WELCOME TO

CELEBRATE
PURDUE'S THINKERS, CREATORS & EXPERIMENTERS

April 23, 2024

11am-1pm

Purdue Memorial Union
South Ballroom

PURDUE UNIVERSITY | Office of Undergraduate Research

Presentations listed by first author's last name. Names listed as submitted.

Purdue Lunabotics Excavation & Deposition Systems
Caleb Abbruzzi, *College of Engineering*
Rachel Barder, *College of Engineering*
Nikolai Perebeinos, *College of Engineering*
Evan Gilheany, *College of Engineering*
Mentor: Nicole Ramirez

Echoes of a Home
Alyssa Androff, *College of Health & Human Sciences*
Mentor: Renee Murray

Lunabotics Dust Mitigation
Jeramiah Arona, *College of Engineering*
Thomas Chuang, *College of Engineering*
Ethan Miller, *College of Engineering*
Dhilan Patel, *College of Engineering*
Mentor: Nichole Ramirez

RoboMasters Social Media
Andrew Behl, *School of Business*
Drake Hagerman, *School of Business*
Mentors: Shivam Bhat and Zijian He

An Origami-Inspired Tree Climbing Robot
Harrison Booker, *College of Engineering*
Atharva Awasthi, *College of Engineering*
Mentors: Ran Dai and Yuto Tanaka

Addressing Tetrachloroethylene Exposure in an Impacted Community
Katelyn Bottando, *College of Agriculture*
Mentor: Sa Liu

between the lines
Yunchong Chen, C*ollege of Liberal Arts*
Rachel Chen, *College of Engineering*
Mentor: Renee Murray

VIP Lunabotics Power & Hardware
Seth Feickert, *College of Engineering*
Olivia Purdy, *College of Engineering*
Rowe Tracy, *College of Engineering*
Hunter Biggs, *College of Engineering*
Sean Kelley, *College of Engineering*
Mentor: Nicole Ramirez

Impact of Generative AI on Education & Research
Riddhi Gupta, *College of Science*
Mentor: Lisa Bosman

Gustav Mahler: The Piano Rolls
Rebecca Hackett, *Colleges of Science and Liberal Arts*
Mentors: Adam Bodony and Tae Hong Park

We are many people
Audrey Harrison, *College of Science*
Mentor: Renee Murray

Ag-DOST: A friendly and Intelligent Chatbot for Farmers
Jungeun Hwang, *College of Science*
Son Thai Ha, *College of Science*
Mentors: Dharmendra Saraswat and Varun Aggarwal

Crater Detection with RGBD for SLAM
Andrew Kreimer, *College of Engineering*
Junyoung Kim, *College of Engineering*
Suhani Mathur, *College of Engineering*
Mentor: Nichole Ramirez

MotionPose: Machine Learning in Motion
Michael Li, *College of Science, School of Business*
Arunima Chowdhury, *College of Science*
Shamsad Rahman, *College of Engineering*
Hai Lam Le, *College of Engineering*
Roohee Urs, *College of Science*
Mert Ryan Kiroglu, *School of Business*
Sami Zagha, *College of Science*
Ryan Leonard, *College of Science*
Rishi Mantri, *College of Engineering*
Zahra Ghorrati, *Purdue Polytechnic Institute*
Mentors: Renee L Murray and Frederick C Berry

FDB Medication Risk Implementation and Design
Adam Ma, *College of Science*
Mentor: Donna Dillihay

Internal Thoughts
Kennedy Miller, *School of Business*
Mentor: Renee Murray

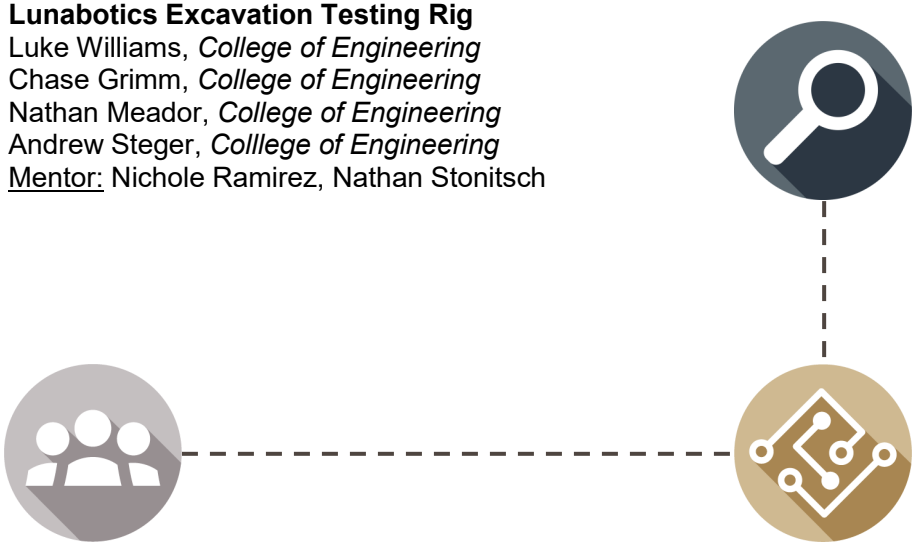
Roller Coaster Track and Support Structure: Dynamics, Simulation, and Optimization
Rohan Patel, *College of Engineering*

Lunabotics Wheel Design
Isaiah Salcedo, *College of Engineering*
Kevin Kuida, *College of Engineering*
Ty Hill, *College of Engineering*
Jay Shah, *College of Engineering*
Mentor: Nichole Ramirez

VIP Lunabotics Wheel Traction and Turing Capacity Test Rig
Trevor Smyth, *College of Engineering*
Gabriel Montoya, *College of Engineering*
Mentor: Nichole Ramirez

contRAST
Abigail Sullivan, *College of Health and Human Sciences*
Mentor: Renee Murray

Lunabotics Excavation Testing Rig
Luke Williams, *College of Engineering*
Chase Grimm, *College of Engineering*
Nathan Meador, *College of Engineering*
Andrew Steger, *Colllege of Engineering*
Mentor: Nichole Ramirez, Nathan Stonitsch



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Purdue Lunabotics Excavation & Deposition Systems

Innovative Technology/Entrepreneurship/Design

Authors:

Caleb Abbruzzi, *College of Engineering*

Rachel Barder, *College of Engineering*

Nikolai Perebeinos, *College of Engineering*

Evan Gilheany, *College of Engineering*

Project Description:

Description redacted.

Mentor:

Nicole Ramirez

Echoes of a Home

Fine Arts

Author:

Alyssa Androff, *College of Health & Human Sciences*

Project Description:

Echoes of a Home, an intermedia dance work, explores grief and memories through movement and projected video. This practical research creates a relationship between movement and emotion, which is expressed through live dance and asynchronous projected home videos of the choreographer’s childhood and family. The dance work consists of one dancer, performing in a contemporary movement style, and evolves in tone from somber to hopeful. The choreographic intention of grief provides the audience with an opportunity to reflect on their own lost relationships.

Mentor:

Renee Murray

Lunabotics Dust Mitigation

Innovative Technology/Entrepreneurship/Design

Authors:

Jeramiah Arona, *College of Engineering*

Thomas Chuang, *College of Engineering*

Ethan Miller, *College of Engineering*

Dhilan Patel, *College of Engineering*

Project Description:

Our team objective is to design and build a series of covers that mount to the robot's ex-dep system to eliminate the collection of regolith in the crevices of certain components. In NASA's Lunabotics competition, robots will be driving on a moon-like surface, so lots of material tends to be kicked up in the air when driving. Having a system that protects the robot from flying regolith will greatly increase our efficiency and speed when competing on the field. We designed our covers for manufacturability, easy installation/, and low mass.

We focused most of our time on designing a mitigation cover between the excavation system and the bucket/auger where regolith would be dispensed. This was considered a major problem because during last year's competition, regolith would tend to fly out in the area between their excavation and deposition system which lost them large amounts of points. To fix this issue from recurring, our team decided to design a cover that would angle the regolith toward the bucket when coming out of the excavation system. This will not only increase the amount of intake we collect in our bucket but also decrease the chance of regolith buildup in parts of our robot. We took multiple designs into account such as a funnel and tarp cover, but we finalized on an angled aluminum box because we believed it was the cheapest and simplest while being the most efficient for a competition robot. All of our parts were developed in SolidWorks.

Mentor:

Nichole Ramirez

RoboMasters Social Media

Innovative Technology/Entrepreneurship/Design

Authors:

Andrew Behl, *School of Business*

Drake Hagerman, *School of Business*

Project Description:

Description redacted.

Mentors:

Shivam Bhat

Zijian He

An Origami-Inspired Tree Climbing Robot

Innovative Technology/Entrepreneurship/Design

Authors:

Harrison Booker, *College of Engineering*

Atharva Awasthi, *College of Engineering*

Project Description:

Description redacted.

Mentors:

Ran Dai

Yuto Tanaka

Addressing Tetrachloroethylene Exposure in an Impacted Community

Life Sciences

Author:

Katelyn Bottando, *College of Agriculture*

Project Description:

Description redacted.

Mentor:

Sa Liu

between the lines

Fine Arts

Authors:

Yunchong Chen, *College of Liberal Arts*

Rachel Chen, *College of Engineering*

Project Description:

This practical research explores the dynamic expression of poetry through dance, which aims to translate the essence and emotional depth of poetic works into visual form though live and projected dance. By integrating dance and poetry, the choreography seeks to convey the unspoken beauty and emotional resonance found within the lines of poetry through the movement of two dancers, unlike traditional theater, which often directly represents the text. This approach emphasizes the principle that bodily movements can communicate concepts that words cannot, offering a unique interpretive experience that bridges verbal and non-verbal forms of expression.

Mentor:

Renee Murray

VIP Lunabotics Power & Hardware

Innovative Technology/Entrepreneurship/Design

Authors:

Seth Feickert, *College of Engineering*

Olivia Purdy, *College of Engineering*

Rowe Tracy, *College of Engineering*

Hunter Biggs, *College of Engineering*

Sean Kelley, *College of Engineering*

Project Description:

This project focused on assembling the wiring and electronics for the Purdue Lunabotics 2024 robot, as well as designing and assembling a custom printed circuit board to monitor the health of an attached lithium-polymer battery.

Mentor:

Nicole Ramirez

Impact of Generative AI on Education & Research

Physical Sciences

Author:

Riddhi Gupta, *College of Science*

Project Description:

As Generative AI's use increases drastically, also influencing education, understanding its impact becomes crucial. This study investigates Generative AI's role in education, focusing on language-specific differences in outcomes, specifically Spanish to English Translations, AI detector performance in how different AI detectors yield different results for the same dataset and implications of AI on teaching.

The study addresses four central questions: comparing outcomes for Spanish and English assignments using AI detectors, evaluating different AI detectors' performance, exploring teaching implications, and examining Generative AI's impact on research. Methodologically, statistical analysis and extensive literature review guide the study.

This research provides valuable insights for both educators and researchers to tackle the advent of Generative AI and its immense usage within students especially when writing assignments are involved. By understanding Generative AI's nuances, educators can optimize teaching strategies, while researchers can harness its capabilities for scholarly exploration. Dissemination through JPUR, Undergraduate Research Symposium, and ASEE conference proceedings is how we plan to bring these findings to a broad audience. Collaboration with Dr. Bosman aims to amplify the research's impact through a comprehensive journal article, thus further expanding the reach and influence of this study.

Mentor:

Lisa Bosman

Gustav Mahler: The Piano Rolls

Fine Arts

Author:

Rebecca Hackett, *College of Science, College of Liberal Arts*

Project Description:

Description redacted.

Mentors:

Adam Bodony

Tae Hong Park

We are many people

Fine Arts

Author:

Audrey Harrison, *College of Science*

Project Description:

We Are Many People is an intermedia choreographic work of how one person can have many versions of themselves. This piece will explore the relationship between variations of an individual through movement, projection, and sounds. The live and projected dance will be a culmination of different scenes. The overlapping live and projected movement will contrast each other in time, space, or effort, but both will be accompanied by the same sound. The projected video will evolve through various stages of distortion until the color and shape become identical to that of the live dancer. Evolution of dancer and projection mirrors an individual's acceptance of their many selves. We Are Many People calls out to the humanity in all individuals, and it embraces the existence of being many people within one body.

Mentor:

Renee Murray

Ag-DOST: A friendly and Intelligent Chatbot for Farmers.

Mathematical/Computation Sciences

Authors:

Jungeun Hwang, *College of Science*

Son Thai Ha, *College of Science*

Project Description:

Recent advancements in AI and technology have made chatbots increasingly popular for use in education, customer service, healthcare, and other fields. However, their application in agriculture for helping farmers manage crops and improve yield is limited. Therefore, this study focused on developing a chatbot to assist farmers in managing weeds to improve crop yield. The proposed method is intended to enable farmers to ask questions and receive relevant responses for easier and faster decision-making corresponding to their fields. The user interface for the chatbot was developed using React Native, enabling deployment on both iOS and Android platforms. The Pinecone application was used to store agriculture-related text and tabular data extracted from PDF files, along with their corresponding vectors. The development of the knowledge base for the chatbot involved a meticulous and strategic approach centered around the comprehensive Ohio 2023 Weed Guide, specifically targeting the Corn and Soybean chapters. The OpenAI ada-002 embedding model was used to vectorize and interpret user queries, matching them against a vectorized Pinecone dataset to locate the relevant information from the knowledge base. Additionally, a large language model (ChatGPT-turbo-3.5) provided the answer to the query based on the identified relevant article. A Bidirectional Encoder Representations from Transformers (BERT) - based intent classification model was utilized to discern the user's intent or purpose behind a given query, fostering a more personalized interaction. Overall, the proposed chatbot needs further testing to determine its potential for assisting farmers in obtaining answers to queries corresponding to weed management.

Mentors:

Dharmendra Saraswat

Varun Aggarwal

Crater Detection with RGBD for SLAM

Mathematical/Computation Sciences

Authors:

Andrew Kreimer, *College of Engineering*

Junyoung Kim, *College of Engineering*

Suhani Mathur, *College of Engineering*

Project Description:

Description redacted.

Mentor:

Nichole Ramirez

MotionPose: Machine Learning in Motion

Innovative Technology/Entrepreneurship/Design

Authors:

Michael Li, *College of Science, School of Business*

Arunima Chowdhury, *College of Science*

Shamsad Rahman, *College of Engineering*

Hai Lam Le, *College of Engineering*

Roohee Urs, *College of Science*

Mert Ryan Kiroglu, *School of Business*

Sami Zagha, *College of Science*

Ryan Leonard, *College of Science*

Rishi Mantri, *College of Engineering*

Zahra Ghorrati, *Purdue Polytechnic Institute*

Project Description:

The use of technology in the performing arts has transformed the way artists express themselves. The introduction of technology into dance performances has enabled a new degree of inventiveness, opening new dimensions and possibilities for choreography. Unfortunately, the high cost and complexity of existing solutions have kept them unavailable to many artists. MotionPose offers a creative and low-cost solution that utilizes YOLO (You Only Look Once) and OpenCV to develop a machine learning application for depth estimation between a person and the camera, and the distance measurement between two individuals. The main goal of MotionPose is to capture and analyze the spatial dynamics of human movement, focusing particularly on dances. In the development of this project, an important consideration is the trade-off between speed and accuracy. Fast processing is essential for real-time performance, but it can sometimes impact the precision of depth estimation and distance measurement. On the other hand, prioritizing accuracy can lead to slower processing speeds, which may not be suitable for real-time applications. By using YOLO for object detection and OpenCV for image processing, our model aims to balance these two critical factors. The coordinates generated by the model are then integrated into a front-end interface, which is designed to respond to the dancers' movements. This combination of machine learning and computer vision technologies offers a combined analytic and artistic approach to interactive performances and motion analysis by integrating frontend visuals/sound that interact with the data gathered from the model.

Mentors:

Renee L Murray

Frederick C Berry

FDB Medication Risk Implementation and Design

Mathematical/Computation Sciences

Author:

Adam Ma, *Computer Science*

Project Description:

Description redacted.

Mentor:

Donna Dillihay

Internal Thoughts

Fine Arts

Author:

Kennedy Miller, *School of Business*

Project Description:

"Internal Thoughts", an intermedia dance work, explores the relationship between movement and thoughts. It includes one dancer moving in relation to a piece of music that lives in a world between instrumental and spoken word poetry. The movement is a vehicle to express through the body rather than words and explores the differences in tempo, effort, and pathways that keep a shadow of the dancer on the screen throughout the performance. The design of the projected video evolves from bright, blurred dots to dark, crisp lines. The relationship between dance and technology represents the world inside of the dancer’s brain of things that they don’t know how to say through words but can express through dance. To the dancer, thoughts influence their movement and are expressed through instrumental sound and poetry. By witnessing "Internal Thoughts" the audience can reflect on the physical manifestations of one’s own thoughts.

Mentor:

Renee Murray

Roller Coaster Track and Support Structure: Dynamics, Simulation, and Optimization

Mathematical/Computation Sciences

Author:

Rohan Patel, *College of Engineering*

Project Description:

Roller coasters offer high speed entertainment to passengers. When designing a roller coaster, the dynamics of the track, train, and supports must be evaluated before manufacturing. By analyzing the discrete points and Frenet frames of a given roller coaster track, kinematic variables are found. Furthermore, the reaction forces between the vehicle and the track are estimated along with the deflection of the track. Track segmentation and deflection is optimized for when deciding locations how support and segment locations are found.

Lunabotics Wheel Design

Innovative Technology/Entrepreneurship/Design

Authors:

Isaiah Salcedo, *College of Engineering*

Kevin Kuida, *College of Engineering*

Ty Hill, *College of Engineering*

Jay Shah, *College of Engineering*

Project Description:

We are the wheel design subgroup of the drivetrain in the Lunabotics club. The purpose of the wheel design group was to make a new wheel that fits the parameters of what is needed for the new excavation and deposition group’s design and to update and try to fix past problems that went wrong with last year's wheel design. First, we asked what qualifications the robot needed to fit, such as lower mass. Then, we inquired about the dimensions of the wheel needed for the motor. Finally, we ensured that the wheel would not interfere with what would be on top. The lower mass meant that the wheel design needed to be made from a lighter material, like aluminum or plastic. We wanted to make sure there would be less pressure on the wheels and more traction on the ground, so we came up with a plan and decided for the wheel design to be thicker. We also investigated how to shape metal like aluminum and what it would be possible to accomplish by shaping the metal here at Purdue. We explored the manufacturability of specific design ideas for the wheel by researching each one from a list of five options. Afterward, we used a matrix selection process to determine which design we would proceed with. Also, we ruled out materials such as rubber due to cost, shipping time, and how tough they would be to work with to get the desired shape effect.

Mentor:

Nichole Ramirez

VIP Lunabotics Wheel Traction and Turing Capacity Test Rig

Innovative Technology/Entrepreneurship/Design

Authors:

Trevor Smyth, *College of Engineering*

Gabriel Montoya, *College of Engineering*

Project Description:

This research project centers on the design, development, and application of an online load simulation system for comprehensive wheel performance analysis. This will be used to test the capacities of the wheels for Purdue Lunabotics. The system leverages advanced computational techniques, including Computational Fluid Dynamics (CFD), to simulate various loads and forces acting on the wheel under different driving conditions.The online load simulation system represents scenarios such as acceleration, braking, and cornering, providing valuable insights into the wheel's behavior. It will also take into account what the wheel will be going into at the Lunabotics competition. This approach helps understand how the wheel performs under different weight distributions and different terrains that contribute to the overall safety and stability of the robot. The project incorporates advanced data acquisition systems for real-time data collection, capturing parameters such as wheel speed, torque, slip, and other relevant variables. The analysis of this data aids in making informed design decisions, enhancing the maneuverability and durability of the robot. This research contributes to the Purdue Lunabotics Club by providing a robust and flexible platform for comprehensive wheel load simulation. It paves the way for safer and more efficient robots that can potentially win at competitions by enabling detailed and accurate analysis of wheel performance under various conditions.

Mentor:

Nichole Ramirez

contRAST

Fine Arts

Author:

Abigail Sullivan, *College of Health and Human Sciences*

Project Description:

Through a choreographic exploration, this practical research displays how the same movement can be perceived in two different mediums. The dancer performing the piece live in dull-colored costuming is contrasted with the recorded dancer performing the piece in bright-colored costuming. The recorded dancer additionally undergoes a series of saturation changes through the Isadora 3 software. The movement embodies an attentive focus, shifting between sharp and soft accents. It is presented through the modern dance style, which encourages abstract approaches to movement. This piece creates an intersection between the art of dance and technology, two forms that provide their own introspection and creativity.

Mentor:

Renee Murray

Lunabotics Excavation Testing Rig

Innovative Technology/Entrepreneurship/Design

Authors:

Luke Williams, *College of Engineering*

Chase Grimm, *College of Engineering*

Nathan Meador, *College of Engineering*

Andrew Steger, *Colllege of Engineering*

Project Description:

Within the Purdue Lunabotics team, each year the team designs and creates an autonomous robot with some form of excavation tool. However year after year, the exact forces applied to this component are unknown. Our project sets out to change this. Our goal these past few months has been to design, sketch, and CAD a testing rig that can mount the current Lunabtoitcs excavation system and through the use of force sensors, gain a better understanding of the forces experienced on the the robot during mining. We had three main goals for our project. Firstly, to create a design that is very compact or able to be disassembled. Storage space is very limited for the Lunabotics club, so the testing rig needs to be able to accommodate this. Secondly, the rig needs to be able to measure forces in both the x and y direction. This ensures our rig is sensitive and effective at relaying accurate data to the Lunabotics team. And finally, the design needs to be built to withstand an upward load of 500 N. This ensures the rig can hold whatever excavation component Lunabotics creates, and will be applicable for all future excavation components. With these constraints in mind, we created a final CAD model of a rig we believe both achieves all our goals and will be an effective source of knowledge for the Lunabotics team.

Mentors:

Nichole Ramirez

Nathan Stonitsch

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