping users navigate Terre Haute more effectively.

(Table 113) Automotive Benchmarking Photo Table

Presenter(s): Christian Duh, Caleb Lehman, Carter Lindfelt, James Morehouse, Max Wheatley
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: thyssenkrupp Presta North America, LLC

Abstract:
Our project is an automated photo table designed to capture high-quality images of thyssenkrupp steering columns and other automotive parts for benchmarking. It features a laptop-controlled user interface that controls the movement of a prismatic arm assembly for precise vertical and horizontal positioning of the camera. To capture all angles, a tilt

mechanism is used to aim the camera and a rotating plate turns the part for complete imaging. By automating the imaging process, this system enhances efficiency, repeatability, and accuracy in image collection, reducing manual errors and ensuring consistent documentation for future inspection.

(Table 114) P31 Wheel Deployment Mechanism

Presenter(s): Hongzheng Pan, David Rogers, Zaizhou Zhang
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Dr. Bernal

Abstract:
This project focuses on designing a wheel deployment and retraction mechanism to enhance the fluid drag performance of amphibious vehicles in water without compromising mobility on land. The objective is to create a compact and durable system that allows for quick transition between terrains while reducing hydrodynamic drag. Instead of focusing on the vehicle body as a whole, this study primarily addresses the mechanism itself, ensuring it meets structural integrity, performance, and feasibility requirements. The linkage analysis performed for this project can also be applied to other systems, such as airplane landing gears and other lifting-arm mechanisms.

(Table 115) Galvanized Sheet Steel Impact Tester

Presenter(s): Owen Dixon, David Kanowitz, Caleb Munger, Sally Zhang
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bercich
Sponsor: Steel Dynamics Heartland Division

Abstract:
The Steel Sheet Impact Tester is the proverbial bigger hammer designed to drive a quarter-sized punch through sheets of newly galvanized steel. The impact tester is a pneumatically actuated punch that drives through and ruptures the sheet steel, providing a failed edge for quality testing. This project provides an upgrade to the current ASTM standard tester, delivering more energy to the sheet steel and testing beyond material failure. This destructive test is one of a series of quality checks meant to provide a leading indicator of failing adhesion of galvanized coating.

(Table 116) Rose-Hulman Human Powered Vehicle Team

Presenter(s): Braedon Vrooman, Gabriel Halperin, Justin Lin, Sam Blake
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Adam, Cunningham
Sponsor: Rose-Hulman Human Powered Vehicle Team

Abstract:
During the 2024 - 2025 school year, the Rose-Hulman e-Human Powered Vehicle Team

designed and constructed Mako, a lightweight, efficient, and practical electric-assisted human-powered vehicle that can be safely and effectively used for everyday transportation. A broad spectrum of modeling, analysis, and physical testing was implemented to ensure that Mako pushed the envelope of electrically assisted human powered vehicle safety and performance. This came in the form of performing simulations and verifying them with experiments such as wind tunnel tests, tensile tests, and crush tests. By using sound engineering principles, Mako achieved its goals and strengthened the knowledge base of the team and e-Human Powered Vehicles community.

(Table 121) Revive the Run Initiative

Presenter(s): Alyssa Solomon, Finn Bromenschenkel, Landen Kerns, Justin O'Donnell
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan
Sponsor: Terre Haute Children's Musem

Abstract:
The Terre Haute Children's Museum is home to the Run with the Animals exhibit that was created nearly 20 years ago. The Run with the Animals exhibit is a fun, interactive exhibit where the museum's guests can select an animal they would like to run against and run along a track that lights up at the speed of the animal they chose. The exhibit has been loved and cherished by the museum's guests, which is the reason the project was brought back to Rose-Hulman to be renovated. After 20 years of love, the exhibit has become non-functional, and it is up to the Revive the Run group to revive this beloved exhibit.

(Table 122) Wine Chiller

Presenter(s): Thomas Lowery, Ben Jacobs, John Paul Dalton, Andrew Pena
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bernal

(Table 123) Flip Lip

Presenter(s): Dominic Cipriani, John Hoeksema, Lando Jongeward, Coleman Weller
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan
Sponsor: Dr. Lovell

Abstract:
Our client observed that patio doors in High Velocity Hurricane Zones (HVHZ) came with a 4" tall aluminum lip fixed to the bottom of the door, which poses a major tripping hazard. This project must produce a design that prevents water from entering a home via a patio door, follows all codes necessary to maintain home insurability, and not pose a trip hazard. The current design meets those needs by fixing a piece of waterproof material to the bottom and sides of the door that covers an aluminum lip which hinges on the bottom of the door, allowing it to mechanically flip up and down as the user desires.

(Table 124) Flex Cable Oiling System

Presenter(s): Dexter Ande, Owen Austin, Dale Reiff, Katie Stuart
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Milwaukee Tool

Abstract:
Our client has tasked us with integrating an automatic oiling system into the Milwaukee Tool High-Speed Chain Snake. For our project we will be delivering to our client a functional prototype along with some final recommendations for a design solution. Automation, integration, durability, ease of maintenance, and cost effectiveness are among the most important qualities of our design. Come learn how our team uses smarter oil to achieve smoother performance.

(Table 125) RoseGPE Aerodynamics Package

Presenter(s): Tyler Blaszczak, Kyle Rehberg, John Biederstedt
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers
Sponsor: Dr. Allen White

Abstract:
RoseGPE is a student-run competition team that competes in an annual FSAE (Formula Society of Automotive Engineers) competition that involves the design, fabrication, testing, and performance of student-designed, formula-style vehicles. The aerodynamics package is of vital importance to the car, providing necessary downforce and balance adjustments for improvements to competition performance. The aerodynamics team primarily serves to increase downforce and stability while mitigating the trade-offs of drag and weight in an effort to boost the overall success of the RoseGPE vehicle.

(Table 129) Small-Scale Wind Turbine

Presenter(s): Steph Harpold, Edith Klasing, Laura Smith, Everest Zang
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Dr. Ben Mertz

Abstract:
The small-scale wind turbine project has now completed its 5th year. The goal for this year was to make the turbine, and how the performance is measured, safer. In previous years, the turbine's performance improved so much that the old components could no longer withstand the conditions created during testing. Thus, the blade design and manufacturing methods were improved to account for the additional load. While redesigning the blades, a safety cage was constructed to ensure that potential unexpected disassembly did not harm the observers or surrounding equipment. Finally, a remote measurement apparatus was

integrated into the base of the turbine to remove the need for human interaction with the system to quantify the performance.

(Table 130) PLA Composting

Presenter(s): John Dinkel, Ben King, Audrey Pangerc, Anthony Vail, Donald Woodruff
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bercich
Sponsor: Tom Rogge

Abstract:
The PLA Composter sustainably processes 3D printed PLA waste generated in Rose-Hulman's innovation centers. PLA is a corn-derived bioplastic that is advertised as compostable. However, it can only be fully decomposed under specific conditions which are not met by current at-home composting solutions. The goal of this project is to develop a safe and effective method of breaking down 3D printed PLA waste generated at Rose-Hulman and turning it into compost to be used in campus gardens.

(Table 131) Smart Chair-iot

Presenter(s): William Geoghegan, Shaun Yamamoto
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Fisher

Abstract:
The Smart Chair-iot is a drivable chair created as a Mechatronics project. The user provides driver input through a joystick. An LCD supplies readout information about the operational state of the chair. An RFID detector allows the user to lock and unlock the chair using registered ID cards, with audible lock state feedback given through an onboard speaker. 20-volt drill batteries power it. The drivetrain comprises one DC motor driving a differential gearbox coupled to an axle that extends to two wheels. Two bike brake calipers stationed about rotor disks provide turning control.

(Table 132) Psyche Robotic Explorer

Presenter(s): Grant Paradowski, Isaac Jochum, Gabriel Trotter, Charlie Wake
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Arizona State University Psyche Team - Dr. Bowman

Abstract:
Psyche 16 is a metal-rich asteroid which has been hypothesized to be core material of a planetesimal, currently orbiting the Sun between Mars and Jupiter. Arizona State University partners with NASA to oversee research pertaining to the Psyche project. Our project goal is to design a low-cost mobility system that is capable of operating in the extreme conditions present on Psyche. The final design to date introduces three additional

features to the existing Rocker-Bogie suspension system, adding versatility while maintaining the core functionality of the explorer.

(Table 133) RoseGPE EV Powertrain

Presenter(s): Hammond Law, Michael Noack, Levi Wallace, Axel Johnson, Elan Varhan
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers, Constans
Sponsor: RoseGPE

Abstract:
This project focuses on the design and optimization of the FSAE EV powertrain, with emphasis on cooling, accumulator design, and component placement. A liquid-cooled system was developed to manage thermal loads, improving performance and reliability. The accumulator was designed for efficiency, safety, and serviceability. Wire routing and component placement were optimized for minimal losses and ease of maintenance. Simulation, prototyping, and testing guided design decisions, ensuring a robust and high-performance powertrain.

(Table 136) Team P.E.D.A.L. – Designing a bike trailer chassis to provide transitional housing for those experiencing homelessness

Presenter(s): Dylan Baumgartner, Brock Beehler, Naomi Knudtson, Owen Mullins, Ethan Swanner
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bercich
Sponsor: Garri Knezevich of S.H.O.W. (Sheltering Homeless on Wheels)

Abstract:
In the United States, the number of homeless individuals is growing every day. In Vigo County alone there are over 2000 homeless individuals. There are resources to help those experiencing homelessness, including shelters, kitchens, and volunteer services, but none are long-term solutions. There is a need for a solution that includes better stability, security, and longevity to aid homeless individuals and help them get back on their feet. We aim to provide transitional housing through a bicycle trailer chassis system that features universality, stability, and manufacturability, without compromising on an affordable and lightweight frame.

(Table 17) Vertical Garden

Presenter(s): Chelsea Saucedo, Timothy Johnson, Taylor Bussett, Karissa Givens
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers
Sponsor: reThink Inc.

Abstract:
Integrating a vertical garden at reThink offers a multifaceted solution to their mission of reducing landfill waste and promoting sustainability, it allows the residents of the Wabash Valley to become inspired to cultivate their own food. A few key features of the vertical garden are multi-level garden beds, 18 square feet of gardening area, a circular watering system, locking wheels, and the ability to disassemble.

(Table 2) ExStream Team

Presenter(s): Emily Buchta, Cole Chmielewski, Libby Smith, Cate Stauffer
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan
Sponsor: Montessori Academy of Terre Haute

Abstract:
The ExStream Team was tasked with designing a stream table to fit the needs of the Montessori Academy of Terre Haute to teach environmental science topics. We developed a robust and durable stream table to meet the client's needs of an interactive option for students aged 2-12 years old as an alternative to the more demonstrative market options. Recyclable materials and a closed water loop system met the client's sustainability goals. Child operable valves ensure student learning independence, following the Montessori's "follow the child" methodology of teaching. Industry standard sand and filtration ensures our tables matches or exceeds commercial models on the market today.

(Table 25) Fixing SDI's Achilles' Steel: The Automation of Steel Marking

Presenter(s): Adam Deckard, Andrew Nichols, Elijah Bahr, Ian Resnik, Sai Ganumpally
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan
Sponsor: Steel Dynamics, Inc.

Abstract:
Steel Dynamics (SDI) is a large steel producer in North America featuring a flat roll group here in Terre Haute. One of the important steps in steel manufacturing is marking client information on the product through the use of print heads. SDI has requested we automate the printing process on their flat roll line. SDI's current solution consists of manually moving two print heads to the desired locations. We automated this process using a cart and rail system that utilizes a Programmable Logic Controller (PLC) in tandem with an edge tracking system to move the carts to their required locations.

(Table 83) Steel Dynamics Coil Bander

Presenter(s): Cameron Buckmaster, Liam Fish, Hannah Ponstine, Susan Smucz
Program: Mechanical Engineering

Faculty Advisor(s): Prof(s). Bercich
Sponsor: Steel Dynamics

Abstract:
Finished steel coils on Steel Dynamics' (SDI) Galvanizing Line are banded before transportation. This process is currently manual, the operator wraps plastic banding material around the coils, which range up to six feet in diameter. Nearby structures make this an unsafe and tedious process. This team built a banding arch to feed the band around the coil while the operator stays in place. The arch contains the band with a rubber flap until it is pulled free and tightened around the coil. The arch is retractable under the coil and rides on linear rails to move between multiple banding locations.

(Table 84) Cold Shipment, Develop, designing and testing a refrigerated shipment device that is cost-effective to perform in the medical sector

Presenter(s): P45, Isabella Patterson, Nolan Perito
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: Mechtek, Cliff Meyer

Abstract:
P45 Cold Shipment is focused on designing and testing a refrigerated shipment device that is cost-effective to perform in the medical sector. This means we are creating a system of devices that maintain refrigeration temperatures according to medical standards. We must comply by all standards that insure valid tissue shipment. In addition, we have been tasked with developing a cost-effective solution, so not only should our product be competitively priced to produce, but it must be able to be shipped through traditional commercial shipping practices. Due to this commercial shipping requirement, we have developed a solution that can hold temperature for at least 48 hours which allows for error in an overnight or one-day shipping modality.

(Table 9) Artic Amphibious All Terrain Vehicle - Build Team

Presenter(s): Jacob Durenberger, Nick Edwards, Sam West, Zachary Yong
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Sangelkar
Sponsor: SERC-Capstone Dr. Michael Delorme and William Shepard

Abstract:
Our team designed, modeled, and tested innovative systems for an all-terrain vehicle traversing amphibious and arctic conditions. Using subscale proof-of-concept demonstrations, we aimed to optimize the vehicle's ingress and egress maneuvers on sloped shorelines. The systems will autonomously regulate the vehicle's attitude in water and automatically detect wheel slip to redistribute torque across four independent motors, which maximizes vehicle traction in all-terrain situations. By modifying an off-the-shelf

remote-controlled truck chassis and fabricating a representative hull model, we are validating the innovations proposed for the full-scale model designed by a peer modeling team.

(Table 90) Autonomous Lawnmower

Presenter(s): PLo Lodha, Tom Hendrix, Andrew Leonard, Trent Steele, Daniel Gove
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bernal

Abstract:
This project focuses on the design and development of an autonomous lawnmower intended to serve as a safer, more cost effective alternative for commercial lawn care operations. By prioritizing manufacturability, reliability, and affordability, the proposed system aims to reduce labor costs while enhancing efficiency.

(Table 91) GSI Grain Elevator Boot Cleanout Door

Presenter(s): David Burden, Brennen Walker, Tyler Eldridge, Matthew Glazer
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers
Sponsor: GSI

Abstract:
This project is a redesign of a boot cleanout door for a GSI grain elevator. The main areas of focus were the self-contained nature of the design and the introduction of a locking mechanism that improved the safety and usability of the cleanout door.

(Table 92) Campus Waste Measurement

Presenter(s): Toby Furgat, Landon Purdue, Jay Adams, Christopher Kellar
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Bercich
Sponsor: Jake Campbell and Justin Perry

Abstract:
Rose-Hulman has an issue with the current method of waste measurement. Most waste that leaves campus is estimated by assuming a fixed waste weight per dumpster pickup, leading to a high degree of error in the campus's waste tonnage data. We can't manage what isn't measured. Under the directive of Jake Campbell and Justin Perry, our solution intends to reduce this error by targeting the campus dumpsters. Our solution is a steel frame that takes continuous weight measurements of dumpsters via load cells connected to an Arduino microcontroller.

(Table 97) EM103 Introduction to Design - Sections 08 and 10 Project Teams

Presenter(s): Prof. Dugan, Prof. McCormack
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan, McCormack

(Table 98) Battery Workforce Challenge Vibrational Analysis Team

Presenter(s): Braden Blackburn, DJ Liveris, Richard Peters, Paul Sofineti, Jack Martin
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Chambers
Sponsor: Battery Workforce Challenge

Abstract:
Our team is conducting vibrational analysis on a modular electric vehicle battery pack for the Battery Workforce Challenge. Using ANSYS simulations and physical testing with the ObserVR1000 and tri-axial accelerometers, we aim to identify natural frequencies, shock forces, and fatigue life. We're verifying the pack's mechanical integrity under real-world vibration conditions to ensure long-term durability. In addition to our own testing, we support other teams in the competition with any vibration-related concerns that could impact system performance. This project is supported through close collaboration with Vibration Research, Stellantis, Argonne National Laboratory, the U.S. Department of Energy, and PCB Piezotronics.

(Table 99) Vibing With Wheels

Presenter(s): Ethan Cobble, Chase Wilkinson, Daniel Ingram, Luke Poole
Program: Mechanical Engineering
Faculty Advisor(s): Prof(s). Dugan
Sponsor: Dr. Simon Jones

Abstract:
The Vibrations Analysis (EM406) course at Rose-Hulman Institute of Technology contains rotational unbalance as a topic in its curriculum, but there is currently no laboratory assignment that features this topic. Dr. Simon Jones, a professor of mechanical engineering at Rose-Hulman who teaches EM406 would like a piece of lab equipment that shows the effects of rotational unbalance emulating the process of balancing a tire, a process that uses rotational unbalance theory. He has asked our capstone team to design a table-top device that will give students visual and physical intuition for rotational unbalance while connecting the course to a practical, every-day application.