STUDENT Innovation + Excellence SHOWCASE

APRIL 24, 2025

PURDUE UNIVERSITY
INDIANAPOLIS, INDIANA

Presentation Abstract Number: 100
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Autonomous Kart

VIP

Author(s):

Ahammad Ashar Ahammad Ashar† (Engineering); Krtin Akkineni† (Engineering); Kalani K Harada† (Engineering); Pinidu Nanayakkara† (Engineering); Annalyz Nguyen† (Engineering); Neilambar Risal† (Engineering); Chaitanya Dnyanesh Sonawane† (Engineering); Daniella Daluchi Chizoba Ejeckam‡ (Engineering); Kjaesean Jaisyn Forde‡ (Engineering); Nolan Lee Hardman‡ (Engineering); Vasanth Kalangari‡ (Engineering); Brandon Lee Koers‡ (Engineering); Juan Felipe McKendry‡ (Engineering); Zilan Patel‡ (Engineering); Cameron G Summersgill‡ (Engineering)

Abstract:

In collaboration with Code19, a professional autonomous racing team, the Autonomous Kart project aims to develop a conversion kit for the Blue Shock X3 kart, enabling new autonomous karting teams to focus on automation. The kit includes five systems: steering, braking, throttle, sensors, and software, all designed for easy installation.

The steering system autonomously controls direction via a NEO Brushless motor, transferring power through a 45:1 gearbox to the control arms. The entire system is designed for maximum simplicity and reliability while also being strong enough to withstand 5G of loading.

The braking system automates braking without relying on kart-specific features like regen systems. It uses linear actuators and a robust mounting system to ensure effective control. The software regulates braking force, and can stop the kart as quickly as possible in emergencies.

The sensors team integrates visual processing, GPS, a dead man’s switch, remote control, and a central computing unit. The Vision RTK2 handles object avoidance and location tracking, while the NVIDIA Jetson Orin Nano processes autonomy code. A remote control assists in testing, and the dead man’s switch enhances safety.

The throttle system provides precise acceleration via ROS2 integration. A servo motor with 624 oz-in of torque at 8.4V manipulates the throttle cable, with a custom-machined bracket ensuring stability under racing conditions.

The software team develops the autonomous system using ROS2, integrating steering, sensors, throttle, and braking. ROS2 ensures smooth coordination, enabling safe navigation around detected obstacles.

Keywords: Autonomous; Kart; Motorsports; Code19

Mentor(s):

Charles Holliday Jenckes (Purdue University)

Other Acknowledgment(s):

Ahamed Thaha Hussein (Engineering)

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Presentation Abstract Number: 101
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Juncos Hollinger Racing Brake System Test Bed

Motorsports Engineering Capstone

Author(s):

Padraig Alford† (Engineering); Saketh E Thillai† (Engineering); Brandon Christopher Howard† (Engineering)

Abstract:

Juncos Hollinger Racing was connected with the Purdue University Indianapolis Motorsports Program to complete a project that comprised of concepting, designing, and manufacturing a brake system test bed assembly to be used to analyze differences between brake lines for their IndyCar program. The project stems from a desire to investigate the differing performance of various brake line lengths, sizes, and materials using an apparatus that would allow for consistent and repeatable brake pedal press for each test. This apparatus was to be built as a portable setup that is entirely separate from the racecar and aims to replace the human foot with an adjustable linear actuator to eliminate human error and will allow for precise control over the brake pedal force application as well as the release. To create this apparatus, the full engineering design process was utilized to concept, design, and select the items that make up the brake system test bed. Project objectives, targets, and constraints were initially identified before moving on to an extensive brainstorming process that led to many initial concepts and design alternatives. Key equations and project constraints directed the selection of options for major system components. Weighted design matrices were then used to select the best option for these major system components. A top-level assembly was completed in SolidWorks using all major system components and assisted in creating detailed assembly drawings and an extensive bill of materials (BoM) encompassing the brake system test bed project.

Keywords: IndyCar; Brake; Test; Pneumatic; Motorsports

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgment(s):

Jess Flynn Chen (Purdue University)

Presentation Abstract Number: 102
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Automated Spark-Based Data Filtering Tool for Trip Qualification

The Data Mine

Author(s):

Raja Allmdar Tariq Ali† (Science|JMHC); Vishal Wagh† (Science|JMHC); Avanish Jayarama Mallya† (Science); Hana Zoaib† (Science); Jazmin Pulido† (Science); Muhammad Ahmad Rizwan† (Science|JMHC); Ping-Chun Tsou† (Science); Prisha Singh† (Science); Vihaan Pradeep† (Science)

Abstract:

This project develops an automated data filtering tool to improve machine learning model decision-making by removing records that may skew results or be unsuitable for training. Using Databricks, Python, and Spark, we built a pipeline that cleans engine telemetry data by applying multiple filters. The tool includes an interactive, widget-driven configuration interface that gives users both options: they can simulate the filtering process to preview which records would be flagged without actually dropping them, or they can apply the filters to permanently drop records based on their selected criteria. This dual functionality helps reduce false positives and false negatives, resulting in a cleaner dataset for both training and production. Also, by automating the filtering process, we reduced processing time for end users and achieved reduction in labor costs, ensuring the tool is both efficient and user friendly.

Keywords: Machine Learning; Databricks; PySpark; SQL; Data Filtering

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 103
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Enhancing Farmer Access to Agricultural Programs in Indiana

The Data Mine

Author(s):

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Abstract:

This project is a centralized web-based platform designed to empower Indiana farmers with streamlined access to over 150 agricultural and conservation programs. In a landscape where information is scattered across numerous websites - resulting in an estimated $1.8 billion in missed opportunities - farmers often struggle to locate and apply for the vital resources they need. Our innovative solution leverages advanced web scraping techniques to aggregate data from key sources such as the USDA and NRCS, and it delivers the information through an interactive map with county-specific filtering. Using our web scraping tool, all relevant program information is collected efficiently, not only saving valuable time for administrators but also ensuring that farmers have access to the most up-to-date information in real-time. A user-friendly administrative interface further simplifies program updates by enabling effortless data refresh through URL submissions. This innovative approach brings together multiple resources into one easy-to-use platform - enhancing program accessibility, fostering sustainable agriculture, and unlocking untapped opportunities across Indiana.

Keywords: Agriculture; Web Scraping; Conservation Programs; Data Analysis; Data Cleaning

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 104
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Optimization of Food Pantry

EPICS

Author(s):

Daniel Richard Douglas† (Engineering); Victoria Susan Mantai† (Engineering); Carter Egan Reeve† (Engineering); Vanisha Rajlakshmi Vanisha Rajlakshmi† (Engineering); Jaden Patricio Almendarez‡ (Engineering); Nishant Bonthala‡ (Engineering); Shauryeh Raj Kapur‡ (Engineering); Arnav Rajay Khapekar‡ (Engineering); Keshav Elesh Patel‡ (Engineering); Ishaan Raut‡ (Engineering); Yianni Nicholas Roditis‡ (Engineering); John Richard Semenoro‡ (Engineering); Luke Gorman Stratford‡ (Engineering); Ofer Zeltzer‡ (Engineering)

Abstract:

As of 2025 over 1 million Indiana residents are food insecure. Food insecurity has to do with a person's lack of resources to properly feed themselves or their family. This issue was first picked up by Gleaners in 1980, serving 21 counties within Indiana, and Indiana University joined the effort in 2023 . Our project focuses on the reasons Hoosiers are food insecure and taking data to help us better understand the nature of the issue in order to optimize the process of food distribution within Gleaner’s system. We have approached this issue from three different directions; analyzing Gleaner's floor plan and layout, developing an app that can help organize Gleaner's system, and looking for "Bad Receivers" which would allow us to determine the roots of each issue in an attempt to mitigate food insecurity in Indiana.

Keywords: Food Pantry; Optimization; Gleaners

Mentor(s):

Kevin T Lee (Purdue University); Ramaa Saket Suri (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 105
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

VIP 17912's Section 504 Presentation

VIP

Author(s):

Sayee Sabri Anand† (Engineering); James Courtland Bailey† (Engineering); Joseph Adam Braun† (Engineering); Julian Bawi Lian Cawi† (Engineering); Tristen John-Paul Hendzel† (Engineering); Dashel Xavier Meiners† (Engineering); Nahyr Sehgal† (Engineering); Sachiv Sekaran† (Engineering); Nathaniel Ray Willhite† (Engineering); Yusuf Esmat Arafa‡ (Engineering); Luke Davis‡ (Engineering); Evelyn Clare Hays‡ (Engineering); Rich Liu‡ (Engineering); Maverick James Masterson‡ (Engineering); James M Scanlan‡ (Engineering); Koebin M Shake‡ (Engineering); Zi Zhu‡ (Engineering)

Abstract:

This application includes three projects, each with three different industry partners, that will be condensed into one poster to represent VIP 17912's section 504 in Indianapolis.

Abstract 1, Allison Transmission:

In collaboration with Allison Transmission, this research project addresses the challenge of retrofitting legacy manufacturing machinery on their Plant 4 facility in Indianapolis, where approximately 75% of the machines lack internal capabilities to output digital data. These machines are critical to producing "Series-1000" transmissions, and the absence of built-in data collection mechanisms limits the ability to monitor performance or implement predictive maintenance strategies. To overcome this limitation, this project focuses on integrating external sensors—specifically vibration, acoustic, or current sensors—to enable real-time data collection and analysis. The system aims to predict cycle times, detect spindle failures, and estimate tool life by analyzing patterns in vibration frequencies, acoustic emissions, or motor current draw. The implementation of a sensor network is designed to enhance production reliability, reduce unplanned downtime, and extend the lifespan of tools and machinery. This study demonstrates the feasibility of retrofitting older equipment with modern data collection capabilities and highlights the potential for significant operational improvements in high-volume manufacturing environments.

Abstract 2, Raybestos:

The purpose of this study is to analyze and obtain data regarding employees working at Raybestos and determine the cause of high turnover. Though unfinished, current progress involves using current Raybestos statistics. Using Excell allows for the neat organization of said data. For the years 2024 and 2025, a total of 235 employees left the company – 79.15% of them involuntarily. The reasons for these terminations involved lack of work at 9.79%, job abandonment at 22.98%, and attendance at 34.04%, among many other reasons that took up a smaller percentage of the involuntary leave employees. Additionally, only 16.17% of these employees worked for more than one year, highlighting the retention issue. Based on these findings, Raybestos should consider some key factors influencing employee turnover. A review of attendance-related terminations, including sickness, personal, or unavoidable circumstances could help improve their turnover. The high percentage of job abandonment may indicate underlying workpla

Keywords: Fabrication; Sensors; Manufacturing; Data Analysis; Employee Retention

Mentor(s):

Charles Holliday Jenckes (Purdue University); Steven R Dunlop (Purdue University); Ahamed Thaha Hussein (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 106
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Outdoor Theater Camp Riley

EPICS

Author(s):

Jude Stephen Kieper† (Engineering); Natalie Rose Vasquez† (Engineering); Landon James Paul† (Engineering); Nurlan Arzumanzade‡ (Engineering); Austin Ray Hughes‡ (Engineering); Jibrael Rasheed Crossman‡ (Engineering); Daniel Larue Armstrong‡ (Engineering)

Abstract:

This project focuses on creating an outdoor theater at Camp Riley that blends naturally into the environment while being both cost-effective and family-friendly. Instead of using expensive new materials, we're repurposing leftover and recycled materials wherever possible. This not only keeps costs down but also makes the project more sustainable.

The seating will be designed with kids and families in mind, offering a mix of comfortable spots that fit all ages. The layout ensures everyone gets a great view while keeping the space open and welcoming. The screen will have a secure storage system to protect it when not in use, and the speaker setup will be carefully placed to provide clear sound without being intrusive.

Keywords: Camp Riley; EPICS; Outdoor; Service Project; Theatre

Mentor(s):

Kevin T Lee (Purdue University); Sai Abhishikth Somishetty (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 107
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

BME Outreach EPICS Team

EPICS

Author(s):

Mehdi Omar Badawi† (Engineering); Logan Taylor Bragg† (Engineering); Aurelia Azifa Chelfannisa† (Engineering); Alia Eissa† (Engineering); Ava Elizabeth Fuchs† (Engineering); Diego Lara Prieto† (Engineering); Seongho Lee† (Engineering); Mason William Smith† (Engineering); Aliza Marie Soyster† (Engineering); Elizebeth Ann Zike† (Engineering); Malachi Eriq Barnett‡ (Engineering)

Abstract:

The BME outreach team is building a Mirroring Robotic Arm with a Compatible Glove, aiming to ignite interest in Biomedical Engineering (BME) among middle and high school students. The project integrates a human-like robotic arm that can mimic essential hand and arm movements with an interactive glove capable of translating sensor data into corresponding mechanical actions. Designed to be lightweight (under 10 pounds) and durable enough to withstand everyday impacts and a 30-inch fall, the arm utilizes 3D-printed components, fishing line connected fingers, and motor-driven joints. These materials ensure both functionality and ease of assembly. The glove incorporates flex sensors, a gyroscopic sensor, and an ADC module interfaced with a Raspberry Pi to capture and convert user movements into readable digital data in real-time. Progressive prototyping led to improvements including redesigned finger joints, repositioned thumb mechanisms, and optimized circuit designs. Our project explored multiple material perspectives such as using neoprene for its strength and flexibility over less durable materials, keeping with our commitment to balancing safety and performance. The design is structured not only to demonstrate complex engineering principles but also to engage students through interactive, hands-on activities and informative presentations about the expansive biomedical engineering field. With extensive risk analysis, rigorous testing, and clear documentation, the Mirroring Robotic Arm project serves as a tool for experiential learning and a great way to exemplify BME innovation. We emphasize cost-effectiveness, safety, and educational outreach, ensuring the project provides a comprehensive platform for learning and innovation in the Biomedical Engineering Profession.

Keywords: BME; EPICS; ARM; HAND

Mentor(s):

Sydney Gorman Hillan (Purdue University)

Other Acknowledgment(s):

Ashley Thachuthara sonny (Engineering)

Presentation Abstract Number: 108
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Engineering Escape Room

EPICS

Author(s):

Daniel Patrick Bueno† (Engineering); Liam Benjamin Ramos† (Engineering); Olaoluwa David James-Ayantunji‡ (Engineering); Shawn Brinster Brinster‡ (Engineering); Carol Emad Fekri Tawfik Shenouda‡ (Engineering); Peter Dogbegah‡ (Engineering); David Andrew Tomlin‡ (Engineering)

Abstract:

You and your team have mysteriously found yourselves locked inside Purdue University President Mung Chiang's office, and time is running out! The only way to escape is by solving a series of engineering-themed puzzles that test your problem-solving, critical thinking, and teamwork skills. From decoding secret messages to repairing complex systems, every challenge will push your engineering knowledge to the limit. Work together, think fast, and unlock the mystery before the 60-minute countdown reaches zero—or risk being stuck forever!

Keywords: Mechanical Engineering; Arduino; Electrical Engineering; Computer Engineering; Puzzles

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 109
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Data Driven Defect Analysis in High Pressure Die Casting

The Data Mine

Author(s):

Amaan Zahid Chaudhry† (Polytechnic); Doniv Joseph Vinod† (Science); Lekhya Sree Akella† (Science); Kyra Li† (Engineering); Savir Rajeshwar Patil† (Science); Shlok Tandon† (Science); Vishwa Mohan Surabhi‡ (Science); Mason Nicholas Arnoldy‡ (Science)

Abstract:

Defects in die-cast parts contribute to substantial material waste and increased production costs for manufacturers. The high-pressure die casting process involves numerous variables, with measurements taken at multiple stages to monitor quality. This study analyzes production data from Walker Die Casting, specifically focusing on parts manufactured for Allison Transmission. The goal is to identify patterns and insights within the data that can help predict and mitigate defects, ultimately reducing scrap rates and improving manufacturing efficiency.

Keywords: Defect Analysis; Die Casting; Manufacturing

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 110
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Live Like Lou Assistive Technology

EPICS

Author(s):

Yi-Lien Chen† (Engineering); Celine Lu† (Engineering); Mixuan Pan† (Engineering); Supalerk Chularojmontri‡ (Engineering); Alan Brandon Arispe‡ (Engineering); Peter Rafael Astarbi‡ (Engineering|JMHC); Steven Chen‡ (Engineering); Rohan Haldankar‡ (Engineering); Muhammed Qaanith Kamal‡ (Engineering); Robert Henry Smith‡ (Engineering); Siddarth Velnati‡ (Engineering); Ethan Yang‡ (Engineering)

Abstract:

The goal of our project is to create a product (website) that would autonomize the process of matching ALS patients with volunteers, a process that is currently being done manually by the Live Like Lou foundation. The product works in three parts combined into one. The first part is the front-end coding that inputs data into the database containing information on registered volunteers and patients. The second part of the program is the matching program, which matches volunteers with patients closest to their location using longitude and latitude coordinates. The last part of the program is the database itself containing sensitive information and can both import and export information when needed. Combining all of these makes a website that allows volunteers and patients to register for the organization and locate them to their nearest volunteer/patient. Their data is secured in the database and can also be used to contact them with important information if need be.

Keywords: ALS Patients; Autonomize; Matching; Database; Volunteers

Mentor(s):

Kevin T Lee (Purdue University); Garvit Agarwal (Polytechnic)

Other Acknowledgment(s):

Presentation Abstract Number: 111
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Simple Synth

VIP

Author(s):

Jacob Tyler Renta† (Engineering); Ojus Giri† (Engineering); Hao-Chen Li† (Engineering); Kyston Reeve Howard† (Engineering); Luke Charles Crummett‡ (Engineering); Tsz Pui Jiang‡ (Engineering)

Abstract:

The objective is to create a simple synthesizer to produce digital sound waveforms that can be controlled with a number pad. The focus of this design is being designed for System on Chip(SoC) and with the intent to create an integrated chip that can be manufactured to produce the design. The synthesizer works on a simple one octave scale and is designed in software and simulated on AMD Urbana FPGA.

Keywords: Synthesizer; Student Made

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 112
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Indiana School For the Blind and Visually Impaired EPICS Team

EPICS

Author(s):

Kyle Richard Ding† (Engineering); Sami Iqbal† (Engineering); Seongho Lee† (Engineering); Abdullah Mohamed† (Engineering); Junbin Cui‡ (Engineering); Andrew Joseph Hruskocy‡ (Engineering); Abigail Prathika Jebaraj‡ (Engineering); Ilana Jhirad‡ (Engineering); Zechariah Jones‡ (Engineering); Ju En Kim‡ (Engineering); Moyinoluwa Samuel Ojerinde‡ (Engineering); Angelina C Powell‡ (Engineering); Ibrahim A Riazi‡ (Engineering); Sachidanand Sreeraj‡ (Engineering)

Abstract:

Our EPICS class is partnered with the Indiana School for the Blind and Visually Impaired, aiming to create accessible solutions to various problems they have presented to us. The following are short descriptions of these projects.

The Clarinet Reed Alignment Tool Project aims to develop an accessible tool that will assist visually impaired students in properly aligning a clarinet reed on a mouthpiece. This tool addresses the issue of aligning the reed without vision, offering better sound quality and usability for visually impaired musicians. The project involves user-centered design, prototyping, and testing phases to offer a functional, durable, and adaptable solution that enhances music education inclusivity.

The Tuner Project aims to design a music tuner specifically for blind and/or people with visual impairments. This tuner would give feedback to the students in a way that is not dependent on sight. We are focusing on producing prototypes and researching filtering/haptic feedback changes to the project. Our approach builds upon the concept developed in the past and aims for comfortability and cost effectiveness.

The LEAP project is a braille typewriter that converts contracted braille, uncontracted braille, and mathematical braille into English. This is accomplished through sensors that track the keys being pressed. The information from the sensors is sent to a Raspberry Pi that converts the braille into English after detecting the type of braille, then outputs the English translation to a document.

Keywords: ISBVI; EPICS; Music; Braille

Mentor(s):

Sydney Gorman Hillan (Purdue University)

Other Acknowledgment(s):

Ashley Thachuthara sonny (Engineering)

Presentation Abstract Number: 113
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

SAFETY Project

EPICS

Author(s):

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Abstract:

The SAFETY project is creating an interactive demonstration for the Indianapolis Motor Speedway Museum exemplifying the importance of energy reduction barriers in motor racing applications. Our main concept is showing what kind of materials work best as barriers for the racetrack, and the role that these different materials have on impact with a car. This demonstration will serve as a way for the public to learn about motorsports safety, as well as show how the absorbance of energy from an impact can affect a car. Our group is striving to give a better explanation for safety both on and off the track.

Keywords: Safety; Motorsports; Museum

Mentor(s):

Charles Holliday Jenckes (Purdue University); MohammadHossein Jamshidnejad (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 114
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Corteva Database and LLM Analysis of Crop Protection Product Labels and SDSs

The Data Mine

Author(s):

Sameeksha Sekhar Desai† (Science); Jason Chan† (Science); Jay Vatti† (Science); Lakshya Chaudhry† (Science); Nandika Yadav† (Engineering); Nicholas Alexander Loyd† (Science); Sriman V Donthireddi† (Science); Anh Khoa Duc Nguyen† (Science); Same Mehretab Kiflu‡ (Science); Kashyap Vallur‡ (Science)

Abstract:

In collaboration with Corteva Agriscience, this project under Purdue's The Data Mine program addresses the inefficiencies in accessing vital crop protection product information from Safety Data Sheets (SDS) and product labels. Traditionally, Corteva's chemical formalists manually sift through thousands of such documents—an error-prone and time-consuming task. To overcome this, our team developed an automated pipeline that extracts and structures data from PDF documents and enables natural language querying via a Large Language Model (LLM)-powered chatbot.

Keywords: AI Chatbot; Document Intelligence; Vector Database; Data Extraction; Agriscience Automation

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 115
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Indiana State Museum EPICS

EPICS

Author(s):

Jacob Henry Rikkola† (Engineering); Ayden Matthew Rosencranz† (Engineering); Aarav Singh† (Engineering); Colin S Ternus† (Engineering); Caiden A Diaz‡ (Engineering); Scott F Dukes‡ (Engineering); Nickolas Anthony Frascone‡ (Engineering); Aidan Joseph Ghosh‡ (Engineering); Joseph Andres Gonzalez‡ (Engineering)

Abstract:

Motivation/&Problem statement: The Indiana State Museum highlights and showcases innovation, history, and rich culture of Indiana. The Indiana State Museum partnered with Purdue's Epics to help showcase Indiana's contributions to agriculture and Automotive industry through the development of two unique exhibits.

Agriculture: The Agriculture exhibit highlights Indiana's impacts & contributions to Agriculture. Our agricultural exhibit does this by showing the rich history of tractors and highlighter their evolution over time, a tactile learning element of custom designed and husk-able corn with factoids on the significance of corn growth in Indiana, and a interactable design box that highlights the importance and changes different tills have had on the development of agriculture and more efficient farming practices.

Speedway: The Speedway exhibit demonstrates Indiana's history of car innovation through the lens of STEM, as requested by the museum. It utilizes a mirror minigame and a harness to demonstrate to visitors the innovations in safety equipment, and then gives users hands-on experience with a hydraulic braking system. All the while, the visitors are guided through the exhibit with the lens of STEM, creating an informative and interactive experience.

Keywords: [no keywords provided]

Mentor(s):

Charles Holliday Jenckes (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 116
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Bridging the Performance Gap for Females in Motorsport

Motorsports Engineering Capstone

Author(s):

Nathaniel Loewito Elijanto† (Engineering); Kyle Prakash Gyawali† (Engineering); Carter John Kundinger† (Engineering)

Abstract:

Motorsport is one of the most unique sports in the world, as it is based entirely on the connection between a human and a vehicle. It is also one of the few sports in the world where both men and women can compete on a level playing field. However, due to the nature of the biological differences between male and female bodies, females have different requirements to extract the most performance from their driving. With the help of Tatiana Calderón, former Formula 2 and INDYCAR driver, and current driver for Gradient Racing in the IMSA WeatherTech Sportscar Championship, this project will tackle the differences and produce solutions to help bridge the gap between male and female performance in motorsports. Her experience in multiple forms of motorsports will be essential information to understand strategies and methodologies that could be long-term solutions for the problem at hand. Utilizing the categories Tatiana provides as areas where females may be at a disadvantage, the project dives into body position in a race car, tying a 2D model of forces and loads, to the biological muscular makeup of the female body. The results from these models, along with experiments conducted on racing simulators, can be combined to conclude whether or not there is a significant disadvantage for females in motorsports and can help drive future design modifications to vehicle cockpits and systems to help level the competitive field in racing.

Keywords: Gender Performance Differences; Vehicle Ergonomics; Biomechanics; Cockpit Design; Motorsports

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgment(s):

Seyedeh fatemeh Nabavi (Engineering)

Presentation Abstract Number: 117
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

EPICS Cathedral High School

EPICS

Author(s):

Owen Jacques Friedman† (Engineering); Kinser Earle Maners† (Engineering); Alexander R Morales† (Engineering); Moustafa Elsayed Abdelsamad† (Engineering)

Abstract:

We are students of EPICS at Purdue University Indianapolis and are collaborating with Cathedral High School (CHS), a Catholic private school on the North-East side of Indianapolis that values education, to solve problems using the engineering design process. We are contributing to their mission of creating the best possible learning experience for students and teaching experience for teachers. CHS has four science laboratory spaces that are much larger than needed for the number of students using them resulting in noise, distractions, and inefficient use of space. To solve this problem, our project will design and build a movable wall system using sound deadening material to divide these large laboratories into smaller, more manageable learning environments. Our project scope includes designing, constructing, and installing movable dividers that will enhance the way CHS is able to use this space.

Additionally, a Student Data Management System was made to develop a system that helps improve academic course decision planning by analyzing past student academic performance. The project organizes and stores student demographics such as GPA, SAT, and AP scores in a secure database which is integrated into a user-friendly website. The system will assist students and teachers in making informed academic recommendations for future courses and college preparation based on their past performance trends. The goal of this project will focus on refining the data process, website front-end functionality, and better algorithms to enhance academic predictions. This will result in an efficient, secure, and reliable website that benefits CHS students and faculty.

Keywords: Cathedral; EPICS; Data Management; Engineering; Divider

Mentor(s):

Patrick Corey Gee (Purdue University)

Other Acknowledgment(s):

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India 3 EPICS Team

EPICS

Author(s):

Soterios Steven Koukios† (Engineering); Shay H Hardsaw‡ (Engineering); Trinity I'Shae Houston‡ (Engineering); Andrew Oscar Kahn‡ (Engineering); Faysal Olakunle Kasim‡ (Engineering); Khoa Dinh Dang Tran‡ (Engineering)

Abstract:

The India 3 EPICS class is partnered with two universities in India, each of which has their own community partner they are working with.

Our first team is partnered with Chennai University and is focused on creating health related attachments for wheelchairs. Our solution is to provide detachable module features that provide thermal comfort, physical therapy, and health monitoring systems. We are currently testing our health monitoring prototype, augmenting the code of the health monitor processor to accurately calculate the bpm and additional features such as status report concluded from the user's pulse data, spO2, etc. We are still designing our thermal/physical therapy, we're finding the right fabric for the heating wire to effectively warm the user and safe for use.

The second project is in partnership with Malla Reddy University. The group of students that we are working with has created a code for the Raspberry Pi that takes a picture of Banana tree leaves and then runs them through a deep learning module to identify if they have a disease or a mineral deficiency. Our role in this project was to design a case to house a 3b Raspberry Pi connected to a Pi Camera module, and a power bank for the system. This case is meant to be 3d printable, so we have created CAD models that are separated into 3 parts. We've been redesigning the case to be thicker in order to be able to properly screw it together.

Keywords: EPICS; India; 3D Printing; Wheelchair

Mentor(s):

Sydney Gorman Hillan (Purdue University)

Other Acknowledgment(s):

Ashay Uday Berde (Engineering)

Presentation Abstract Number: 119
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

EPICS India 1: Developing a Prosthetic arm for Brain-Computer Interface Studies

EPICS

Author(s):

Jonathan Steven Hickle† (Engineering); Meyan Ketan† (Engineering); Ahana Roy Chaudhury† (Engineering); Valerie Wingsee Cheang† (Engineering); Erik William Schneider‡ (Engineering); John Richard Cox‡ (Engineering); William Edward Dietsch‡ (Engineering); Aadi Bhattacharya‡ (Engineering); Michelle Katrin Novoselova‡ (Engineering); Richard James Buchanan‡ (Engineering); Nicholas Andrew Ostavnenko‡ (Engineering)

Abstract:

Our partner team in India, Kalasalingam Academy of Research and Education, has requested a prosthetic arm for transhumeral amputees to integrate with their brain-computer interface research. The project is divided into three mechanical design teams elbow, wrist, and hand and one electronics team. The elbow team is developing a joint with sufficient torque to support the arm's weight while meeting the required degrees of freedom. The wrist team is maximizing mobility while ensuring adequate force output. The hand team is designing a compact structure with several joints for natural grasping. Meanwhile, the electronics team has been prototyping control code, planning circuit connections, and coordinating with our partners for seamless integration.

Our goal is to create a functional prosthetic that improves user control and usability. Our next steps include refining the design, testing mechanical and electronic systems, Integrating the subteams' work into a finalized design, incorporating our partner team's research, and preparing for real-world implementation.

Keywords: Prosthetic Arm; Neuroprosthetics; Biomedical Engineering

Mentor(s):

Charles Holliday Jenckes (Purdue University); Ramaa Saket Suri (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 120
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

EPICS: Engineers Without Borders

EPICS

Author(s):

Ryan Khoury† (Engineering); Tilak Chandrakant Gondalia† (Engineering); David Quan Xing Chin† (Engineering); Lindsey Denise Laine† (Engineering); Hailey Elizabeth Holstein‡ (Engineering); Rodrigo Barrento Sobral‡ (Engineering); Aiden Jasareno‡ (Engineering); Kyra Li‡ (Engineering); Emma Elizabeth Matoka‡ (Engineering); Jacob Isaiah Medina‡ (Engineering); Stephanie Morin‡ (Engineering); Ishita Mukadam‡ (Engineering); Nicholas Edward Perry‡ (Engineering); Sam William Pierce‡ (Engineering); Bennett Nathan Popp‡ (Engineering); Jaezmin Ruiz-Sanchez‡ (Engineering); Keira Riona Sadoski‡ (Engineering); Vishal Sandeep Sawant‡ (Engineering); Karamvir Singh‡ (Engineering); Estin Renato Stanisich‡ (Engineering); Alexander Maxim Volovich‡ (Engineering)

Abstract:

The Engineers Without Borders (EWB) EPICS section is working toward establishing a new student chapter of Engineers Without Borders USA at Purdue University in Indianapolis. Engineers Without Borders looks to build a better world through engineering projects that empower communities to meet their basic human needs. To that end, the Leadership Team is working on completing the chapter application to gain official organization status while also engaging with chapters and professionals within and beyond the organization. Additionally, they are securing grants and funding for dues and future projects, all while overseeing operations to ensure the club runs smoothly and continues to make progress. The Business Team is building interest in the organization through information sessions and social media engagement and is planning future fundraising opportunities. In order to build the hands-on design skills needed for an official EWB project, the Design Team is partnering with the master gardener at Eskenazi Health on a gardening tool to plant seedlings more efficiently. The produce from these gardens helps ensure patients have access to fresh, healthy food. Through this work, the team is cultivating their skills in networking, understanding user needs, following a design process, documentation, and presenting to other engineers as well as project partners.

Keywords: Engineers Without Borders; EPICS; Community Health

Mentor(s):

Karen Denise Alfrey (Purdue University); Jenna Suzanne Carter (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 121
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Calculator with addition and subtraction capabilities.

VIP

Author(s):

Jason Zhengxuan Huang† (Engineering); YuKuan Lu† (Engineering); Aaditi Anupam Vaval† (Engineering); Eric Chase Williams† (Engineering); Roni H Aziz† (Engineering); Matthew D Samuel‡ (Engineering)

Abstract:

The goal of this project is to create a calculator with addition and subtraction capabilities. We are output the results to a two seven segment display with a sign. The calculator runs on 10MHz clock and we have 13 keypad inputs.

Keywords: SoCET; VIP; Calculator

Mentor(s):

Steve Clayton Rausch (Engineering); Mark Johnson (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 122
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Habitat for Humanity, EPICS

EPICS

Author(s):

Shani H Hui† (Engineering); Ethan Michael Elliott† (Engineering); Hunter James Rutledge† (Engineering); Lakota Storm Robbins† (Engineering)

Abstract:

Habitat for Humanity Indianapolis commissioned a new sign frame design to overcome challenges faced by previous models, including weather resistance, damage, and theft. The objective was to create a durable, cost-effective, lightweight, and easily transportable solution that could be assembled by a single person. Collaboration with the project partner helped define key requirements, leading to the selection of an optimal design. The finalized frame incorporates sturdy yet lightweight materials, ensuring ease of transport and assembly while addressing durability and theft resistance. During prototyping, inefficiencies in the assembly process were identified and resolved, resulting in an improved second prototype that reduced build time without compromising quality. Testing confirmed that the design meets strength and longevity requirements, with additional evaluations planned to validate long-term weather resistance. Habitat for Humanity will implement the design across future properties, ensuring effective communication, enhanced community engagement, and improved property presentation.

Keywords: Community-Engagement; Prototype; Collaboration

Mentor(s):

Michelle S Ulmer (Purdue University); Kevin T Lee (Purdue University); Garvit Agarwal (Polytechnic)

Other Acknowledgment(s):

Presentation Abstract Number: 123
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Allison Transmission - Final Test Stand Warranty Correlation

The Data Mine

Author(s):

Lina Im† (Science|JMHC); Justin Azanli† (Science); Angad Singh† (Science); Dhruv Raj Patel† (Science); Jorge Antonio Jimenez† (Science); James M Scanlan‡ (Engineering); Justin Carmine DeRosa‡ (Science); Trung Duc Lam‡ (Science); Mason Nicholas Arnoldy‡ (Science); Larry Wei‡ (Engineering)

Abstract:

The project will be a correlation study of Allison Transmission on highway transmission warranty claims compared to in plant functional test rejects and repairs. The project will involve review of large warranty files and functional test data files looking for trends in the functional test stands with corresponding warranty claims. Student researchers will collect and analyze functional test data from test stands that reside in the Indianapolis manufacturing facility. Using both data sets, they will correlate any functional test rejects or variable data to warranty claims. The ultimate goal is to build an automated system through a web application that can take both data sets and provide early indication of warranty risk based off of functional test results.

Keywords: Warranty; Correlation; Claims; Transmissions; Rejects

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 124
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Shafer Data Transfer Team

EPICS

Author(s):

Karan Rahul Karkhanis† (Engineering); Ian D Morris† (Engineering); Matthew Van Conner‡ (Engineering); Mason Lee Morgan‡ (Engineering); Isabelle Anne Hunt‡ (Engineering); Sophia Yixuan Lu‡ (Engineering)

Abstract:

Shafer Leadership Academy (SLA), a non-profit organization providing team leadership programs, contacted us about their outdated data management and workflow. Their main priorities were removing the inefficient processes embedded into their system to increase their growth capability and organizing their data structures to simplify analytics.

Our focus has been implementing an improved data management system. Currently, they do most of the work manually including sending individual emails, uploading data, and having to use personal accounts for storage. In order to solve these issues, we proposed to further utilize the software Zapier, which connects various services through automation. Using Zapier, we can create “paths” that move data around and organize without the extra hassle. Additionally, we can connect Zapier to Google, which is not only great for storage but also provides access to forms, surveys, and sheets. The main idea is to condense and create efficiency within their system while changing their day to day as little as possible.

So far, we have completed various tests using Zapier, for example, sending an email containing details about the program. We have had several meetings with SLA to clarify how their current situation operates, what their needs are, and what they liked about our ideas.

In the future, we plan to expand and test our full Zapier solution as well as share a prototype to SLA that has at least the required functionality. SLA would provide feedback to us and we could improve the system from there.

Keywords: Zapier; EPICS

Mentor(s):

Sydney Gorman Hillan (Purdue University)

Other Acknowledgment(s):

Suchandra Teja Torlakonda (Engineering)

Presentation Abstract Number: 125
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

India 2

EPICS

Author(s):

Woojung Kim† (Engineering); Roman Theodore Vander Zwart† (Engineering); Dylan Joseph White† (Engineering|JMHC); Isabel Moreno‡ (Engineering); Megan Marie Puntney‡ (Engineering); Tyler David Bender‡ (Engineering); Kamusiime Justus Byaruhanga‡ (Engineering); Nessim Leon Chreky‡ (Engineering); Za Kham Tluang‡ (Engineering)

Abstract:

Abstract

India 2 team is collaborating with two institutes in India to tackle issues within the communities.

The purpose of this project is to manage food waste generated at MIT Solapur cafeteria. Our team is working on two projects: developing a microorganism composter bin and building a food management website. Our goal is to reduce food waste and improve lunchtime efficiency for our partner. To address this issue, we decided that a microorganism composter bin would be an eco-friendlier solution than incineration, which is a common way to manage food waste. Designed with minimal technology, it will be applicable to various communities worldwide, making sustainable food waste management more accessible. Additionally, the website will allow students to register food options, reserve or purchase meals in advance, and help the canteen prepare accurate portions. This will minimize excess food while tracking waste data for future improvements.

The next team is collaborating with Narsee Monjee Institute of Management Studies in Mumbai to partner with the Balipara foundation in Eastern India, working on reforestation of the region to reduce damage caused by deforestation. We are using ArcGIS to render 3d map templates of tree canopy cover using the Miyawaki method. This model can then be used to predict where reforestation efforts will be most effective and more likely to be successful. This project not only aims to benefits the locals in the area by protecting their property from floods and restoring the environment, but it also provides jobs to locals as they will implement and monitor reforestation efforts.

Keywords: Composter Bin; Food Waste Management; Forestation; Geospatial Analysis

Mentor(s):

Aakanksha Desai (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 126
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Junior Achievement BizTown

EPICS

Author(s):

Ian Alexander Slowinski† (Engineering); Madeline Hae Kyung Kim† (Engineering); Prithvijit Dutta† (Engineering); Neel Kothari‡ (Engineering); Daniel Alexander Garcia‡ (Engineering); Andrew Theisen‡ (Engineering); Mathew Michael Drenning‡ (Engineering); Jeffrey Zhang‡ (Engineering)

Abstract:

This project aims to develop a dedicated workspace within Junior Achievement BizTown to provide a safe and functional environment for students engaging in real-world work simulations. The proposed kiosk design incorporates accessibility, durability, and practicality to meet the needs of children, teachers, and supervisors. After evaluating multiple conceptual designs, the final iteration integrates elements from coffee shop and mall kiosk inspirations, ensuring an open and inviting layout with structured seating for four to six students.

The project follows a structured development process, including benchmarking, prototyping, and stakeholder feedback, to refine specifications and address potential risks. The design prioritizes safety with rounded edges, durable materials, and a fixed structure to prevent movement. Additionally, storage solutions and electrical accommodations support students' learning needs. A comprehensive prototyping phase, including 3D modeling and physical testing, identified design weaknesses and informed necessary modifications to enhance stability.

The implementation plan includes a phased approach, beginning with CAD modeling and approval, followed by material procurement and on-site assembly. The verification and validation process ensures the structure meets accessibility and safety requirements while aligning with JA BizTown's educational objectives. Future considerations involve user feedback post-implementation and potential improvements for scalability.

By creating an optimized workspace, this project enhances the educational experience for students, providing an environment conducive to professional skill development. The design aligns with community partner requirements, balancing aesthetics and functionality, ensuring a long-lasting impact within the BizTown program.

Keywords: Kiosk; Creativity; BizTown

Mentor(s):

Peter Osire Orono (Purdue University); Sai Abhishikth Somishetty (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 127
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Purdue HAIN

EPICS

Author(s):

Milo Orson Lamas† (Engineering); Colin Robert Eddington† (Engineering); Mia Rae Laskiewicz† (Engineering); Darrick Khoi Le† (Engineering); Michael Shearer† (Engineering); Mantavya Vashishth† (Engineering); Kyle Martinez† (Engineering); Kevin Dong‡ (Engineering); Austin James Henson‡ (Engineering); Noah Scott Hindley‡ (Engineering); Daniel Junsik Kim‡ (Engineering); Manan Pahwa‡ (Engineering); William Zachary Rowen‡ (Engineering); Koichiro Saito‡ (Engineering); Carlo Juan Salenda‡ (Engineering); Ashaz Adil Shaikh‡ (Engineering)

Abstract:

The HAIN system is fundamentally a website where people can write natural language queries and receive a scientifically based answer alongside medical journals supporting that answer. In a more nuanced approach to this system we have developed 4 sub teams: database management, medical journal parse, data visualization, and data generation. Our database management team has been working closely with Purdue's IT to set up the server in the Purdue Indy server housing, alongside loading proper OS and software. Medical journal parse has been building and testing an in house LLM to parse the databases medical journals while reducing hallucinations. Data visualization has been working on front and backend website development alongside using Python integrated visualization libraries to help provide visual results to queries based on medical journal data. Finally, data generation has been working closely with field experts to design a glove capable of recording patient medical information in a rural, on hand setting, and then networking with the database to determine possible health issues.

Keywords: Database; Medical; Python; Visualization; Large Language Model

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 128
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Projecting Future Delta Faucet Product Contacts and Defects

The Data Mine

Author(s):

Kelci Maire Malloy† (Engineering|JMHC); Claire Mari Johnson† (Science); Luis Santiago Mendez Perez† (Science); Aahan Ritesh Patel† (Science); Anand Shanker† (Science); Om Shrikanth Janamanchi† (Science); Shreya Samiksha Baral† (Science); Mixuan Pan† (Engineering); Frederick Gengyu Lu† (Science|JMHC); Quinton Ulysses Pedrick‡ (Science); Ihenna Nathan Anoliefo‡ (Science)

Abstract:

Delta Faucet Company provides lifetime warranties on all products, collecting warranty and defect data throughout a product's lifespan. This project used customer service, sales, and warranty data to predict future product contacts and defects for top-selling models since 2018. The goal of this project was to identify defect patterns, predict warranty costs, and improve business analytics using customer service data. This data recorded each faucet as a unique stock keeping unit (SKU), which identified attributes like finish and model, and its reported warranty cases. Data normalization allowed SKU analysis by Effect Codes, identifying the finish with the highest defect percentage. These results were incorporated into a predictive model that inputs sales data, model, finish type, and time to output a warranty defect curve, providing insights for Delta Faucet's business analytics team to reduce warranty defects.

Keywords: Predictive Analytics; Data Science; Statistics; Data Analytics; Business Analytics

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Aissata Bah (Science)

Presentation Abstract Number: 129
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

AI-Driven Patent Data Extraction and Analysis for Agricultural Patents

The Data Mine

Author(s):

Thanh Dat Le† (Science); Urjit Aich† (Science); Seshanth Karthik† (Science); Lina Im† (Science|JMHC); Sidarth Nuthi† (Science); Bach Gia Le† (Science); Shivan Dipakkumar Pandya† (Engineering); Anna Bajszczak† (Polytechnic|Graduate); Srishti Maurya‡ (Science)

Abstract:

The AI-Driven Patent Data Extraction and Analysis System for Corteva is designed for efficient retrieval, extraction, and analysis of agricultural patents related to crop protection. The project integrates cutting-edge technologies, including large language models (LLMs) and advanced tools for data extraction and structured search. These capabilities will allow scientists and researchers to efficiently access, extract, and analyze patent data enabling faster, more informed decision-making. The project has the following three objections: Patent Repository Development, Automated Data Extraction, Interactive Chat Module.

Keywords: Patent Data Extraction; IP Analysis; Agricultural Patents; AI Chatbot; LLM

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 130
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Forced Induction Group

EPICS

Author(s):

Akaash J Mondal† (Engineering); Safa Islam‡ (Engineering); James McAlindon‡ (Engineering); Fred Kadima‡ (Engineering|JMHC); Xiaoyang Yu‡ (Engineering)

Abstract:

We are the EPICS Speedway Forced Induction group. Our project is a pair of models demonstrating the function of forced induction devices such as turbochargers and superchargers in the context of performance vehicles. The goal of our project is to help the Indianapolis Motor Speedway Museum educate visitors about forced induction and connect the performance of the vehicles on display with these specialized devices that improve their performance on the circuit. The display consists of 3-D printed model of a supercharger and turbocharger fitted with motors and moving components to demonstrate the pressurization of air within the intake manifold. Both models have portions cut out and replaced with clear panels to allow patrons to view the inner workings of the device. The display also has information about the benefits and drawbacks of each model, as well as common use cases.

Keywords: Induction; Motorsports; Museum

Mentor(s):

Charles Holliday Jenckes (Purdue University); MohammadHossein Jamshidnejad (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 131
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Effect of Temporal Bone Quality Changes in Progressive Chronic Kidney Disease

First Time Researcher Fellowship: Purdue undergraduates are encouraged to participate in the First-Time Researcher (FTR) fellowship during the upcoming spring semester. These opportunities are specifically designed for students who are new to college

Author(s):

Ishita Mukadam† (Engineering)

Abstract:

Chronic kidney disease (CKD) is a significant global health issue, is an under-recognized global health concern, causing more deaths annually than many other major diseases. Characterized by a gradual decline in kidney function, CKD leads to increased bone fragility and a 2-100 times increased fracture risk, which is associated with elevated mortality compared to individuals without CKD. However, detecting this risk through conventional gold-standard imaging methods is challenging. Thus, it is hypothesized that changes in bone water content occur before detectible alterations in bone minerals, offering a new biomarker for predicting bone fragility. This research investigates two crucial aspects of CKD-related bone deterioration. First, temporal changes were investigated in bone water content during CKD progression using novel biomedical engineering concepts including medical imaging, mechanical testing, thermogravimetric analysis (TGA), and infrared (IR) microscopic imaging. Additionally, a dynamic method was developed to quantify glycosaminoglycan (GAG) content in the cortical bone matrix throughout CKD progression. This involved using an Alcian blue staining procedure, followed by code to quantify staining intensity. Alcian blue binds to acidic mucopolysaccharides in bone's matrix which contains collagen, and thus binds to negatively charged glycosaminoglycans, providing a detailed analysis of their potential role in regulating cortical bone matrix water. This approach, combined with mechanical testing, TGA, and IR, was crucial in assessing bone hydration, structure, and molecular changes. These findings have potential applications in identifying new biomarkers for early detection of bone fragility and developing targeted therapies to address CKD-specific bone pathology.

Keywords: Chronic Kidney Disease; Bone Water; Fracture Risk; Medical Imaging; Collagen

Mentor(s):

Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgment(s):

Renee Chantal El Miller (Engineering); Wikum Roshan Ban Ranasinghe Mudiyanselage (Engineering)

Presentation Abstract Number: 132
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Extend battery life - Alle-IoT

VIP

Author(s):

Hang Minh Nguyen† (Engineering); Kunaal Parashar† (Engineering); Jonathan Ka-Wing Chan† (Engineering); Antonio C De Oliveira Segura† (Engineering); Jan-Lun Chang† (Engineering); Stephanie Allissa Chau† (Engineering); Kaitlyn Hope Isaak‡ (Engineering); Sachenka Katrina Angel Aranguena‡ (Engineering)

Abstract:

The purpose of this research is to increase the lifespans of the e-lock from Allegion from 6 months to a year without changing the power supply system. This research focuses on learning about the lock and collecting data about the current, voltage, and power that the lock uses in each task that it performs to find a way to optimize the power supply and find the boundaries of the lock. By using Ohm's laws, the resistance of the lock can be found by applying the equation R=V/I where R is the resistance, V is the voltage, and I is the current of the board. The resistance of the lock will help to find the power absorption by using the equation P=IR^2. By using the oscilloscope, tasks like starting up the lock, opening and closing the lock by using Wi-Fi or Bluetooth were detected to use the largest amount of energy, the lock stop working and shut down when the battery is at 4.72V or the lock display fully charge when the battery is at 6.33V. To solve the problem, capturing energy from the environment and battery management systems are currently focus on.

Keywords: Battery Life; Extend; Energy Capture; Manage System

Mentor(s):

Steve Clayton Rausch (Engineering); Rama Harika Nanduri (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 133
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Detection of Digital Fraud for Elevance Health

The Data Mine

Author(s):

Sarah Jessica O Farril-Gonzalez† (Polytechnic|JMHC); Sriya N Chakravarthula† (Science|JMHC); Aditya sanjay Pawar† (Science|JMHC); Raynad Chishty† (Science); Landon Mitchell Berger† (Polytechnic); Anna Bajszczak† (Polytechnic|Graduate); Bozidar Perovic† (Science); Nithil Krishnaraj† (Science); Abha Anilkumar Gupta† (Science); Vishal Subramani Ramasubramanian† (Science); Nolan Thomas Patterson‡ (Polytechnic)

Abstract:

This project addresses the critical challenge of detecting digital fraud within security-oriented telemetry data. In collaboration with a leading healthcare company, our team developed a methodology to identify potential fraudulent activities in near real-time. The approach involves a comprehensive data-driven process, beginning with extensive research into fraud patterns and the analysis of security logs. Data aggregation and preprocessing techniques were applied to prepare the data for machine learning analysis. An anomaly detection model was implemented to identify deviations from normal behavior, indicative of potential fraud. This system aims to enhance security measures by enabling the early detection of compromised accounts and suspicious transactions, thereby mitigating risks and safeguarding sensitive data. The project provides a foundation for a robust and repeatable fraud detection system that can be deployed in a production environment to analyze incoming data and trigger appropriate workflows.

Keywords: Fraud Detection; Anomaly Detection; Machine Learning; Security Telemetry; Healthcare Security

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 134
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Player Archetyping & Evaluation

The Data Mine

Author(s):

Eniola Vikky Owolabi† (Engineering); Jasper Leeron Basir† (Science); Maninder Kaur† (Science); Thirukumaran Veleyudham† (Science); Gregory K Harner† (Science); Jermaine Leebron Basir† (Science); Prem Dilipkumar Patel† (Science)

Abstract:

As women's basketball begins to expand into analytics, the rise of position less basketball will likely follow, and the need to evaluate players outside of the traditional five-position system becomes paramount. We are interested in determining a series of categories representing the playstyles and roles of players across the globe. In addition to these categories, we are aiming to create a singular "grade" of sorts that boils an entire box score of a player into one metric representing their overall performance within a game. This metric would be utilized to find "breakout performances" of players with sudden performance improvements in addition to consistent "top performers" within a given competition.

Keywords: WNBA; Archetyping; Statistics; Machine Learning; Data Analysis

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 135
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Allison Transmission Vehicle Clustering Project

The Data Mine

Author(s):

Sevinch Pasilova† (Engineering); Victor Vladimirovich Voznyuk† (Science); Abhinav Kotamreddy† (Science); Kashyap Vallur† (Science); Chanh Ly† (Polytechnic); Nathan T Fecadu† (Science); Aman Ibrahim Ali† (Science); Younes Y Aref† (Science); Omar M Ibrahim† (Science); Pragun Sethi† (Science); Parshawn Taxiyah Jamil Haynes† (Science); Badr A Ramadan† (Science); Dhruv Raj Patel‡ (Science)

Abstract:

The Allison Transmission Vehicle Clustering project focuses on analyzing and categorizing vehicle data to enhance performance insights and operational efficiency. This project aims to uncover meaningful patterns that can support decision-making in vehicle performance optimization.

Keywords: Allison Transmission; Vehicle; Machine Learning; Clustering; Data

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 136
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Design of a Record-Breaking Gas Lakester Drag Racer for Top Speed and Overall Performance

Motorsports Engineering Capstone

Author(s):

Scott Alan Lohman† (Engineering|JMHC); Tyler J Hagan† (Engineering); Cade Evan Pell‡ (Engineering); Reed Emory England‡ (Engineering)

Abstract:

The Southern California Timing Association (SCTA) hosts annual top-speed competitions for Gas Lakester (GL) vehicles at the Bonneville Salt Flats in Utah, a site internationally recognized for land speed record attempts. These competitions feature vehicles of various classes and configurations striving to break existing ground speed records. The current GL record, set in October 2004 by R. Steele with the chassis Bockscar, stands at 211.463 mph and has remained unchallenged for nearly two decades. The objective of this project is to design a GL classed vehicle capable of reliably surpassing this longstanding record. To achieve this goal, a comprehensive vehicle design was developed, including detailed frame and body models in SolidWorks. Static and dynamic chassis analyses were performed in SolidWorks, while aerodynamic performance of the bodywork was evaluated using CFD simulations in StarCCM. Additionally, custom calculators for use on competition day and MATLAB simulations were developed to support vehicle parameter testing and optimization. Preliminary results indicate that with careful integration of optimized frame design, powertrain selection, and aerodynamic refinement—along with favorable environmental conditions—the vehicle is capable of achieving a top average speed exceeding 213 mph, with projections reaching up to 216 mph.

Keywords: Motorsports; Computational Fluid Dynamics (CFD); Aerodynamics; Computational Simulation; Land Speed Record

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgment(s):

Charles Holliday Jenckes (Purdue University)

Presentation Abstract Number: 137
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

LLM Maintenance Troubleshooter

The Data Mine

Author(s):

Ashish Kumar Kashyap† (Science|JMHC); Sankhya Ganesh† (Science); Neelay Ranjan† (Engineering|JMHC); Ptolemy Bryce Henson† (Polytechnic); Fetume G Teklu† (Science); Anuj Nirav Shah† (Science); Yassir Khalaf† (Science); Shreyas Sreenath† (Science); Reva Arlene Pettigrew‡ (Engineering|JMHC)

Abstract:

We've built a LLM-based chatbot, with a user-focused application that accurately answers maintenance queries based on analogous maintenance and flight manuals. Moving away from the traditional training-based LLM methodology, the project implements a Retrieval-Augmented Generation (RAG) system to create a more accurate and cost effective model. The application has features that provide emphasize usability, while still implementing necessary business logic.

Keywords: Chatbot; LLM; Web Application; Python; React

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 138
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Voltage Activated Slide Seperator

VIP

Author(s):

Ashwin Srisai Pulla† (Engineering); Tamara Shakri Houran† (Engineering)

Abstract:

This research explores the design and fabrication of a microscale device that uses an applied electric field to mix two solutions. The device consists of a central rod positioned between two chambers, where fluids can be introduced for controlled interaction. Using Fusion 360 for modeling and 3D printing for fabrication, the device allows for precise manipulation of fluids at the microscale. When a voltage is applied, electrokinetic forces induce mixing of the solutions, enabling controlled interactions between different substances. While the device has potential applications in cancer research, such as studying the interaction between cancer cells and immune cells like T cells, it can also be adapted for various other fields, including drug testing, chemical analysis, and material science. The device was tested under various voltage conditions to evaluate its performance in mixing fluids efficiently with minimal energy use. The results demonstrate that this microfluidic system could serve as a valuable tool for a range of biomedical and scientific applications.

Keywords: Biomedical Research; Voltage Fluid Control; Cancer Research; 3D Printing; Drug Testing

Mentor(s):

Afshin Izadian (Purdue University); Christine Taylor (Polytechnic); Fateme Karimi Hafshejani (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 139
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Family Ark

EPICS

Author(s):

Carson Xavier D Mello† (Engineering); Aksh Aggarwal† (Engineering); Chelsie Drew Rayl‡ (Engineering); Amir Mohammad Abdelhadi AlBustanji‡ (Engineering); Brenden Jason Fannin‡ (Engineering); Joseph Giglio‡ (Engineering); Matthew Lawrence Harney‡ (Engineering); Adam Earl Joy‡ (Engineering); Kanishk Maheshwari‡ (Engineering); Levi Joshua Smith‡ (Engineering); Biak Tin Sum‡ (Engineering); Isabela Tassone Haddad‡ (Engineering); Draven Michael Vaughn‡ (Engineering); Arun Vudi‡ (Engineering)

Abstract:

Our project aims to improve the outdoor environment for families at Family Ark by creating safe and engaging recreational spaces. After their playground was removed due to safety concerns, there is now a need for interactive areas where children can play and explore. To address this, we plan to design and build installations such as a tic-tac-toe board and a musical instrument area, offering fun and engaging activities. Additionally, we will create a fairy garden to provide a peaceful space that encourages creativity and relaxation for both children and adults. These outdoor areas will not only foster play but also serve as therapeutic spaces, providing a calming and engaging environment for therapy sessions with children and families. To further enhance the campus, we will install a bench along the walking trails, giving residents a place to rest and enjoy nature. By creating these spaces, we hope to support both recreational and therapeutic needs, ensuring families have a safe and enriching outdoor environment.

Keywords: Woodworking; Playground; Community

Mentor(s):

Kevin T Lee (Purdue University); Ramaa Saket Suri (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 140
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Thermoplastic Starch Filament Production for Additive Manufacturing

ME UG Research

Author(s):

Joshua Glen Renshaw† (Engineering)

Abstract:

The demand for compostable bio-based plastics has surged in recent years, driving the development of various sustainable material production techniques. Additive manufacturing has also grown significantly, and incorporating compostable plastics into this field presents unique challenges. This research focuses on producing thermoplastic starch (TPS) pellets, extruding them into filament, and successfully 3D printing parts using fused deposition modeling (FDM). Both pellets and filament have been produced and tested. To ensure that the 3D-printed parts maintain dimensional accuracy and mechanical integrity, TPS filament fabrication and FDM parameters are being optimized concurrently. Further experimentation will involve producing additional filament batches, refining extrusion parameters, and subjecting printed parts to mechanical testing to evaluate their strength, durability, and overall viability for additive manufacturing applications.

Keywords: Compostable Plastic; Filament Extrusion; Fused Deposition Modeling (FDM); Mechanical Testing; Biodegradable Polymers

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 141
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Our Lady of Grace Community Garden

EPICS

Author(s):

Kade Stephen McPherson† (Engineering); Myles Joshua Pristin Querimit† (Engineering); Mohammad Raiyan Ashraf† (Engineering); Peiyuan Yu† (Engineering); Vincent George Romand-Heuyer‡ (Engineering); Samuel Evan Harpham‡ (Engineering); Wen Ling See‡ (Engineering); George Rares Nicolau‡ (Engineering); Angie Allison Vazquez‡ (Engineering); Udan Ranmika Nimalasena‡ (Engineering); Navin Gopinath‡ (Engineering); Taylor A Smith‡ (Engineering)

Abstract:

Our EPICS project focuses on the comprehensive renovation of the community garden at Our Lady of Grace Catholic School. The initiative is structured into three specialized teams addressing critical infrastructure needs: the rehabilitation of the greenhouse structure, toolshed design and construction, and designing an irrigation system to water the surrounding garden. Beyond the physical improvements of the greenhouse, the project creates a learning environment and source of fresh produce, not only for the school but also for the surrounding community.

The tool shed team designed an innovative multi-part storage system that will allow the project partner to safely store all tools, seeds, and fertilizers in an organized manner. The roof and walls team completely redesigned the greenhouse to enhance both safety standards and functionality. The irrigation team designed a distribution system that prioritizes user accessibility and ensures convenient, flexible, and efficient water distribution throughout the garden area.

All teams are in the prototyping and design stages of the project, preparing to implement the solutions. The project has encountered some challenges, including necessary cost reduction for the toolshed construction, and required redesigns for the irrigation piping. Despite these obstacles, the teams remain on track to deliver sustainable solutions that will benefit the students, teachers, and surrounding community. Looking to the future, the greenhouse team plans to create a prototype, irrigation plans to dry-fit a portion of the distribution system, and the tool shed will finalize benchmarking and begin construction of a smaller scale toolbox.

Keywords: Greenhouse; Irrigation; Tool Shed; Prototype; Benchmarking

Mentor(s):

Michelle S Ulmer (Purdue University); Suchandra Teja Torlakonda (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 142
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Elevance Health: Abnormalities & Outliers - Detecting Abnormalities in Log Data

The Data Mine

Author(s):

Edwin Antonio Sanchez†; Harshita Pasupuleti† (Science); Taemoor Hasan† (Science|JMHC); Faiza Bashir Mukhtar† (Polytechnic|JMHC); Alex Douglas Stephen Veal† (Science); Minh Triet Vu† (Science); Kaleb Bacztub‡ (Polytechnic|JMHC); Ramani Satishkumar‡ (Science|JMHC); Gabrielle Pesito‡ (Science); Bach Gia Le‡ (Science); Neel Jitesh Bhate‡ (Science)

Abstract:

In today's threat environment, having state-of-the-art cybersecurity mechanisms to support large-scale business needs are a must. One way of detecting threats is by examining log data generated by company systems.

Our project focuses on finding abnormalities & outliers in log data. With the high volume of information captured by system logs, it is impossible to parse it all by hand. With this in mind, we have developed methods of detecting abnormalities in events captured by system logs using both statistical and deep learning methods.

Keywords: Cybersecurity; Machine Learning; Artificial Intelligence; Deep Learning; Statistical Analysis

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 143
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

A systematic study on the effect of different carbon precursors for the synthesis of MAX and two-dimensional MXenes

Author(s):

Christian Paul Hardy Scott† (Engineering|JMHC)

Abstract:

MXenes are a growing family of two-dimensional (2D) transition metal carbides, nitrides, which contribute to diverse applications in the field of energy, electronics, photonics, and biomedicine. These unique properties of MXene are paralleled by their relative complexity with various synthesis parameters, like the purity of the MAX phase, that impact their quality. In this systematic study, mono-transition metal (stoichiometric and optimized Ti3AlC2) and double-transition metal (Mo2TiAlC2 and Mo2Ti2AlC3) MAX grains were studied by varying the carbon precursor source (petroleum coke and graphite). The synthesized MAX phases were characterized using scanning electron microscopy (SEM), X-ray diffraction (XRD), and energy-dispersive X-ray spectroscopy (EDS) to evaluate morphology, grain size, crystal structure, and elemental composition. Further, we synthesized the MXenes (Ti3C2Tx, Mo2TiC2Tx, and Mo2Ti2C3Tx) using a top-down wet chemical etching approach. The effect of different carbon precursors on the synthesis and quality of the resulting Ti3C2Tx, Mo2TiC2Tx, and Mo2Ti2C3Tx MXenes were evaluated based on flake size, synthesis yield, electrical conductivity, and colloidal stability. The use of graphite in the synthesis increases the purity of the MAX phase which positively impacts the MXene quality and synthesis yield. For example, the synthesis yield of the Mo2TiC2Tx MXene was doubled when graphite was used. This study improves the fundamental understanding of how different carbon precursors affect the synthesis of parent MAX phases and resulting 2D MXenes.

Keywords: Max Phase; Two-Dimensional; MXenes; Sintering

Mentor(s):

Babak Anasori (Purdue University); Anupma Thakur (Purdue University); Nithin Chandran Balachandran Sajitha (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 144
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Synthesis, structural and protein binding analysis of differently substituted Ru(II)-hydrazine complexes

Author(s):

Milica Slavkovic† (Science)

Abstract:

[Abstract Redacted]

Keywords: Ruthenium(II) Complexes; Protein Binding; Serum albumins (HSA and BSA); Anti-Cancer Drug Design; Thermodynamic Analysis

Mentor(s):

Michael Humes Borkowski (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 145
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Low-temperature growth of multi-principle element 2D carbides from heterostructure thin-films

Office of Naval research, NEIL Training program

Author(s):

John Ryan Waggle† (Engineering)

Abstract:

Two-dimensional (2D) transition metal carbides, commonly known as MXenes, are a chemically diverse and exciting class of functional nanomaterials. Typically, in MXene synthesis, bulk precursors, called MAX phases, are used to derive MXenes using topdown synthesis methods, which limits possible MXene compositions based on thermodynamics in the MAX phase synthesis at high temperatures (>1400 °C). MXenes' compositional and structural space, paired with its solution processibility, also permits formation of heterostructures of MXenes, comprised of a film architecture of alternating MXene compositions at the ~1 nm scale. In this study, we explored the intermixing behavior of layer-by-layer mixed MXene heterostructure films made with various compositions of MXenes made using solution processing techniques using in-situ annealing x-ray diffraction methods. In this work, we demonstrate that MXenes with the largest difference in flake thickness (i.e., 5 atomic layer vs. 11 atomic layer thick) illustrate the largest crystallographic growth, which suggests that we are fusing MXene flake structures (i.e., Ti2C + Nb4C3) to form mixed composition structures (i.e., (Ti,Nb)3C2) below 800°C. We also further this work to include more than two transition metals (i.e., V2C + Ti3C2 + Nb4C3 + Ta4C3) to demonstrate formation of multi-principle element MXenes (i.e., (Ti,V,Nb,Ta)3C2) and delaminate these flakes out of the film structure into mono-layers. This work demonstrates the capability of MXene heterostructures to form uniform multi-principle element MXenes using MXenes' solution processing, which provides a new avenue for design of multi-principle element MXenes for desirable applications.

Keywords: Nanomaterials; MXene; Extreme Environments

Mentor(s):

Babak Anasori (Purdue University); Brian Cecil Wyatt (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 200
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Mechanotransduction in progerin-expressing endothelial cells

First Time Researcher Fellowship

Author(s):

Laila Abdelwahab† (Engineering|JMHC); Karan Rahul Karkhanis* (Engineering)

Abstract:

Hutchinson Gilford Progeria syndrome is a rare laminopathy caused by a truncated mutation in the LMNA gene, producing the protein called progerin. Due to this protein, the nuclear lamina weakens in its ability to maintain nuclear structure and transfer forces to the chromatin. As a result, progerin-expressed cells have deformed nuclei and are less responsive to the mechanical forces experienced within the body. However, this is not unique to HGPS, as previous research has shown that older adults, especially those with cardiovascular diseases, have wild-type expressed endothelial cells with similar characteristics. With cardiovascular aging, these endothelial cells expressing wild-type Lamin A exhibit similarities with those expressing progerin. This study aims to explore these similarities further. Cell culture and transfection will be used to create a stable endothelial cell line with cells expressing both GFP-fused wild-type Lamin A and progerin proteins. Arterial shear stress will be applied to the cells through flow experiments conducted in a flow chamber. Fluorescence microscopy will then be utilized to analyze the effects of shear stress on these cells. Nuclear morphology will be analyzed and compared between the two protein expressions, to understand the effects of shear stress on signaling pathways. The results will provide deeper insight into how progerin impacts endothelial cell behavior and its potential role in vascular aging. Furthermore, this research may serve as a basis for future research focused on understanding and potentially preventing age-related cardiovascular diseases.

Keywords: Mechanotransduction; Endothelial Cells; Shear Stress; Progerin

Mentor(s):

Julie Ying Hui Ji (Purdue University); Sungsoo Na (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 201
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

EPICS Boys and Girls Club Wheeler Dowe

EPICS

Author(s):

Teresa Britton Abraham† (Engineering); Jack Edward Bobek McLachlan† (Engineering); Nolan Larsa Sanouvong† (Engineering); Alejandro Caballero-Julian† (Engineering); Nuthawat Rojratchadakorn† (Engineering); Grant Isaac Hutchison† (Engineering); Connor Maddox Seagrave† (Engineering); Arabella Fortunato Hofrichter† (Engineering); Andrew Alex Soldatov† (Engineering); Oscar E Druxman† (Engineering); Jimmy Ramirez‡ (Engineering); William Patrick Prendergast‡ (Engineering)

Abstract:

Our goal with this project is to improve the experience and create a more welcoming environment for those at the Boys and Girls Club Indianapolis Wheeler Dowe. Our project was split into two teams to accomplish two different goals: make the BGC a better place for younger kids to do their schoolwork and make the BGC a more appealing place for older kids to play games and congregate.

Team 1 found that young kids most often used the space to complete homework, as they have supervisors at hand to help them, among other things. The primary focus drawn from that observation was to improve the sociality of the kids that attended and create opportunities for the kids to create friendships. The solution that was designed was a desk that had shelves for materials, a whiteboard top-surface, and a 2 person design, encouraging kids to collaborate and discuss the work that they're doing while at the BGC.

Team 2 went about their mission by assessing what things teens were most interested in and what would draw them to the BGC. After brainstorming and doing a bit of research on the demographic, the focus was to improve the user experience for the gaming consoles that the club had access to. The objectives were to find a way to secure the consoles on the wall in a case, create a retractable controller-charger mechanism, and to implement a timer system to make it easier for supervisors to keep track of the time.

Keywords: Service; Community; Indianapolis

Mentor(s):

Aakanksha Desai (Purdue University); Shubham Kapil Upadhyay (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 202
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Alle-IoT

VIP

Author(s):

Bader Emad Abu-Shanab† (Engineering); Danielle May Hatt† (Engineering); Toby Dwayne George† (Engineering); Muhammad Irfan Bin Khairuddin† (Engineering); Bekhruza Mamajonova† (Engineering|JMHC); Jin Park† (Engineering); Adam Zikry Mohd Shahrizan† (Engineering); Caleb Jaramillo Bonham‡ (Engineering); Carter Joseph Christie‡ (Engineering)

Abstract:

This project introduces a mechanical power modulation device that significantly extends a smart lock battery's life. By dynamically regulating power flow based on real-time voltage, it minimizes energy waste during standby periods without affecting core functionality like Bluetooth and Wi-Fi.

Keywords: Battery; Lock; Electronics; Battery Life

Mentor(s):

Steve Clayton Rausch (Engineering); Arvind Krishna Radhakrishnan (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 203
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Enhancing Farmer Access to Agricultural Programs in Indiana

The Data Mine

Author(s):

Raja Allmdar Tariq Ali† (Science|JMHC); Adwin Sujin† (Science); Alexia Isabella del Cuvillo† (Engineering); Dhiren T Rao† (Science); Emily Zhongqing Zheng† (Science); Eric Tang† (Science); Richin Mrudul† (Science); Sai Amruta Varshini Killampalli† (Science|JMHC); Victor Popescu† (Science)

Abstract:

This project is a centralized web-based platform designed to empower Indiana farmers with streamlined access to over 150 agricultural and conservation programs. In a landscape where information is scattered across numerous websites - resulting in an estimated $1.8 billion in missed opportunities - farmers often struggle to locate and apply for the vital resources they need. Our innovative solution leverages advanced web scraping techniques to aggregate data from key sources such as the USDA and NRCS, and it delivers the information through an interactive map with county-specific filtering. Using our web scraping tool, all relevant program information is collected efficiently, not only saving valuable time for administrators but also ensuring that farmers have access to the most up-to-date information in real-time. A user-friendly administrative interface further simplifies program updates by enabling effortless data refresh through URL submissions. This innovative approach brings together multiple resources into one easy-to-use platform - enhancing program accessibility, fostering sustainable agriculture, and unlocking untapped opportunities across Indiana.

Keywords: Agriculture; Web Scraping; Conservation Programs; Data Analysis; Data Cleaning

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 204
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Automated Spark-Based Data Filtering Tool for Trip Qualification

The Data Mine

Author(s):

Raja Allmdar Tariq Ali† (Science|JMHC); Vishal Wagh† (Science|JMHC); Avanish Jayarama Mallya† (Science); Hana Zoaib† (Science); Jazmin Pulido† (Science); Muhammad Ahmad Rizwan† (Science|JMHC); Ping-Chun Tsou† (Science); Prisha Singh† (Science); Vihaan Pradeep† (Science)

Abstract:

This project develops an automated data filtering tool to improve machine learning model decision-making by removing records that may skew results or be unsuitable for training. Using Databricks, Python, and Spark, we built a pipeline that cleans engine telemetry data by applying multiple filters. The tool includes an interactive, widget-driven configuration interface that gives users both options: they can simulate the filtering process to preview which records would be flagged without actually dropping them, or they can apply the filters to permanently drop records based on their selected criteria. This dual functionality helps reduce false positives and false negatives, resulting in a cleaner dataset for both training and production. Also, by automating the filtering process, we reduced processing time for end users and achieved reduction in labor costs, ensuring the tool is both efficient and user friendly.

Keywords: Machine Learning; Databricks; PySpark; SQL; Data Filtering

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 205
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Acrylic Redesign for Rat Enclosures

VIP

Author(s):

Gavin Allen Arner† (Engineering); Zachary Gosnell† (Engineering); Elliott Samuel Korentager† (Engineering); Cohen Scott Meredith† (Engineering); Pralhad Prashant Mundargi† (Engineering); Gavin Wang† (Engineering); Aditi R Hemmige† (Engineering); Willard Gabriel Rash Cuevas† (Engineering); Samir Niradbhai Patel† (Engineering); Meghana Sunil Kumar† (Engineering); Jaskarandeep Kaur‡ (Engineering); Jakob Eric Mikolajczyk‡ (Engineering)

Abstract:

This project uses methods of redesign that focus on data collection and refinement of previous iterations of a specialized cage used to monitor electrical signals during rat seizures. The materials group collected data for annealment method such as cooling time, and time to temperature. These variables were used to create a cooling curve and discover the efficiency of annealment for different lengths of time. The hinge and suspension group collected data for spring force calculations to help relieve tension from the wires. This will improve accuracy by addressing issues of previous designs. The box team collected measurements from previous designs to match with the new lid. Using previous prototypes and additional research, tolerances were determined for the new wedges and base. Further utilization of CNC machines is being used to innovate new designs for the enclosure. Milling will aid in the design and concept of perhaps the lever or parts of the box in the future. These findings significantly enhance the output of our project by improving upon the previous designs.

Keywords: Cage; Electroencephalogram; Rat; Acrylic; Laser Cut

Mentor(s):

Ken Yoshida (Purdue University); Mahdi Ghanati (Engineering)

Other Acknowledgment(s):

Gabriel Thomas Flath-Everhard (Purdue University)

Presentation Abstract Number: 206
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Controlled Electrostatics of lipid membranes

Author(s):

Chinwendu Zachariah Ayogu† (Engineering|JMHC)

Abstract:

[Abstract Redacted]

Keywords: [no keywords provided]

Mentor(s):

Mohamed Razi Nalim (Purdue University); Horia I Petrache (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 207
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

AI applications in marine navigation

VIP

Author(s):

Partha Rathi† (Engineering); Rikhil Tadiparthi† (Engineering); Nishant Ramashankar Bhargava‡ (Engineering); Adrienne Dale Torres Balahadia‡ (Engineering); Cassandra Lobo Gonzalez‡ (Engineering); Eeshwar Ram Chalasani‡ (Engineering); Ihenna Nathan Anoliefo‡ (Science)

Abstract:

This project explores the application of object detection AI for autonomous navigation through a water-based obstacle course marked by buoys. Utilizing advanced computer vision techniques and machine learning algorithms, the AI system identifies and classifies buoys in real time, enabling precise course adjustments. The project integrates sensors, cameras, and AI-driven decision-making to optimize movement efficiency while avoiding collisions.

Keywords: NSWC AIMM; Object Detection

Mentor(s):

Kevin T Lee (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 208
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Wearable System for Tracking Stroke Rehabilitation Progress

VIP

Author(s):

Samarth Bhat† (Engineering); Nicholas John Albrecht† (Engineering); Pratika Kumar† (Engineering); Taran Reddy Kamireddy† (Engineering); Cooper Lee Cotton† (Engineering); Owen Michael Bartel‡ (Engineering); Gema Roselyn Parra‡ (Engineering); Andrew Loren Peterson‡ (Engineering); Lara Nour Courgi‡ (Engineering); Elias Malak‡ (Engineering); Nadia Bailen Boluda‡ (Engineering)

Abstract:

Approximately 80% of stroke survivors experience motor impairments in their upper limbs, impacting independence in daily activities. Traditional clinical assessments, such as the Action Research Arm Test (ARAT) and Modified Ashworth Scale (MAS), are limited by subjectivity and the inability to track detailed movement patterns continuously. The team used an intelligent glove equipped with Inertial Measurement Units (IMUs) and encoders to find a solution.

This project introduces an intelligent glove equipped with IMUs for real-time, objective monitoring of motor recovery. The glove integrates IMUs sewn into Neoprene fabric with 3D-printed components to ensure comfort, durability, accurate acceleration, angular velocity, and orientation tracking. Its modular design allows independent patient placement, facilitating consistent and continuous data collection. Machine Learning (ML) was used to detect deviations from healthy movement patterns.

In addition, four encoders are placed around the arm with a counter-sprung string that is attached to four of the patient's fingers, excluding the thumb. An ML model is used to generate predicted joint angles from the encoder output that can be measured to track the range of motion change over time and apply polynomial models to the data to generate R^2 values, quantifying how closely the patient's movements match smooth trajectories.

The IMUs and encoders work together to evaluate upper limb function. This cost-effective, wearable system provides objective feedback and supports at-home monitoring, reducing clinical visits while enabling personalized rehabilitation. Future work will focus on refining the ML models and sensor configurations to enhance accuracy and expand the system's clinical applicability.

Keywords: Stroke; IMU; Hand Assessment; Encoder; Machine Learning

Mentor(s):

Ken Yoshida (Purdue University); Steve Higbee (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 209
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Drop Tower Device for Investigating Biological Response From Mouse Intervertebral Disc Injury

Author(s):

Phillip John Bock† (Engineering); Shagunpreet Kaur† (Engineering|JMHC); Benjamin Allen Romig† (Engineering); Gavin Michael Strickland† (Engineering)

Abstract:

In partnership with our sponsor, Dr. Diane Wagner, our team worked through the development of a drop tower device designed to apply a controlled and uniform load to isolated mouse intervertebral discs (IVDs), a crucial advancement in the fields of orthopedic biomechanics, mechanobiology, and spinal research; the clinical need to advance these fields is imperative, as the economic burden of low-back pain in the United States exceeds $100 billion per year [1]. The scope of this project was to create a device that accurately simulated traumatic impacts and overloads on spinal tissues, providing researchers with a valuable tool to investigate these effects on IVDs, including the biological injury response of the tissue rather than complete mechanical failure. The device design facilitates reproducible testing conditions essential for assessing the biomechanical and biological response of IVDs under various impact testing scenarios. By providing a precise and consistent means of applying loads, this drop tower device holds the potential to advance research in orthopedic, tissue engineering, and spinal biomechanics therapeutics.

[1] J. N. Katz, “Lumbar Disc Disorders and Low-Back Pain: Socioeconomic Factors and Consequences,” J. Bone Jt. Surg., vol. 88, no. suppl_2, pp. 21–24, Apr. 2006, doi: 10.2106/JBJS.E.01273.

Keywords: Drop Tower; IVDs; Impact; Injury Response

Mentor(s):

Sharon J Miller (Purdue University); Diane Wagner (Purdue University); Steve Higbee (Purdue University); Olivia Nicole White (Engineering)

Other Acknowledgment(s):

Violet Mikaela Frye (Purdue University); Kevin Jay Carr (Purdue University)

Presentation Abstract Number: 210
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Simple Synthesizer

VIP

Author(s):

Nolan Douglas Brown† (Engineering); Abhijeet Vijay Mohod† (Engineering); Grayson Dean Gibson† (Engineering); Michael Brayden Hudson† (Engineering); Aditya Hegde† (Engineering)

Abstract:

This project involves the design, verification, and implementation of a digital audio synthesizer as part of Purdue's Introduction to SoCET (System on Chip Extension Technologies) II program. The synthesizer comprises essential components, including a finite state machine (FSM), waveform processor, pulse-width modulation (PWM) generator, oscillator, frequency lookup table (LUT), keypad encoder, and frequency divider. User input from a keypad determines the system's behavior, specifically controlling the output waveform and frequency. The synthesizer supports multiple waveform modes, including square, sawtooth, and triangle, achieved through coordinated modulation of the duty cycle by the waveform processor and oscillator. Functional verification is conducted using testbenches and waveform analysis to ensure design accuracy. The primary objective of this project is to enhance understanding of digital design methodologies, Register Transfer Level (RTL) development, design flow, and verification processes, equipping students with the skills necessary for future digital design projects.

Keywords: [no keywords provided]

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 211
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Dynamic Spondylolisthesis Model for Patient Education

Senior Design Capstone Project, BME 49101/49200 (Biomedical Engineering Design), Weldon School of Biomedical Engineering

Author(s):

Gavin L Burtch† (Engineering|JMHC); Katelynn Rose Gallagher† (Engineering); Kelci Maire Malloy† (Engineering|JMHC); Logan C Schomaker† (Engineering)

Abstract:

Spondylolisthesis is a spinal condition where at least one vertebra slips out of its normal position, affecting patients' range of motion and causing significant pain from compression of nerves. This condition commonly occurs in the L4 and L5 vertebrae, although it can occur anywhere along the spine. It is estimated that 4-6% of the U.S. population has spondylolisthesis. Patients with spondylolisthesis must work with a healthcare professional to diagnose the condition, manage symptoms, and correct the misalignment if needed. Patient education is a crucial component of this process. When patients are educated about their condition and why symptoms occur, they are more likely to follow prescribed treatment plans. However, effective communication in patient education can be challenging when discussing spondylolisthesis. Currently, only 2D images or static 3D models are available, neither of which show dynamic vertebrae slippage and how this affects spinal nerves. To address this gap, a dynamic model was designed that transitions between correct spinal alignment and grade one spondylolisthesis. This 3D model not only shows the L4 and L5 vertebrae mechanically sliding away from each other, but it also "pinches" nerve tissue in the process, allowing patients to better visualize their condition. Healthcare providers may use this to explain treatment plans by displaying vertebrae in a spondylolisthesis state and showing a method of correction that will move vertebrae into an anatomically correct state. By addressing the lack of interactive spine models, this product hopes to improve patients' understanding of their condition and increase trust in healthcare providers.

Keywords: Spondylolisthesis; Spine Model; Patient Education; Vertebrae; Pinched Nerve

Mentor(s):

Sharon J Miller (Purdue University); Steve Higbee (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 212
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Data Driven Defect Analysis in High Pressure Die Casting

The Data Mine

Author(s):

Amaan Zahid Chaudhry† (Polytechnic); Doniv Joseph Vinod† (Science); Lekhya Sree Akella† (Science); Kyra Li† (Engineering); Savir Rajeshwar Patil† (Science); Shlok Tandon† (Science); Vishwa Mohan Surabhi‡ (Science); Mason Nicholas Arnoldy‡ (Science)

Abstract:

Defects in die-cast parts contribute to substantial material waste and increased production costs for manufacturers. The high-pressure die casting process involves numerous variables, with measurements taken at multiple stages to monitor quality. This study analyzes production data from Walker Die Casting, specifically focusing on parts manufactured for Allison Transmission. The goal is to identify patterns and insights within the data that can help predict and mitigate defects, ultimately reducing scrap rates and improving manufacturing efficiency.

Keywords: Defect Analysis; Die Casting; Manufacturing

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 213
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Uncovering spatial temporal bone quality changes in progressive chronic kidney disease: Is water a new biomarker for fracture risk?

First-Time Researcher Fellowship

Author(s):

Aurelia Azifa Chelfannisa† (Engineering)

Abstract:

Chronic Kidney Disease (CKD) leads to a gradual decline in kidney function, affecting approximately 10% of the global population. As renal function deteriorates, the risk of bone fracture and associated morbidity significantly increases. Dual-energy X-ray absorptiometry (DXA) is the current standard for evaluating fracture risk but has limited efficacy as fractures frequently occur despite identifying healthy bone mineral density (BMD). Therefore, more accurate methods are needed to identify fracture risk. This study aims to develop a novel technique to analyze bone water distribution over CKD progression and its influence on mechanical properties. Using a rat model of CKD, animals were sacrificed at 5 timepoints throughout disease progression and the tibiae were removed for analysis. Thermogravimetric analysis (TGA) evaluates the water composition of bone by examining the weight loss at various temperature peaks, representing the water content in the different components (free, loosely-bound, tightly-bound, mineral structural water). Fourier Transform Near Infrared (FT-NIR) microscopic imaging captures the spatial distribution of bone components. Post-processing segmentation of data will be performed using the ISys 5.0 software to isolate regions of interest, specifically the water components, within the bone samples. The distribution and composition of water in the bone will then be mapped onto the bone structure and compared across time and groups. Understanding how water is modulated during disease progression will determine its relevance as a biomarker for bone fragility. If found significant, future work can explore MRI-based techniques for clinical assessment of fracture risk in patients by targeting bone water.

Keywords: Fourier Transform Near Infrared Microscopic Imaging; Thermogravimetric Analysis; Chronic Kidney Disease; Spectroscopy

Mentor(s):

Rachel Kathleen Surowiec (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 214
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Corteva Database and LLM Analysis of Crop Protection Product Labels and SDSs

The Data Mine

Author(s):

Sameeksha Sekhar Desai† (Science); Jason Chan† (Science); Jay Vatti† (Science); Lakshya Chaudhry† (Science); Nandika Yadav† (Engineering); Nicholas Alexander Loyd† (Science); Sriman V Donthireddi† (Science); Anh Khoa Duc Nguyen† (Science); Same Mehretab Kiflu‡ (Science); Kashyap Vallur‡ (Science)

Abstract:

In collaboration with Corteva Agriscience, this project under Purdue's The Data Mine program addresses the inefficiencies in accessing vital crop protection product information from Safety Data Sheets (SDS) and product labels. Traditionally, Corteva's chemical formalists manually sift through thousands of such documents—an error-prone and time-consuming task. To overcome this, our team developed an automated pipeline that extracts and structures data from PDF documents and enables natural language querying via a Large Language Model (LLM)-powered chatbot.

Keywords: AI Chatbot; Document Intelligence; Vector Database; Data Extraction; Agriscience Automation

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 215
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

CED Inline 4 Engine display

EPICS

Author(s):

Yousef Tarek Morsey Elarabi† (Engineering); Michael Patrick O'Hara† (Engineering); Peter Thomas Larson† (Engineering); Nebras Alam† (Engineering); Dillon Michael Smitherman‡ (Engineering); Matthew Christian Burke‡ (Engineering); Abiel Amanuel Tesfazion‡ (Engineering)

Abstract:

Our plan for this exhibit is to create a display with an example of an in line 4, internal combustion engine, that will be 3D printed and powered by a speed modulating motor. The purpose of our project is to show how impactful engines and motorsports are for a k-12 audience. We want to teach the users of our project about all the different factors that are parts that make an internal combustion engine work.

We plan to do this through interactive displays of different parts on each side of the stand. Each display will have a description of the given part or system on that side, and there will also be a momentary button to illuminate that part on the full engine model that will be inside a case on top of the stand. One of the four sides there will also be a throttle pedal, so the observer on that side will be able to modulate the rpm of the engine. We plan for the engine to rotate at a constant low rpm “idle”, somewhere close to or below 60 rpm to help viewers be able to interpret and see every part with the slower motion.

Keywords: Engine; Mechanics; Power Train

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 216
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

ME Outreach

EPICS

Author(s):

Ryan Faraji† (Engineering); Ethan Alexander Sutherlin† (Engineering); Ellenah Jaye Del Rio† (Engineering); Lauren Riley Kinsman‡ (Engineering); Dominique Nieto Corona‡ (Engineering); Diego Alejandro Cedeno‡ (Engineering); Isaac David Jones‡ (Engineering); Martin James Placido Pasco‡ (Engineering); Aidan James Mungovan‡ (Engineering); Ansh S Bhatt‡ (Engineering); Carter Jay McFall‡ (Engineering); Aaryan Gupte‡ (Engineering)

Abstract:

The ME Outreach team is constructing an RC car workshop to assist the Department of Mechanical Engineering at Purdue in promoting its program in Indianapolis. This 50-minute workshop offers students a hands-on experience with RC car mechanics and pulley systems, introducing them to fundamental engineering principles. The workshop begins with a presentation covering the concept of gear ratios followed by telling the students why they should choose Purdue Indy for mechanical engineering. Students will modify the pulley systems on their RC cars, experimenting with different configurations. They will understand how larger drive pulleys increase torque but reduce speed, while smaller ones enhance speed but lower torque. They will also notice how ramps are correlated with the ratios as well. After the modifications, participants complete time trials where they record their lap times or compete in a race with a maximum of three cars. The final product will comprise of a track, car, manual for students, manual for presenter, and a presentation for the students.

Keywords: RC; Education; Ratio; Pulleys; Torque

Mentor(s):

Peter Osire Orono (Purdue University); MohammadHossein Jamshidnejad (Engineering)

Other Acknowledgment(s):

Alan S Jones (Purdue University); Christopher Edward Finch (Purdue University)

Presentation Abstract Number: 217
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Evaluating Material Capabilities Using Open-Source Binder Inkjet 3D Printer

Author(s):

Andrew James Gillespie† (Engineering)

Abstract:

With the rapid development in powder-based additive manufacturing (AM), open-source 3D printers that are capable of supporting various materials for experimentation are needed. This research investigates the material possibilities of ceramic powder-based binder inkjet 3D printing by focusing on standard ceramic families, silicon carbide, and zirconia oxide and determining possible solid binder formulations with ethanol liquid binding agent. It aims to decrease the developmental costs of powder with liquid and solid binders to enhance the development of new material possibilities in the future with an easily adaptable printer for use within the research field. This study utilizes an open-source binder-inkjet 3D printer to explore several powder formulations and analyze the part quality, such as powder-binder adhesion and resolution from produced parts, setting a baseline for future cases.

Keywords: Additive Manufacturing; Binder Inkjet 3D Printing; Ethanol Binder; Power-Based Printing

Mentor(s):

Jing Zhang (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 218
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

NASCAR Rear Bumper Structure Crashworthiness Design and Optimization

Motorsports Engineering Capstone

Author(s):

Alexander Jeffrey Grey† (Engineering); Teague Kingsley Walters† (Engineering); Jonah Vadim Hanrahan† (Engineering|JMHC)

Abstract:

This Capstone Project addresses the need for an optimized NASCAR rear bumper structure for enhanced crashworthiness behavior through parametric studies using LS-DYNA simulations. The project focuses on systematically varying structural parameters to synthesize and validate optimal structural topologies. The primary objective of the rear bumper design is to maximize passenger safety by effectively managing crash energy, minimizing structural intrusion, and reducing peak forces during collisions. The methodology involves developing a detailed finite element model, conducting parametric studies to evaluate the effects of various design variables on crash performance, and validating the resulting structure through rigorous dynamic crash simulations.

Keywords: Energy Absorption; LS-DYNA; Dallara; Motorsports; Capstone

Mentor(s):

Andres Tovar (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 219
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Machine Learning driven characterization of thermal conductivity in materials

First Time Researcher Fellowship

Author(s):

Jonathan Steven Hickle† (Engineering)

Abstract:

Thermal properties, alongside electrical properties, dictate the usefulness of materials in semiconductors and microelectronics. These properties are governed by bond strength within a material's crystal structure, which is influenced by its chemical composition. However, identifying materials with desirable thermal properties remains a challenge due to the vast number of potential candidates.

To address this, machine learning models trained on well-characterized materials can be used to predict the thermal properties of new materials. This method utilizes the mp_api library to retrieve material data from the Materials Project, which is then processed into lattice structures using the matgl library. A pretrained model from the PyTorch library analyzes these structures to estimate bond strength and thermal conductivity. The predictions are then sorted by relevant properties and exported for further analysis.

By automating property predictions, this approach streamlines materials discovery, allowing researchers to efficiently identify promising candidates and optimize experimental resources for further study.

Keywords: Machine Learning; Semiconductors; Thermodynamics

Mentor(s):

Krutarth Hemant Khot (Engineering); Xiulin Ruan (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 220
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Allison Transmission - Final Test Stand Warranty Correlation

The Data Mine

Author(s):

Lina Im† (Science|JMHC); Justin Azanli† (Science); Angad Singh† (Science); Dhruv Raj Patel† (Science); Jorge Antonio Jimenez† (Science); James M Scanlan‡ (Engineering); Justin Carmine DeRosa‡ (Science); Trung Duc Lam‡ (Science); Mason Nicholas Arnoldy‡ (Science); Larry Wei‡ (Engineering)

Abstract:

The project will be a correlation study of Allison Transmission on highway transmission warranty claims compared to in plant functional test rejects and repairs. The project will involve review of large warranty files and functional test data files looking for trends in the functional test stands with corresponding warranty claims. Student researchers will collect and analyze functional test data from test stands that reside in the Indianapolis manufacturing facility. Using both data sets, they will correlate any functional test rejects or variable data to warranty claims. The ultimate goal is to build an automated system through a web application that can take both data sets and provide early indication of warranty risk based off of functional test results.

Keywords: Warranty; Correlation; Claims; Transmissions; Rejects

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 221
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Visualizing mechanotransduction of subcellular metabolic signaling in progerin-expressing endothelial cells

First Time Researcher Fellowship

Author(s):

Karan Rahul Karkhanis† (Engineering); Laila Abdelwahab‡ (Engineering|JMHC)

Abstract:

Under the Weldon School of Biomedical Engineering, Dr. Sungsoo Na and Dr. Julie Ying Hui Ji have introduced a joint project regarding “Visualizing mechanotransduction of subcellular metabolic signaling in progerin-expressing endothelial cells”. As the human body ages, the risk of cancer and cardiovascular disease increases over time. By indicating the changes in cell signaling by the AMPK signaling protein in the nucleus, the opportunity for more research regarding biological metabolic signaling can be created. In this project, the nuclear lamina, which supports the nucleus and cytoskeleton, will be analyzed by conducting cell culture on lipotransfected cells, which respond to fluorescent light. A machine and computer-operated inverted microscope, which introduces this light, can highlight fluorescent proteins for counting and visualization. The quantification of this data can further explain changing endothelial cells under shear-stress flow, to further study the human aging process.

Keywords: Biomedical Engineering; Cell Mechanics; Live Cell Imaging; FRET Imaging; Cell Culture

Mentor(s):

Sungsoo Na (Purdue University)

Other Acknowledgment(s):

Julie Ying Hui Ji (Purdue University)

Presentation Abstract Number: 222
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Projecting Future Delta Faucet Product Contacts and Defects

The Data Mine

Author(s):

Kelci Maire Malloy† (Engineering|JMHC); Claire Mari Johnson† (Science); Luis Santiago Mendez Perez† (Science); Aahan Ritesh Patel† (Science); Anand Shanker† (Science); Om Shrikanth Janamanchi† (Science); Shreya Samiksha Baral† (Science); Mixuan Pan† (Engineering); Frederick Gengyu Lu† (Science|JMHC); Quinton Ulysses Pedrick‡ (Science); Ihenna Nathan Anoliefo‡ (Science)

Abstract:

Delta Faucet Company provides lifetime warranties on all products, collecting warranty and defect data throughout a product's lifespan. This project used customer service, sales, and warranty data to predict future product contacts and defects for top-selling models since 2018. The goal of this project was to identify defect patterns, predict warranty costs, and improve business analytics using customer service data. This data recorded each faucet as a unique stock keeping unit (SKU), which identified attributes like finish and model, and its reported warranty cases. Data normalization allowed SKU analysis by Effect Codes, identifying the finish with the highest defect percentage. These results were incorporated into a predictive model that inputs sales data, model, finish type, and time to output a warranty defect curve, providing insights for Delta Faucet's business analytics team to reduce warranty defects.

Keywords: Predictive Analytics; Data Science; Statistics; Data Analytics; Business Analytics

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Aissata Bah (Science)

Presentation Abstract Number: 223
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

NeoPace Adaptor: Development of a Unipolar Adapter for Medtronic's MicraTM Pacemaker to Enable Implantation in the Smallest Pediatric Patients

Author(s):

Caleb Benjamin Manring† (Engineering|JMHC); Pearl-marie M Andoh† (Engineering); Makenzie Leigh Sheehan† (Engineering); Anna Christine Schroeder‡ (Engineering)

Abstract:

Congenital heart block (CHB) affects approximately 1 in 20,000 newborns, with a significant risk for mortality if untreated. Standard treatment that eliminates mortality risk involves pacemaker placement, often in the neonatal period. Current pacemaker options for neonates are limited by outdated technology and size constraints. The Medtronic MicraTM, a leadless pacing system offers a significantly smaller alternative with cutting edge technology though lacks compatibility with standard unipolar leads often used for neonatal pacing. Our team has developed a novel unipolar lead adapter for the MicraTM pacemaker, enabling its use in the smallest pediatric patients. Our design aims to minimize implantation

complexity and device footprint. This innovation expands treatment options for the most vulnerable cardiac patients, offering a promising step toward improving outcomes in neonatal pacing therapy

Keywords: Pacemaker; MicraTM

Mentor(s):

Sharon J Miller (Purdue University); Steve Higbee (Purdue University); Olivia Nicole White (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 224
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

AI-Driven Patent Data Extraction and Analysis for Agricultural Patents

The Data Mine

Author(s):

Thanh Dat Le† (Science); Bach Gia Le† (Science); Seshanth Karthik† (Science); Urjit Aich† (Science); Sidarth Nuthi† (Science); Lina Im† (Science|JMHC); Shivan Dipakkumar Pandya† (Engineering); Anna Bajszczak† (Polytechnic|Graduate); Srishti Maurya‡ (Science)

Abstract:

The AI-Driven Patent Data Extraction and Analysis System for Corteva is designed for efficient retrieval, extraction, and analysis of agricultural patents related to crop protection. The project integrates cutting-edge technologies, including large language models (LLMs) and advanced tools for data extraction and structured search. These capabilities will allow scientists and researchers to efficiently access, extract, and analyze patent data enabling faster, more informed decision-making. The project has the following three objections: Patent Repository Development, Automated Data Extraction, Interactive Chat Module.

Keywords: Patent Extraction; LLMs; IP Analysis; Agricultural Patents; AI Chatbot

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 225
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Indianapolis Zoo

EPICS

Author(s):

Courtney Angela McHale† (Engineering); Jonathan Nathaniel Clinton† (Engineering); Calvin Nathaniel Spaulding† (Engineering); Rylan Jacob Keith† (Engineering); Cole Matthew Burger† (Engineering); Jasen Michal McPartlan† (Engineering); William Ralph Simmons† (Engineering); Zachary Ray Ferguson† (Engineering); Ravi John Pillai‡ (Engineering); Jesse Najera‡ (Engineering); Harrison Lee Fitch‡ (Engineering); Avary Marie Furlong‡ (Engineering); Jayden Pearl Jarmon‡ (Engineering); Zuriel Vazquez‡ (Engineering)

Abstract:

We have the pleasure of working with the Indianapolis Zoo and their Invertebrate Conservation Coordinator at the Global Center for Species Survival, Dr. Sérgio Henriques. Our section has 3 sub-teams; Fire-Lies, Boiler BugBox and the Mobile Field Printer, with each team designing a device that will make Dr. Henriques's work more efficiently. The Global Center for Species Survival has partnered with our EPICS section to create devices which facilitate the observation and study of different invertebrates in their natural environments. Fire-Lies aims to make a foldable, portable, pole-like structure for ease of transportation and storage. To mimic the flashing patterns of fireflies, on the end of the device will be an LED with a built-in programmed Raspberry-Pi to control the LED'S light behavior. As for the Boiler BugBox, the process of collecting pictures and other data associated with the insects is time consuming, so we are making a system that automatically collects the pictures and data he needs and can be left in an outdoor area for an extended period. We propose an automated camera that collects time, temperature, location, humidity, and this image itself and uploads this data to a GitHub website. Lastly, the Mobile Field Printer is working toward creating a portable printer capable of surviving extreme environments and creating chemical and wear-resistant sample labels. All teams within our section are working to aid our partner in his efforts to conserve, protect and learn about the invertebrates in our world.

Keywords: Zoo; Fire-Lies; Boiler BugBox; Mobile Field Printer; EPICS

Mentor(s):

Andrew Aurin Tomaschke (Purdue University); Beata Nicole Johnson (Engineering); Suchandra Teja Torlakonda (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 226
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

DIY Nitrous Oxide Rocket

Author(s):

Jacob Metcalf† (Engineering); Luke Yen† (Engineering)

Abstract:

This project details the design and creation of a 3-inch flight-ready rocket engine using Nitrous Oxide (N2O) and Isopropyl Alcohol (IPA). Built at Purdue University with $200 worth of materials, the rocket motor generates 225 lbs of thrust for 4.33 seconds. The system uses Nitrous Oxide to pressurize the engine, pushing both fuels into the combustion chamber at 250 psi. Design decisions, such as incorporating a "scrintle injector" that combines a flathead screw with fuel nozzles and using straightforward machining techniques like pins and prebuilt jigs, reduce manufacturing complexities and costs. Ultimately, the project demonstrates that even sophisticated liquid propulsion systems can be built affordably and effectively by students. This highlights the accessibility of such technologies and encourages further exploration of liquid propulsion systems in educational settings.

Keywords: Engine; Nitrous; Rocket

Mentor(s):

Michelle S Ulmer (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 227
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

TieTech - Surgical Methods Practice and Assessment Device

Author(s):

Renee Chantal El Miller† (Engineering); Zachary Knauss† (Engineering|JMHC); Alexis Jo Whittinger† (Engineering|JMHC); Geoffrey Lee VanSickle† (Engineering)

Abstract:

The purpose of this project is to design and implement a surgical knot-tying training device that measures and analyzes the forces involved in knot-tying, providing quantitative feedback to medical students and professionals to accelerate their training while maintaining training quality. The device utilizes interchangeable silicone bands to simulate knot-tying, with strain gauges placed on SLS printed nylon blocks to measure displacement in two perpendicular directions via cantilever beam mechanics. An Arduino, paired with a Wheatstone bridge circuit, captures strain data, which is then converted to force measurements using a bank of data from previous tests and a line of best fit. The system allows for the export of data to Excel for further analysis. The device measures strain and converts into force values, providing insight into the forces applied during knot-tying. The integration of the Arduino and Wheatstone bridge circuit ensures reliable and repeatable strain measurements, while the SLS nylon block design offers a practical, cost-effective solution that allows for easy replacement of the blocks if needed. This device is a simple, accessible tool for surgical knot-tying practice, enabling students to better understand the forces involved in the process and adjust their methods accordingly to ensure patient safety during knot-tying. It provides valuable quantitative feedback for improving knot-tying technique and can be used in both educational and professional settings to enhance surgical skills training.

Keywords: Suture; Surgical; Knot-Tying

Mentor(s):

Sharon J Miller (Purdue University); Steve Higbee (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 228
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

CHEQI

EPICS

Author(s):

Anastasia Marie Musson† (Engineering|JMHC); Ian Jacob Castro† (Engineering|JMHC); Esteban Tomas Felix Moran† (Engineering|JMHC); Abdulla Muhammad Asif Galsulkar† (Engineering); Anthony L Garibay† (Engineering); Jaden Donghoon Ko† (Engineering|JMHC); Ferdinand Ebo Koranteng-Barnes† (Engineering|JMHC); Joseph Michael La Polla† (Engineering); Jayden Gabriel Magno† (Engineering|JMHC); Mabrey Blair Manning† (Engineering|JMHC); Jake Creschael Rodriguez-Ashe† (Engineering|JMHC); Grayson Brody Stahl† (Engineering|JMHC)

Abstract:

Our partner, the Center for Health Excellence, Quality, and Innovation (CHEQI) at Purdue University's College of Pharmacy, has connected us with St. Vincent de Paul (SVdP) to collaborate on multiple projects improving efficiency, health, and sustainability.

As the HammerHeads group, we have been working with SVdP to create an app, HammerSpace, to track inventory. Currently, SVdP uses paper manifest received from shipments along with shelf markings to track their inventory. To create a more centralized inventory, we have been working on app to ease the tracking of the inventory at SVdP.

The food pantry needed a way to promote healthy eating within their waiting room, so we have created several poster designs to display recipes, instill confidence in patrons' cooking abilities, and inform readers about healthy eating habits.

Our project aims to recycle single use medical devices to reduce plastic pollution. We designed an innovative solution using UVC light to sterilize medical equipment. This model uses a UVC light inside a reflective container. The medical equipment is placed inside, exposing it to 245nm light for 15 to 20 minutes, and can be repeated after each use.

The food pantry staff at SVDP are required to have all perishable food product, such as bread, lifted at least 4 inches off the ground. We are in the process of designing a ramp-elevation system to lift a set of stacked crates onto pallets. These pallets will be affixed with an antifriction material such as metal or plastic.

Keywords: CHEQI; SVdP; App Programming; Poster; UV Light

Mentor(s):

Patrick Corey Gee (Purdue University); Ashay Uday Berde (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 229
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Motorsports Outreach

EPICS

Author(s):

Robert Steven Norris† (Engineering); Jackson Casey Poer† (Engineering); Sonja Barbara Lemke† (Engineering); Matthew Thomas Lucas† (Engineering); Moussa John Miller† (Engineering); Nilay Thakkar† (Engineering); Noah Richard Walden† (Engineering); Josiah Elijah Acosta‡ (Engineering); Andrew Noble Byers‡ (Engineering); Gabriel Kosma Morali‡ (Engineering); Eubene Ethan In‡ (Engineering); Johnathan Lee‡ (Engineering); Luke Gerard Okonsky‡ (Engineering); Mohammed Samin Ullah Miyan‡ (Engineering); Ian Edward Morrison‡ (Engineering); Olivia Kay Timm‡ (Engineering); August Luke Peters‡ (Engineering); Jason Bricknell Sloan‡ (Engineering); Simon Thaddeus Milligan‡ (Engineering); Kelly Song‡ (Engineering); Jonah Dammes van Antwerpen‡ (Engineering); Zachary Baten‡ (Engineering)

Abstract:

This EPICS project is part of Purdue's Motorsports Outreach, trying to bring attention to the Motorsports Program here in Indianapolis. It involves two projects: a racing simulator and a wind tunnel.

Work on our driving simulator began last semester by drafting specifications, drawing sketches, and designing a model in Solidworks. Now we have a complete bill of materials, have ordered parts, and have begun assembling the final product.

Our second display to promote the Motorsport Engineering program will be a basic, mobile wind tunnel. The first semester was a matter of building a skeleton of the electrical system and a preliminary 3D model in Onshape. This semester has been a matter of focusing that blurry image into something that can be created in the real world with materials and resources we have access to.

These two projects will be brought to outreach events and shown to prospective students in hopes of bringing interest to the program.

Keywords: Motorsports; Racing; Simulator; Wind Tunnel; Engineering

Mentor(s):

Charles Holliday Jenckes (Purdue University); Karen Denise Alfrey (Purdue University); Jorge L Martinez (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 230
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Detection of Digital Fraud for Elevance Health

The Data Mine

Author(s):

Sarah Jessica O Farril-Gonzalez† (Polytechnic|JMHC); Sriya N Chakravarthula† (Science|JMHC); Aditya sanjay Pawar† (Science|JMHC); Raynad Chishty† (Science); Landon Mitchell Berger† (Polytechnic); Anna Bajszczak† (Polytechnic|Graduate); Bozidar Perovic† (Science); Nithil Krishnaraj† (Science); Abha Anilkumar Gupta† (Science); Vishal Subramani Ramasubramanian† (Science); Nolan Thomas Patterson‡ (Polytechnic)

Abstract:

This project addresses the critical challenge of detecting digital fraud within security-oriented telemetry data. In collaboration with a leading healthcare company, our team developed a methodology to identify potential fraudulent activities in near real-time. The approach involves a comprehensive data-driven process, beginning with extensive research into fraud patterns and the analysis of security logs. Data aggregation and preprocessing techniques were applied to prepare the data for machine learning analysis. An anomaly detection model was implemented to identify deviations from normal behavior, indicative of potential fraud. This system aims to enhance security measures by enabling the early detection of compromised accounts and suspicious transactions, thereby mitigating risks and safeguarding sensitive data. The project provides a foundation for a robust and repeatable fraud detection system that can be deployed in a production environment to analyze incoming data and trigger appropriate workflows.

Keywords: Fraud Detection; Anomaly Detection; Machine Learning; Security Telemetry; Healthcare Security

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 231
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Player Archetyping & Evaluation

The Data Mine

Author(s):

Eniola Vikky Owolabi† (Engineering); Jasper Leeron Basir† (Science); Maninder Kaur† (Science); Thirukumaran Veleyudham† (Science); Gregory K Harner† (Science); Jermaine Leebron Basir† (Science); Prem Dilipkumar Patel† (Science)

Abstract:

As women's basketball begins to expand into analytics, the rise of position less basketball will likely follow, and the need to evaluate players outside of the traditional five-position system becomes paramount. We are interested in determining a series of categories representing the playstyles and roles of players across the globe. In addition to these categories, we are aiming to create a singular "grade" of sorts that boils an entire box score of a player into one metric representing their overall performance within a game. This metric would be utilized to find "breakout performances" of players with sudden performance improvements in addition to consistent "top performers" within a given competition.

Keywords: WNBA; Archetyping; Statistics; Machine Learning; Data Analysis

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 232
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Allison Transmission Vehicle Clustering Project

The Data Mine

Author(s):

Sevinch Pasilova† (Engineering); Badr A Ramadan† (Science); Victor Vladimirovich Voznyuk† (Science); Abhinav Kotamreddy† (Science); Kashyap Vallur† (Science); Chanh Ly† (Polytechnic); Nathan T Fecadu† (Science); Omar M Ibrahim† (Science); Younes Y Aref† (Science); Aman Ibrahim Ali† (Science); Pragun Sethi† (Science); Parshawn Ta-xiyah Jamil Haynes† (Science); Dhruv Raj Patel‡ (Science)

Abstract:

The Allison Transmission Vehicle Clustering project focuses on analyzing and categorizing vehicle data to enhance performance insights and operational efficiency. This project aims to uncover meaningful patterns that can support decision-making in vehicle performance optimization.

Keywords: Allison Transmission; Vehicle Clustering; Data Mine; GPS; Python

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 233
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Simple Synthesizer

VIP

Author(s):

Rudra Vimlesh Patel† (Engineering); Alexander Marcus Krapels† (Engineering); Madilyn Grace Shingle† (Engineering); Jack Brian Cramer† (Engineering); Yutong Wu‡ (Engineering); Cole Allen Hufford‡ (Engineering)

Abstract:

[Abstract Redacted]

Keywords: [no keywords provided]

Mentor(s):

Steve Clayton Rausch (Engineering); Arvind Krishna Radhakrishnan (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 234
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

ECE

EPICS

Author(s):

Agastya Patel† (Engineering); Soumik Chaki† (Engineering); Owen Casimir Zuranski† (Engineering); Mekaeel Iqbal† (Engineering); Ethan Heilong Lau† (Engineering); Evan Lin† (Engineering); Iman J Chan† (Engineering); Oluwadara Lagbaja‡ (Engineering); Jack Dennis Moe‡ (Engineering); Preston Edward Buxton‡ (Engineering); Ved Sagar Sonar‡ (Engineering); Hicham Daoudi Daoudi‡ (Engineering); Jayden Michael Early‡ (Engineering); Subham Ghimire‡ (Engineering); Parthiv Venkat Malipeddu‡ (Engineering); Guillermo Amparo-Vargas Amparo-Vargas‡ (Engineering)

Abstract:

The EPICS program has sought to work with the Elmore Family School of Electrical and Computer Engineering (ECE) with the goal of inspiring K-12 students to pursue electrical engineering through two projects.

The first is Project Hovering Inspiration. Worked on by Team Hover, this project seeks to provide high school students with a hands-on learning experience through buildable hovercraft kits. These kits would include parts such as wooden 2 by 4's, plywood, fans, and other necessary materials. Currently, Team Hover is working on a scaled down prototype of their design.

The second project is titled Project Manus. The goal of this project is to create a robotic arm which can demonstrate to onlookers the intricacies of engineering. This will be achieved through an open design which shows off the inner workings of the arm. The arm will be built using aluminum bars given structure by a 3D printed frame, while achieving motion through motors and gear boxes.

Through these projects, Team Hover and Team Maunus will continue to apply engineering principles as well as the innovative spirit of Purdue to inspire the next generation of electrical engineers.

Keywords: Inspire; K-12 Students; Electrical Engineering; Hands-On; Projects

Mentor(s):

Aakanksha Desai (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 235
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

ECHO - ISD Indy

EPICS

Author(s):

Krish A Patel† (Engineering); Blythe Anne-Louise Richardson† (Engineering); Umberto Maria Puddu† (Engineering); Risa Charvi Metta† (Engineering); Elhadj Thierno Sadou Diallo† (Engineering); Runchen Liang‡ (Engineering); Max Edwin Goodchild‡ (Engineering); Maxim Gulyaev‡ (Engineering); Etibar Alakbarzade‡ (Science); Mwee Shee‡ (Engineering); Audrey Anne Tyler‡ (Engineering); Aditya H Joshi‡ (Engineering)

Abstract:

Our project, ECHO, has been developed for the Indiana School for the Deaf, to address the critical need for accessible educational content by translating audio and video inputs into animated American Sign Language (ASL). By enhancing learning experiences for deaf students, the system aims to bridge communication gaps and expand access to knowledge. Users upload media files through a web interface, where the audio is first transcribed using the Whisper OpenAI model. The transcript is then segmented into sentences, converted into ASL gloss via a dedicated machine learning model, and tokenized. Each token is validated against an existing sign library; if a sign is missing, the system automatically retrieves a corresponding video through web scraping and applies key-point tracking to generate an animated sign skeleton. Finally, these individual segments are stitched together to create a complete translation video, delivered as a downloadable file or sharable link. Built on a Django back-end and a HTML/CSS/JavaScript front-end, this application demonstrates potential for further refinement in sign transition normalization and translation accuracy, setting a replicable model for improving educational accessibility for deaf learners.

Keywords: American Sign Language; Machine Learning; AI; Key-Point Trc; Educational Accessibility

Mentor(s):

Aakanksha Desai (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 236
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

EPICS Inline 6 CED

EPICS

Author(s):

Diego Alfonso Perez† (Engineering); Shaun Alexander Conner† (Engineering); Amine El Hamma† (Engineering); Fabio Josue Reyes† (Engineering); Aiden Jake Stankiewicz‡ (Engineering)

Abstract:

Our team is creating an Inline 6 engine 3D model, specifically made to be simple and easy to understand for children. In addition to the engine, we are making a turbo. Our project will be 3D printed with some electrical components added to it. We will have a separate piston from the engine that will be connected toa button. When the button is pressed, the piston will start rotating, showing how the innerworkings of an engine function. We want our project to be easy to understand so that kids can learn more about STEM and gain interest in it.

Keywords: [no keywords provided]

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 237
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Peace Learning Center EPICS

EPICS

Author(s):

Nikolas Perry† (Engineering); Luke Yen† (Engineering); Ethan Michael Elliott† (Engineering); Sarah Eileen Kaufman† (Engineering); Hunter James Rutledge† (Engineering); Lakota Storm Robbins† (Engineering); Shani H Hui† (Engineering); Ethan Cash Rayles‡ (Engineering)

Abstract:

This project addresses the critical need for accessible and immersive outdoor learning spaces identified by the Peace Learning Center. As an organization dedicated to promoting peace through intentional practices and community-driven solutions, the Center requires an ADA-compliant outdoor learning environment to better serve children in the community. This initiative aims to foster inclusivity while creating an engaging educational setting. Solving this problem has broader significance, as it empowers the community with functional and sustainable infrastructure aligned with the Center's mission.

To meet these needs, the project team is designing a freestanding pavilion powered by renewable energy, picnic tables, dock, and an interactive sound wall. The pavilion design focuses on durability and accessibility, while engineered wood picnic tables ensure long-term resilience. The dock will provide access to Eagle Creek and address historical maintenance challenges caused by fluctuating water levels and erosion. CAD models for the pavilion, tables, dock and sound wall are complete, and iterative design reviews are ongoing to refine structural integrity and optimize material selection.

Currently, the project is in the design and prototyping phase. Prototype testing and delivery of tables and sound wall are scheduled for this semester. A major achievement includes completing CAD models, while challenges persist in managing the costs of the pavilion and dock.

Future steps include conducting prototype testing, refining designs based on results, and obtaining professional approvals. Once site preparation and material procurement are completed, the project will advance to construction, providing long-term infrastructure that embodies the Peace Learning Center's values of inclusivity and sustainability.

Keywords: Eagle Creek; Educational; Sustainable; Pavilion; Renewable Energy

Mentor(s):

Michelle S Ulmer (Purdue University); Garvit Agarwal (Polytechnic); Kevin T Lee (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 238
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

LLM Maintenance Troubleshooter

The Data Mine

Author(s):

Ashish Kumar Kashyap† (Science|JMHC); Sankhya Ganesh† (Science); Neelay Ranjan† (Engineering|JMHC); Yassir Khalaf† (Science); Ptolemy Bryce Henson† (Polytechnic); Fetume G Teklu† (Science); Anuj Nirav Shah† (Science); Shreyas Sreenath† (Science); Reva Arlene Pettigrew‡ (Engineering|JMHC)

Abstract:

We've built a LLM-based chatbot, with a user-focused application that accurately answers maintenance queries based on analogous maintenance and flight manuals. Moving away from the traditional training-based LLM methodology, the project implements a Retrieval-Augmented Generation (RAG) system to create a more accurate and cost effective model. The application has features that provide emphasize usability, while still implementing necessary business logic.

Keywords: Chatbot; LLM; Web Application; Python; React

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 239
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

India 5 - Automatic Paneer Machine

EPICS

Author(s):

Soham Amol Purav† (Engineering); Amar Nath Gollamudi† (Engineering); Harry Ip† (Engineering); Carson G Bellak† (Engineering); John Philip Pretzler‡ (Engineering)

Abstract:

Design and construct a fully automatic paneer making machine. Help small dairy farmers in India to improve value of milk production.

Keywords: Automation; Machine; Women

Mentor(s):

Steve Clayton Rausch (Engineering); Sai Abhishikth Somishetty (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 240
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

India 5 - Brick By Brick

EPICS

Author(s):

Megan Elizabeth Raupp† (Engineering); Karla Bravo† (Engineering); Whitney Fung† (Engineering)

Abstract:

[Abstract Redacted]

Keywords: Eco-Friendly Bricks; India; Plastic Bricks; Compressive; Aggregate

Mentor(s):

Steve Clayton Rausch (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 241
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Testing the Longevity of Electrode Coatings Through Accelerated Aging

First Time Researcher Fellowship

Author(s):

Ayden Matthew Rosencranz† (Engineering); Antonio C De Oliveira Segura† (Engineering); Charlita Sinmak* (Engineering)

Abstract:

Bioelectrodes are the future of modern medicine, enabling interact with certain nerve and muscle impulses. Through development in bioelectrodes could lead to longer lasting and more reliable deep tissue implants, expanding treatment options for previously untreatable conditions. However, these electrodes behave and interface in ways that present challenges for both medical professionals and scientists, such as short circuiting and electrodes breaking down overtime. PEDOT:PSS a commonly used coating due to its conductive and protective properties, is being tested to see whether modifications to the PEDOT affect the longevity and conductivity of electrodes over time. These modifications include the use of MXene or Carbon-based materials, which have proven effective within acute testing. In this project we will be testing these materials through a process known as accelerated aging. The electrodes will be submerged consistently in a saline solution at a constant warm temperature (70 ?), while simultaneously being stimulated with electricity. We aim to monitor the conductivity and resistance of the PEDOT (our control group), PEDOT modified with MXene, and PEDOT modified with Carbon over time using data collection tools. Then, the collected data within MATLAB to visualize and analyze data and observe these changes. We expect that the Maxine and carbon basses will have a longer lifespan exhibit greater conductivity. The findings will contribute to advancements within the Biomedical field and influence the development and application of electrode technology.

Keywords: Accelerated Aging; Biomedical Engineering; STEM; Electrodes; PEDOT:PSS

Mentor(s):

Ken Yoshida (Purdue University); Babak Anasori (Purdue University)

Other Acknowledgment(s):

Nathaniel Liam Lazorchak (Engineering); Awadh Mubarak M Al Hawwash (Engineering); Anupma Thakur (Purdue University)

Presentation Abstract Number: 242
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Elevance Health: Abnormalities & Outliers - Detecting Abnormalities in Log Data

The Data Mine

Author(s):

Edwin Antonio Sanchez†; Harshita Pasupuleti† (Science); Taemoor Hasan† (Science|JMHC); Faiza Bashir Mukhtar† (Polytechnic|JMHC); Alex Douglas Stephen Veal† (Science); Minh Triet Vu† (Science); Kaleb Bacztub‡ (Polytechnic|JMHC); Ramani Satishkumar‡ (Science|JMHC); Gabrielle Pesito‡ (Science); Bach Gia Le‡ (Science); Neel Jitesh Bhate‡ (Science)

Abstract:

In today's threat environment, having state-of-the-art cybersecurity mechanisms to support large-scale business needs are a must. One way of detecting threats is by examining log data generated by company systems.

Our project focuses on finding abnormalities & outliers in log data. With the high volume of information captured by system logs, it is impossible to parse it all by hand. With this in mind, we have developed methods of detecting abnormalities in events captured by system logs using both statistical and deep learning methods.

Keywords: Cybersecurity; Machine Learning; Artificial Intelligence; Deep Learning; Statistical Analysis

Mentor(s):

Margaret Ann Betz (Purdue University); Bryce Castle (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 243
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

EPICS - INTERNATIONAL SCHOOL OF INDIANA

EPICS

Author(s):

Trinav Singh† (Engineering); Helen J Caceres† (Engineering); Samuel Yucel Ercan† (Engineering); William Rafael Fisher† (Engineering); Zarah Myemuna Masud† (Engineering); Ian Jeffrey Rash† (Engineering); Iker Rodriguez† (Engineering); Akram S Quol† (Engineering); Miles Deshawn Norfleet† (Engineering)

Abstract:

The International School of Indiana (ISI) is committed to enhancing education through two key infrastructure upgrades: a Patio Shade Sail to encourage outdoor learning and a Sports Storage Shed to replace the deteriorating storage facility. These projects aim to improve academic and athletic experiences, fostering an engaging environment for students and staff. The Patio Sail team is designing a durable, weather-resistant shade sail with supports to provide optimal shading, ventilation, and visibility for comfortable outdoor learning. The Sports Storage Shed team is developing a secure, weatherproof facility to house ISI's track and field equipment, addressing issues like rust, disorganization, and exposure to elements. Both teams are leveraging AutoCAD to ensure structural integrity, efficient design, and material optimization.

Internal design reviews led the Patio Sail team to refine its design with a focus on materials, structural support, and shading efficiency. The Storage Shed team benchmarked existing structures and kits, as well as iterated designs based on feedback and is finalizing specifications for durability and security. Next steps include blueprint finalization, simulations, and professional approvals. Prototyping and shading simulations will help optimize the Patio Sail layout. Upon site preparation and material sourcing, both projects will proceed to construction, providing ISI with long-term solutions that reflect its dedication to academic and athletic excellence.

Keywords: Patio Shade Sail; Storage Shed; CAD; Structural-Simulations; Infrastructure

Mentor(s):

Michelle S Ulmer (Purdue University); Suchandra Teja Torlakonda (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 244
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

FWM - Spring 2025 Abstract - EPICS

EPICS

Author(s):

Jon Talka† (Engineering); Gustavo Solano Ortiz† (Engineering); Ian Michael Kurdelak† (Engineering); Ashlin Thomas LNU† (Engineering); Tyson Maxwell Jones† (Engineering)

Abstract:

The Fish Waste Management (FWM) team at Purdue University in Indianapolis is working together with Vardhaman College of Engineering to create a cost-efficient fish waste management solution to address the needs of the Ramnagar fish market in Hyderabad India.

For this semester, FWM is focused on producing a testable and comprehensive Hydrolysate fertilizer.

Fish markets generate significant amounts of organic waste, leading to sanitation challenges, foul odors, and environmental hazards. Conventional disposal methods, such as dumping or incineration, contribute to pollution and resource wastage. Alternative uses for fish waste, including fish feed, biodiesel production, and fertilizer, have been considered. This project focuses on the fertilizer option, utilizing fermentation techniques to create a nutrient-rich, eco-friendly product, utilizing extremely accessible and cheap local materials, that can benefit agriculture while simultaneously addressing waste management concerns.

The expected outcomes from the testing phase is a higher growth rate caused by the addition of the fish-waste-based fertilizer. The soil samples must have a higher concentration of NPK nutrients, and the leaf size, and the number of seeds both must be greater than the ones for the ‘control’ plants.

By transforming fish waste into fertilizer through fermentation and inducing hydrolysis, this project aims to offer a practical and eco-friendly solution to waste management challenges at Ramnagar fish market. The findings could serve as a model for other markets facing similar issues, promoting waste utilization in a way that benefits both the environment and local agricultural communities while minimizing costs.

Keywords: Fertilizer; Fish Waste; Eco-Friendly; Hydrolysis

Mentor(s):

Aakanksha Desai (Purdue University); Shubham Kapil Upadhyay (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 245
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Formula Ford Aerodynamics

Motorsports Engineering Capstone

Author(s):

Jack C Weron† (Engineering); Dean Michael Ahrens† (Engineering)

Abstract:

Formula Ford is an entry-level class of single-seater, open-wheel formula racing. Design work on the Purdue Motorsports Formula Ford car has been completed for the chassis and suspension components. The car is now at a stage where the bodywork can be designed. The purpose of this project is to optimize the aerodynamics of the Formula Ford using computational fluid dynamics (CFD). The CFD software being used is Siemens STAR-CCM+ and OpenFOAM. The primary objective is to create an aerodynamic package resulting in the lowest drag while also retaining high stability. Having a minimal amount of drag is very important in this series due to the underpowered engines that these cars run. It is also crucial that the car does not produce upward lift as that would create instability at high speeds. The ability to make side force will be investigated to help with the stability and minimum cornering speed. Making any kind of downforce (downward lift) and side force with little to no drag penalty would benefit the Formula Ford's performance over a lap. In addition to aero loading, the package must also provide sufficient air to the engine for cooling and combustion.

Keywords: Computational Fluid Dynamics (CFD); Drag Reduction; Stability; Motorsports; Capstone

Mentor(s):

Andres Tovar (Purdue University); Christopher Edward Finch (Purdue University)

Other Acknowledgment(s):

Charles Holliday Jenckes (Purdue University)

Presentation Abstract Number: 246
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Engineering Outreach Program with The Children

EPICS

Author(s):

Sharaya Lynn Wolfe† (Engineering); Varshetha Senthilkumar† (Engineering); Natalia Regina Figueroa† (Engineering); Ovia Muthu† (Engineering); Isabel Sofia Cifuentes‡ (Engineering)

Abstract:

In collaboration with The Children's Museum of Indianapolis (TCM) and Purdue Women in Engineering (WiE) Outreach, our EPICS section has developed an outreach program designed to encourage youth's creativity and promote their interest in engineering. Purdue WiE Outreach introduces students to engineering through creative hands-on activities, and TCM aims to cultivate learning and curiosity through family learning experiences. In partnership with both organizations, this project introduces students in grades K-6 to engineering and careers in biomedical engineering through an engineering activity related to prosthetic design that is both educational and fun. This program first introduces students to the engineering design process and then presents them with a challenge to build their own prosthetic-like tool using provided materials. The program will help encourage youth's interest in engineering by engaging them in the engineering design process through a fun hands-on activity. Our EPICS section will lead this program at The Children's Museum this spring with youth participants.

Keywords: [no keywords provided]

Mentor(s):

Beata Nicole Johnson (Engineering); Nirmala Priyanka Manthripragada (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 247
Presentation Time: Session 2: 1:30pm-3:00pm in the Campus Center, Room 450

Kurt Vonnegut Museum & Library

EPICS

Author(s):

Oryon Julio Zaragoza† (Engineering); Sera XiaoSheng McClain† (Engineering); Mahathi Adivi† (Engineering); Vindhya Mahapatruni Ganti† (Engineering); Jeerapat Suanthong† (Engineering); Georg William Dingledy† (Engineering); Michael Han† (Engineering); Edward Shao† (Engineering); Alexander Iain McCormick† (Engineering); Roderick James Keith Thomas‡ (Engineering); David Serrano‡ (Engineering); Ryan Wonha Shin‡ (Engineering); Michael Phillip Radchik‡ (Engineering); Colton Layne Yoder‡ (Engineering)

Abstract:

The Kurt Vonnegut Museum and Library EPICS team is developing an interactive exhibit inspired by Kurt Vonnegut's novel Slaughterhouse-Five. The exhibit aims to give visitors an immersive experience of key scenes in the novel while being informative. The exhibit will be split into two sections: Tralfamadore and Military tent. The Military Tent will feature thematic structures made of wood, embedded with graphic decorations, and populated with mannequins representing characters from the story. The Tralfamadore exhibit will be comprised of several key moments from the plot of Slaughterhouse-Five, as the room will be decorated with otherworldly features to portray the sense of an alien environment. By implementing these features to create an immersive environment, the members of this EPICS team will hone their skills in the iterative design process. While this term will be focused on design and planning, future terms will be dedicated to hands-on learning and real-world project monitoring. This innovative installation will provide a deeper understanding of Slaughterhouse-Five and will be open to museum visitors in November 2026.

Keywords: Museum; Library; Vonnegut; Tent; Engineering

Mentor(s):

Aakanksha Desai (Purdue University)

Other Acknowledgment(s):

Presentation Abstract Number: 300
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Developing Lithium-Ion Batteries to enable EV's Low Temperature Operation

NEIL (Naval Engineering Innovation & Leadership)

Author(s):

Larry Gene Jones† (Engineering)

Abstract:

In the realm of electrochemistry, researchers and practitioners have long pursued the development of an efficient and high performance cathode material suitable for practical battery applications. Historically, V2O5 (Vanadium pentoxide) has faced hurdles in this regard, owing to its inherent limitations such as low intrinsic electroconductivity, poor cycle stability, sluggish lithium-ion diffusion, and irreversible phase transitions during deep discharge. Despite these challenges, the potential of V2O5 as a cathode material remains intriguing, particularly given the excellent properties exhibited by metallic oxides in this application, notably their voltage characteristics.

Keywords: Lithium; Battery; Temperature; Electrochemistry; Electroconductivity

Mentor(s):

Clifford Dwyight Campbell (Purdue University); Jian Xie (Purdue University)

Other Acknowledgment(s):

Yikang Yu (Engineering)

Presentation Abstract Number: 301
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

Our Lady of Grace Community Garden

EPICS

Author(s):

Kade Stephen McPherson† (Engineering); Wen Ling See† (Engineering); George Rares Nicolau† (Engineering); Mohammad Raiyan Ashraf† (Engineering); Angie Allison Vazquez† (Engineering); Udan Ranmika Nimalasena† (Engineering); Navin Gopinath† (Engineering); Peiyuan Yu† (Engineering)

Abstract:

Our EPICS project focuses on renovation of the student-built greenhouse structure at Our Lady of Grace Catholic School. Beyond the physical improvements of the greenhouse, the project creates a learning environment and source of fresh produce, not only for the school but also for the surrounding community.

The roof and walls team completely redesigned the greenhouse to enhance both safety standards and functionality. They are in the prototyping and design stages of the project, preparing to implement the solutions. The project has encountered some challenges, including necessary cost reduction. Despite these obstacles, the teams remain on track to deliver sustainable solutions that will benefit the students, teachers, and surrounding community. Most recently, the team disassembled the portions of the existing structure that were structurally unsound. Looking to the future, the greenhouse team plans to create a scaled down prototype.

Keywords: Prototype; Community Garden; Greenhouse; Learning Environment; Renovation

Mentor(s):

Michelle S Ulmer (Purdue University); Suchandra Teja Torlakonda (Engineering)

Other Acknowledgment(s):

Presentation Abstract Number: 302
Presentation Time: Session 1: 10:30am-12:00pm in the Campus Center, Room 450

EPICS - INTERNATIONAL SCHOOL OF INDIANA

EPICS

Author(s):

Trinav Singh† (Engineering); Helen J Caceres† (Engineering); William Rafael Fisher† (Engineering); Zarah Myemuna Masud† (Engineering)

Abstract:

The International School of Indiana (ISI) is committed to enhancing education by designing a Patio Shade Sail to encourage outdoor learning. This project aims to improve students' academic experiences, fostering an engaging environment for students and staff. The Patio Sail team is designing a durable, weather-resistant shade sail with supports to provide optimal shading, ventilation, and visibility for comfortable outdoor learning. The team is leveraging AutoCAD to ensure structural integrity, efficient design, and material optimization.

Internal design reviews led the Patio Sail team to refine its design with a focus on materials, structural support, and shading efficiency. Next steps include blueprint finalization, simulations, and professional approvals. Prototyping and shading simulations will help optimize the Patio Sail layout. Upon site preparation and material sourcing, the project will proceed to construction, providing ISI with long-term solutions that reflect its dedication to academic and athletic excellence.

Keywords: Patio Shade Sail; CAD; Infrastructure; Simulations; Prototyping

Mentor(s):

Michelle S Ulmer (Purdue University); Suchandra Teja Torlakonda (Engineering)

Other Acknowledgment(s):

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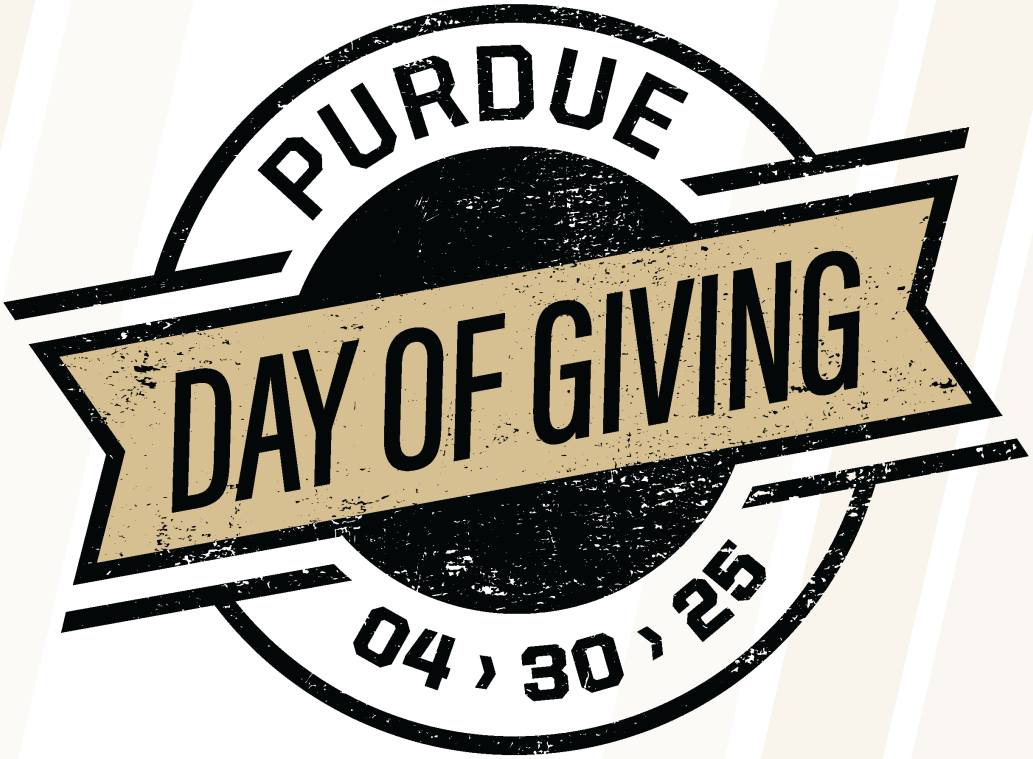

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SHOWCASE NOTES

SCAN FOR THE ABSTRACT BOOK

COORDINATED BY:

College of Engineering

EPICS

John Martinson Honors College

Office of Experiential Education

Office of the Provost

Office of Undergraduate Research

The Data Mine

Vertically Integrated Projects

*The planning committee extends special appreciation to **Morgan Roberts** and **Charlène Hammer** for their graphic design contributions for the Showcase.*

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