

MICHIGAN STATE UNIVERSITY COLLEGE OF ENGINEERING **FALL 2022**

DESIGN DAY



MICHIGAN STATE
UNIVERSITY

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MSU FEDERAL CREDIT UNION

Executive Partner Sponsor

Welcome to the MSU College of Engineering Design Day Booklet!

On behalf of Michigan State University Federal Credit Union (MSUFCU) in partnership with the College of Engineering, and Michigan State University, we **welcome** you to explore this booklet to see the **extraordinary** work of MSU students.


MSUFCU is **proud** to partner with MSU on many programs, especially those that highlight the talents of MSU's outstanding students. As you look through this booklet, you will see the work of MSU students demonstrating their abilities to be **creative, innovative, and problem solve** - traits that we all seek in our next generation of employees.

Design Day projects showcase the students' unique skills exhibited in their **intellect, ingenuity, teamwork**, and core engineering knowledge learned during their academic tenure in the MSU College of Engineering. The students' projects this semester provide insight into their **inspiring solutions** to the real-world challenges presented. As a result, we have great confidence in their futures as engineers and **leaders** in our global workforce.

We wish everyone our **congratulations** on your successes and accomplishments. And, a special **thank you** to the parents, families, faculty, and staff that have supported the students as they **achieve their dreams**.

Sincerely,

April M. Clobes, President/CEO, MSUFCU



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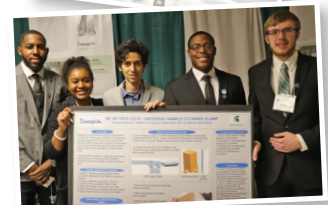
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MICHIGAN STATE UNIVERSITY COLLEGE OF ENGINEERING SPRING 2023

DESIGN DAY

**Look for Spring Design Day
projects coming in April 2023!**



Welcome from the Dean



As Dean of the College of Engineering, on behalf of the entire faculty, staff and students, I welcome you to Design Day!

Since the first Design Day in 1994, it has grown into the premier undergraduate academic event of the semester, featuring over 100 capstone teams and 600 seniors from all 10 of the College's academic programs.

We are pleased to acknowledge MSUFCU as our Design Day Executive Partner Sponsor and Roosevelt Innovations as our Design Day Directing Partner Sponsor. Our Design Day Supporting Partner Sponsors include Amazon, Anthropocene, Meijer, TechSmith and Urban Science. We thank all of our sponsors for their generosity and their ongoing commitment to Design Day. As you explore the exhibits throughout the Engineering Building, you are encouraged to take time to learn about the projects by talking with our students. They are an incredible group of people who love to share their enthusiasm for engineering.

Starting in their first semester, our freshmen learn about the importance of engineering and the positive impact that engineers make on society and the world around them in our Cornerstone and Residential Experience for Spartan Engineers program. Be sure to stop by and see how they innovate, communicate and perform at the highest levels in an increasingly global and demanding world.

The headliners of Design Day are our graduating seniors as they present their design projects through exhibits, posters and presentations. Their projects represent the capstone of their educational career. You will see that our graduating MSU engineers are ready to lead, create and innovate.

Our capstone programs and Design Day would not be possible without the continued support of our capstone project sponsors who provide both funding and a professional experience for our capstone design teams. We appreciate their generosity and their time.

Please join us for the Design Day Awards Ceremony in Anthony Hall Room 1281 at 1:15 pm when we will honor all of our talented Spartans, the best of the best.

A handwritten signature in black ink, appearing to read 'Leo Kempel', with a long, sweeping horizontal line extending to the right.

Dr. Leo Kempel
Dean of the College of Engineering
Professor of Electrical and Computer Engineering
Michigan State University



Building Dreams Building Community

Since 1937, MSUFCU has been an integral part of the MSU community. We believe supporting programs such as Design Day helps prepare students to achieve their goals and dreams.

From cash back Visa Credit Cards and free checking accounts, to our Savings BuilderSM account that's designed to help you save faster, we have the financial tools you need to make your goals a reality.

Engineer a better future with MSUFCU. Open your account today.

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Design Day Events Schedule:

Friday, December 9, 2022

EVENTS	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon	1 p.m.
Engineering Student Organizations		1st Floor Lobby 8:00 a.m. – Noon					
EGR 100 Presentations			2nd Floor 2300 Hallway 8:30 a.m. – Noon				
ME 412 Competition		1st Floor Room 1252 8:00 a.m. - 11:15 a.m.					
ME 470 Competition		1st Floor Room 1345 8:00 a.m. - 11:45 p.m.					

CAPSTONE COURSES							
CSE & ME Posters and ECE Posters		ME Posters: 1st Floor 1300/1200 Hallway 8:00 a.m. - Noon ECE Posters: 2nd Floor 2200 Hallway 8:00 a.m. - Noon CSE Posters: 3rd Floor 3300/3200 Hallway 8:00 a.m. - Noon					
CE 495 Project Presentations		1st Floor Rooms 1225, 1230, 1234 8:00 a.m. - Noon					
ECE 480 Project Presentations		2nd Floor Rooms 2205 8:00 a.m. - 11:40 a.m.					
ME 481 Project Presentations		1st Floor Rooms 1202, 1220 & 1300 8:00 a.m. - 11:30 a.m.					

OPENING AND AWARDS							
High School Opening			1st Floor Anthony Hall Auditorium Room 1279 8:00 a.m. - 8:30 a.m.				
High School Awards			1st Floor Engineering Auditorium 1345 12:15 p.m. - 12:30 p.m.				
MSU Awards			1st Floor Anthony Room 1281 1:15 p.m. - 2:00 p.m.				



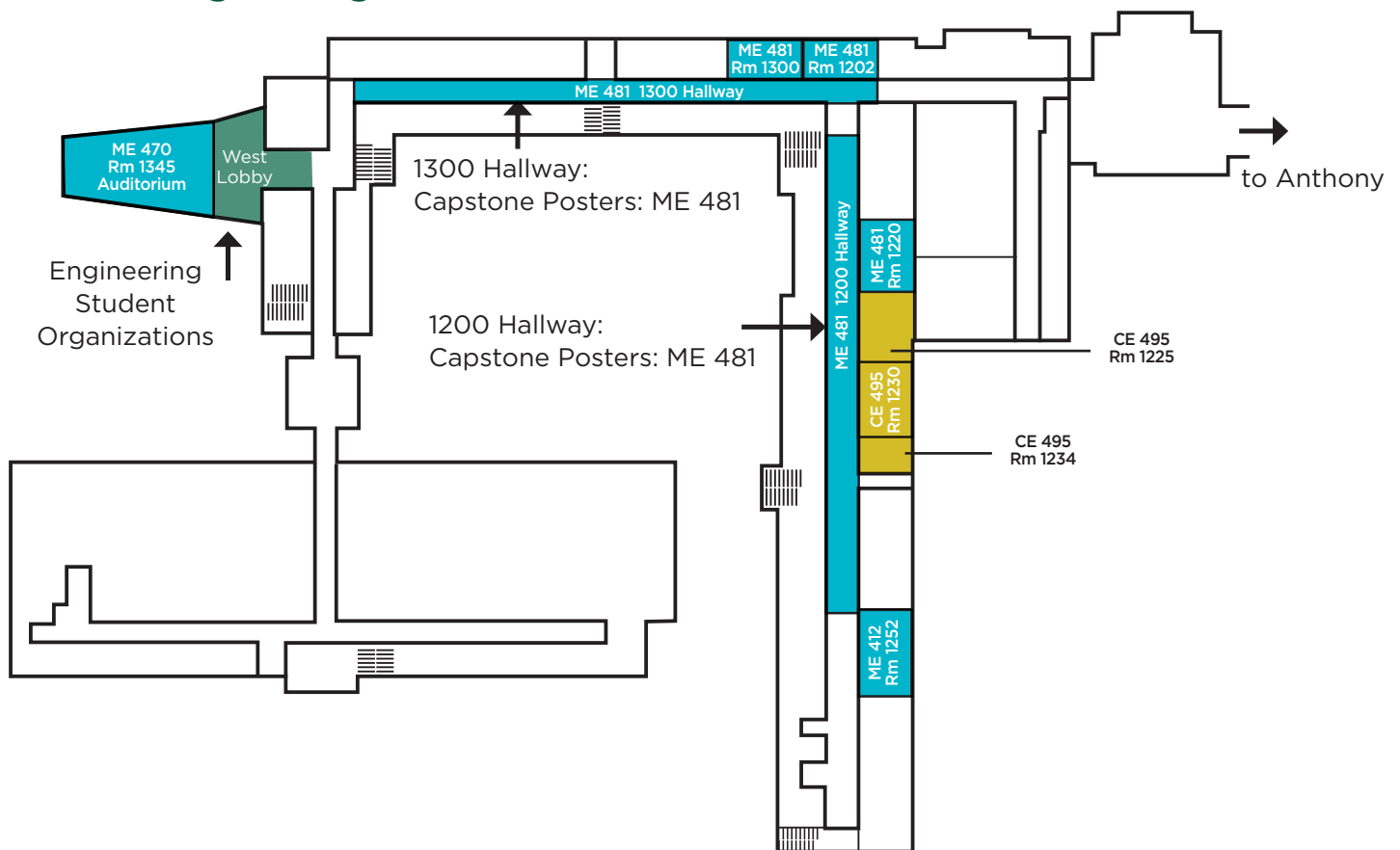
Social Media Links:

"Like" the College: <https://www.facebook.com/MSUEGRS>
 "Follow" the College: https://twitter.com/MSU_EGR

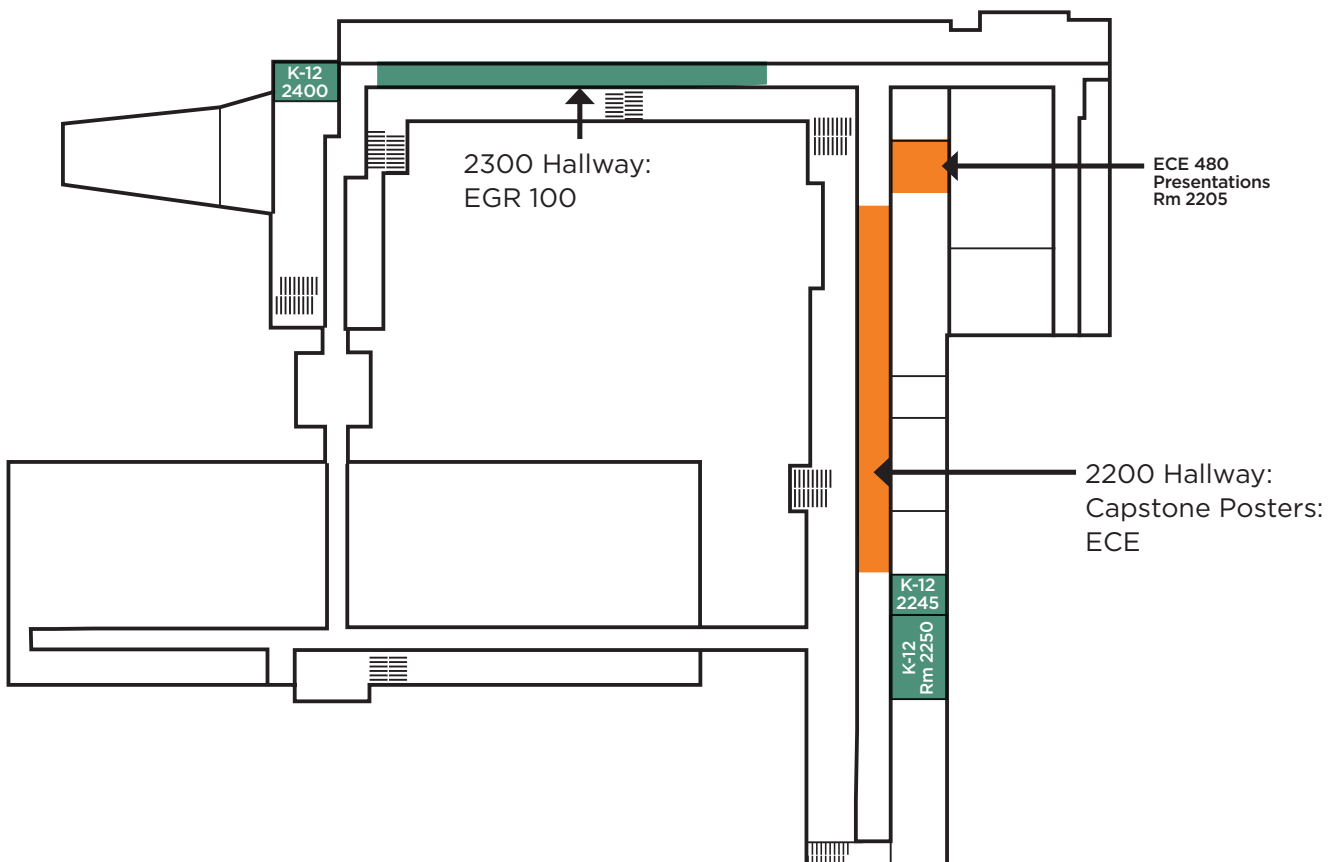
To stay up to date w/Careers in Engineering:

"Like" Us <http://www.facebook.com/pages/The-Center-for-Spartan-Engineering/226159694117936>
 "Follow" Us: <https://twitter.com/msuengineers>

1st Floor Engineering



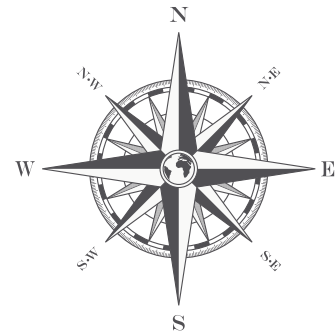
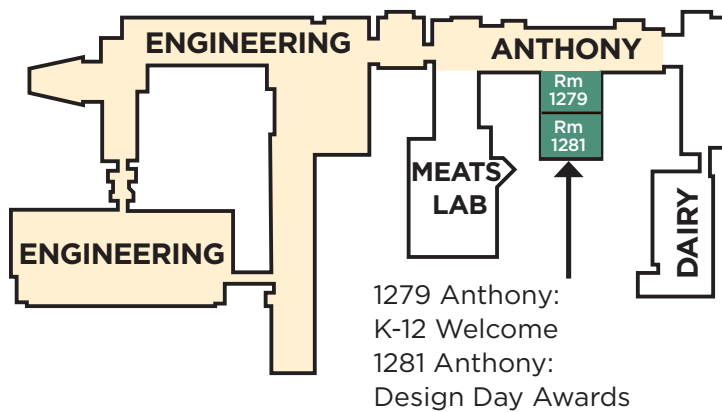
2nd Floor Engineering



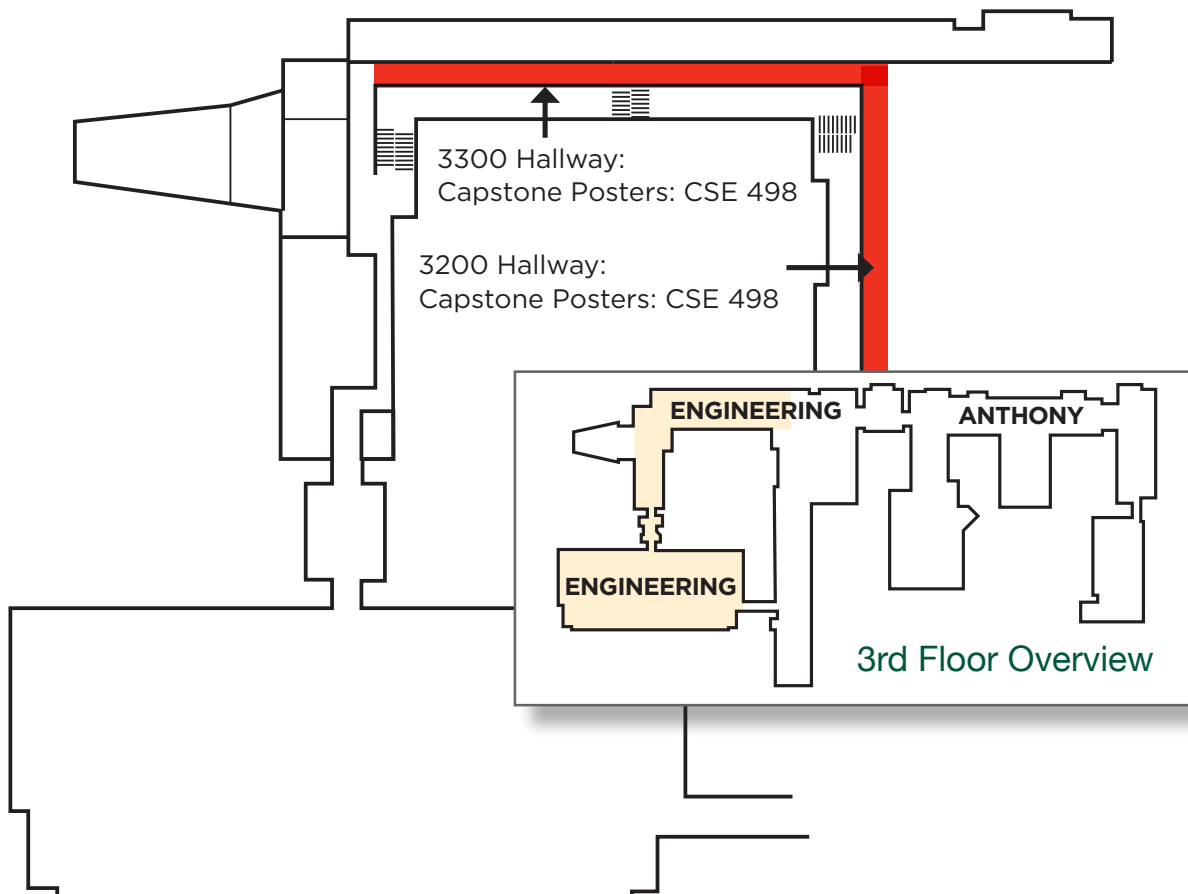
Overview



Design Day Floor Plans of the MSU Engineering Building



3rd Floor Engineering



High School Innovation & Creativity Day

Precollege Student Voting: During the morning on Design Day all visiting precollege students will be viewing Engineering Projects and voting.

During this time, college students will have a chance to interact with “non-engineering” students and demonstrate the underlying principles from their projects. This interaction allows the college students an opportunity to practice explaining engineering concepts to non-engineers. As the precollege students work their way through the wide variety of presentations, they will get an overview of the many different branches of engineering. Additionally, as the precollege students see both entry-level and advanced engineering applications, it allows them to see the natural progression of engineering. Lastly, this session also provides a chance for the precollege students to interact with student organizations within the College of Engineering.

The following schools and groups will be participating in this Fall's Design Day events: Brighton High School (BHS), Detroit Area Precollege Engineering Program (DAPCEP), Innovation Central High School (ICHS), Women in Engineering (WIE).

	1279 Anthony Hall Auditorium: Check-in for all schools	K'NEX Bridge Team Build Room 2250	VEX Robotics Room 2400	1st & 2nd Floor Voting/project viewing	LED Labyrinth Competition Room 2245
8:00–8:15	Check in for all schools				
8:15–8:30	Welcome & voting procedures – Drew Kim, Assistant to Dean, and Luis Donado, Assistant Director				
8:40–9:30		BHS	DAPCEP	ICHS	WIE
9:35–10:20		DAPCEP	ICHS	WIE	BHS
10:25–11:10		ICHS	WIE	BHS	DAPCEP
11:15–12:00		WIE	BHS	DAPCEP	ICHS
12:15–12:30	Awards Ceremony, 1345 Engineering Building				

<http://www.egr.msu.edu/future-engineer/>  LIKE US: <https://www.facebook.com/futurespartanengineers>

MEMBERS OF THE ORGANIZING COMMITTEE FOR HIGH SCHOOL INNOVATION & CREATIVITY DAY FALL 2022



Drew Kim
MSU Engineering
Assistant to the Dean
Recruitment, Scholarships,
and K-12 Outreach



Dean Buggia
Instructor and
Technology Teacher,
Okemos High School



Luis Donado
Assistant Director of MSU
Engineering Recruitment
and K-12 Outreach



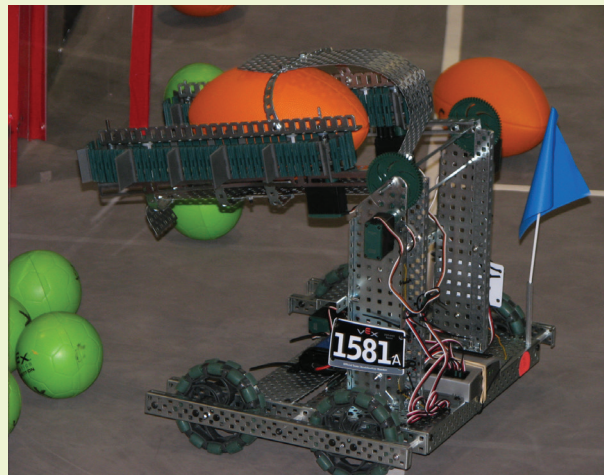
Pahoua Nguyen
Logistics
Coordinator/Office
Manager



Bob Watson
MSU Engineering
K-12 Outreach LEGO and
VEX Robotics Coordinator

VEX ROBOTICS

Our team of experts has designed a lab experience to give precollege students an introduction to robots. Students will work in small groups and have a hands-on approach learning to control the VEX robot. They will write programs using Robot C language, and they will program the robot to be controlled by a remote control. Application and discovery of how programming works will be similar to lessons presented in science and math classes. Each team will discover how to adjust their programs based upon the program inputs and actual output (robot performance). During each phase, new challenges will be introduced to engage the students. This will reinforce new ideas and concepts while exposing students to the newly emerging capabilities of student-controlled robotics programs.



INTERDISCIPLINARY ENGINEERING BUILD

In this build you and your team will be integrating practices from multiple fields of engineering to build and evaluate a support system. Support systems can range from simple beams to intricate bridges composed of gussets, trusses, cables, etc. These types of systems are used throughout Civil, Mechanical and Structural Engineering works. This session will start with a brief introduction to the forces and stresses that act on support systems. Additionally, you will see how digital sensors can read and convey data about these stresses to a computer. We will also look at the computer code that takes this raw data and converts it into a format that can easily be interpreted.

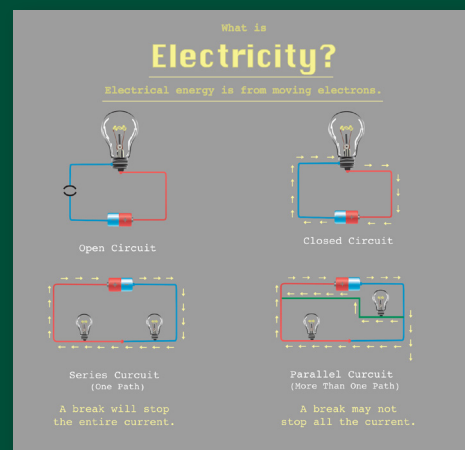
During the build portion of this session, you and your team will be given the design constraints for the structure. Utilizing the information learned at the start of the session and the limited materials provided, your team will need to design and then construct a model to be tested. Your finished structure will be placed on one

of our test beds for evaluation. With the help of MSU Engineering students, the results will be collected by a sonic ranging sensor. These data points will be interpreted by the computer program and your team will be evaluated on percent deflection of your support. Throughout this session you will need to listen, learn and utilize your team to be successful. Good Luck.



LED LABYRINTH COMPETITION

The circuit activity at Design Day provides students with an opportunity to manipulate the path of the electrical current in a circuit by switches. Using basic principles of circuits and parallel/series connection concepts, student groups will turn on and off switches to direct current in a premade electrical circuit with LEDs indicating each active branch. Since an LED allows the current to pass through in only one direction, students should identify the different paths they create by activating different branches, which might be connected in series or in parallel. The event will be scored by how many LEDs can be turned on without breaking the closed circuit.



ENGINEERING AT



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TechSmith offers up to three weeks of paid family medical leave to employees following Family and Medical Leave Act (FMLA) qualified and approved leave.



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TechSmith supports a portion of loan repayment and pays $\frac{2}{3}$ of any tuition and books for qualified classes taken by full-time employees to improve their job skills, up to \$5,250 per year.



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TechSmithies can participate in the company's 401(k) investment plan. TechSmith will match employee contributions up to 3% of your salary, and 50% matching for the next 2% of your salary you contribute.



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EGR 100 Introduction to Engineering Design

Dr. Jenahvive Morgan
Course Instructor

Course Project

EGR 100, Introduction to Engineering Design, is a college-level course required of all incoming first-year engineering students. It is an integral part of the CoRe (Cornerstone and Residential) Experience. The course introduces students to the engineering profession and the engineering design process through team-based, interdisciplinary design projects and assignments. There are 1123 students enrolled in EGR 100 this semester.

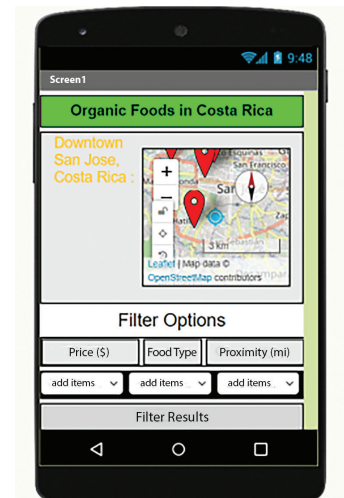
For the final course project, the student teams selected from eight project types: (i) Create a Phone App, (ii) 3D Printing CAD Drawing, (iii) Design a Mini Solar Car, (iv) Water Filtration System Design, (v) Create an Adafruit LED Circuit, (vi) Design a Battlebot, (vii) Costa Rica Community Designs, and (viii) CoRe Industry-Sponsored Projects. CoRe Industry-Sponsored Projects involved collaborations with Eli Lilly on Drug Manufacturing Requirements.

<http://www.egr.msu.edu/core/>

Spring 2022 EGR 100 Project Designs



Adafruit Gemma LED Circuit: Student Design



Costa Rica Community Design Project: Student Organic Produce Cell Phone App





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The Capstone Projects



Mr. Anthony Ingle
Teaching Specialist

Faculty Advisors:
Professors Cetin, Haider, Hashsham, Ingle, Kodur, Li, Zockaie



Cetin



Haider



Hashsham



Ingle



Kodur



Li



Zockaie

PRESENTATION SCHEDULE ROOM 1225

Time	Team	Room 1225
8:00 a.m.	Team 1-White Pine Engineering Solutions	First Floor Room 1225
9:20 a.m.	Team 2-I Lead Inc.	First Floor Room 1225
10:40 a.m.	Team 3-Summit Consultants	First Floor Room 1225

PRESENTATION SCHEDULE ROOM 1230

Time	Team	Room 1230
9:20 a.m.	Team 4-RIV Engineering	First Floor Room 1230
10:40 a.m.	Team 5-C+E Engineering Group	First Floor Room 1230

PRESENTATION SCHEDULE ROOM 1234

Time	Team	Room 1234
8:00 a.m.	Team 6-Spartan Engineers	First Floor Room 1234
9:20 a.m.	Team 7-Spartan Engineering Services	First Floor Room 1234

CE 495 Senior Design in Civil & Environmental Engineering

Undergraduates in civil and environmental engineering must take CE 495. This capstone course prepares students for the workplace by providing an experience with the following challenges:

- A project with multiple issues that must be resolved using civil and environmental engineering knowledge;
- Formulation of conceptual solutions and resolution of conflicting design elements;
- Development of plans that comply with regulations and provide a basis for cost estimates;
- Balancing individual responsibility and group participation in a team based effort;
- Preparation of written reports and oral presentations.

Each team is responsible for developing a design that addresses environmental, hydrological, pavement, structural, and transportation issues for the project. A student project manager coordinates each team. Design reports are judged by the faculty; progress reports and the oral presentations are judged by a board of practicing professionals.

CE 495 SENIOR DESIGN IN CIVIL & ENVIRONMENTAL ENGINEERING

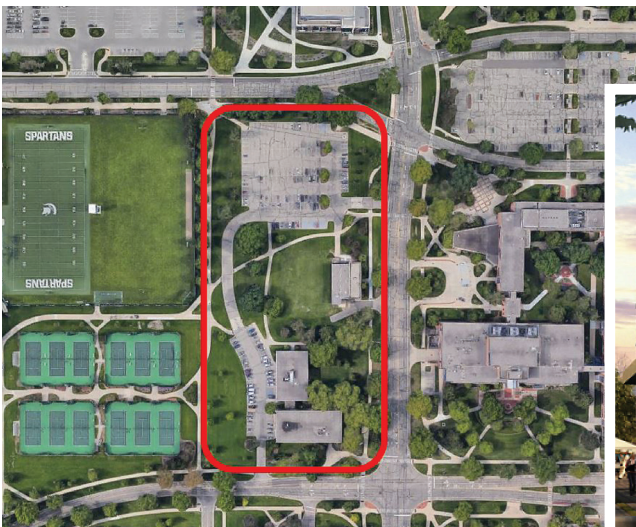
Engineering and Digital Innovation Building

The anticipated location is in the central academic district, in proximity to the Engineering Building, near the STEM Teaching and Learning Facility. Proximity to the functions that occur in these existing buildings in the central academic district is critical to the collaborative nature of the teaching, learning and research. Site evaluation will account for infrastructure requirements. Planning will set the stage for future demolition of infrastructure such as the Urban Planning and Landscape Architecture Building, the decommissioned Water Reservoir, and adaptive reuse of release space for further thematic colocation in buildings including Engineering, thereby reducing capital renewal.

The building is envisioned to comprise two components. One would be dedicated to digital learning with active classrooms, teaching laboratories, student project studios, and e-sports. The other part would be dedicated to laboratories supporting experimental and computational research, core facilities, clean rooms, and flexible modular research units; and vibrant community spaces to support informal gathering and collaboration.

The new building will support an increase in enrollment of new undergraduate students in computational sciences and digital literacy disciplines and in graduate related programs; prepare MSU graduates with skills in computational sciences and digital literacy necessary for postgraduate success; and become MSU's center for excellence in advanced manufacturing, materials science, ultrafast science, and quantum computing including heterogeneous micro-electronic technologies.

The project should emphasize implementation of green infrastructure. Green infrastructure refers to systems and practices that use or mimic natural processes to infiltrate, evapotranspire, or harvest stormwater at its source. The University is seeking proof-of-concept level designs that examine how green infrastructure could be integrated into the particular site to meet multiple environmental, educational, and economic objectives. The development must be consistent with MSU's campus master plan.



Aerial photo site location.

Architectural rendering of building





Team 1: White Pine Engineering Solutions

Left to right: Shane McHugh (H), Sarah Premo (T), Tanner Herald (P), Jiaxin Hu (PM), Justin Shemka (S), Xijiao Wang (E), Martin Louney (G)



Team 2: I Lead Inc.

Left to right: Xiaoxu Shen (S), Ritwik Verma (E), Tyler Frank (G), Logan Pinger (PM), Mitchell Nurenberg (P), Charlie Harmsen (T), Mallika Kothari (H)



Team 3: Summit Consultants

Left to right: Jacob Porter (S), Zachary Lane (P), Grant Cook (G), Carley Allison (E), Marcella Staricco (PM), Kami Karas (H), Mitchell Nemeth (T)



Team 4: RIV Engineering

Left to right: Maxell Robinson (PM), Benjamin Surato (G), Julia Rumely (E), Chloe Clyne (H), Nick Wieferich (S), Mason Parsons (T)



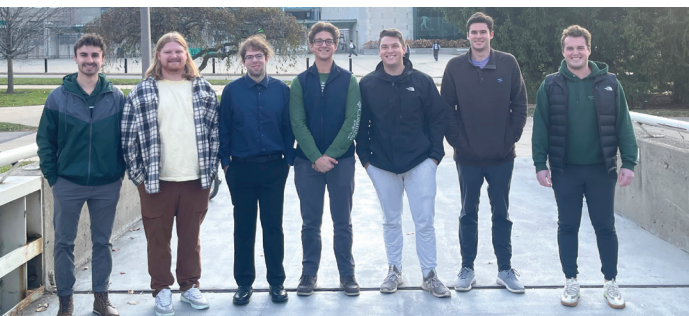
Team 5: C+E Engineering Group

Left to right: Natalie Fylak (PM), Molly Hojnacki (G), Austin Affer (S), Nicole Villarreal (T), Yipeng Chen (E), Jordan Pack (H)



Team 6: Spartan Engineers

Left to right: Bryce Thelen (G), Madison Murphy (H), Nate Whiteley (PM), Maddie Tatara (E), Max Grace (S), Andrew O'Connor (T), John Barbatano (P)



Team 7: Spartan Engineering Services

Left to right: Alec Beauchamp (T), Nathan Richard (S), Matthew Szyperski (E), Michael Toepfner (G), Noah Brackenbury (H), Ryan MacVicar (P), William McCarthy (PM)

KEY TO TEAM ROLES

E = Environmental, G = Geothermal
H = Hydrology, P = Pavements,
PM = Project Manager, S = Structures,
T = Transportation

CE 495 SENIOR DESIGN IN CIVIL & ENVIRONMENTAL ENGINEERING

PROFESSIONAL SEMINAR SPEAKERS

Michele Buckler, P.E.
Daimler Automotive Group

Leanne Panduren, P.E.
Rowe Professional Services

Miranda Spare, P.E.
Michigan Department of Transportation

Ian Clutten, P.E.
Granger Construction

Dee Parker, P.E.
Michigan Department of Transportation

Roy Townsend, P.E.
Washtenaw County Parks and Recreation

Brad Ewart, P.E.
Soil & Materials Engineers, Inc.

James Ranger, P.E.
Michigan Department of Transportation

Steve Warren, P.E.
OHM Advisors

Megan Jacobs, P.E.
Soil & Materials Engineers, Inc.

Robert Rayl, P.E.
RS Engineering LLC

Carissa McQuiston, P.E.
Michigan Department of Transportation

Alex Sherman
Nicholson Construction

PROFESSIONAL EVALUATORS

Engineers and scientists associated with the following firms, municipalities, and companies donated time to provide students with a practicing professional's perspective. We gratefully acknowledge their generous contributions.

Sam Baushke, P.E.
Geosyntec

Max Drenth
Harley Ellis Devereaux

Jon O'Brock, P.E.
Materials Testing Consultants

Dani Booms, P.E.
HTNB

Mike Ellis, P.E.
Barr Engineering Co.

Sarah Ross, P.E.
Practical Engineers, Inc.

Dan Christian, P.E.
Tetra Tech MPS

Jayson Graves, P.E.
Soil & Materials Engineers, Inc.

Brandon Simon, P.E.
Progressive AE

Jim Corsiglia, P.E., S.E.
Harley Ellis Devereaux

David Hayden
DLZ

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Design Day Awards Spring 2022

Rolla C. Carpenter Senior Design Award

The Rolla C. Carpenter Senior Design Award (\$700 and plaques) is presented to the best team as judged by the faculty and a panel of practicing engineers.

Rolla C. Carpenter, Renaissance Engineer, was a graduate of The State Agricultural College in 1873 with a Bachelor of Science degree. After earning a Master of Science Civil Engineering, he was appointed professor of the Department of Mathematics and Civil Engineering at The State Agricultural College, which would later become MSU. He designed bridges, built ice houses, taught students French, astronomy, mathematics, mechanical drawing, hydrostatics, hydraulics, survey, and civil engineering. He prepared the design and working drawings for the Farm Lane Bridge, laid a water supply pipe to Williams and Wells Halls, and designed a pile driver for a dam built across the Red Cedar River. He later designed several buildings on campus, including the Mechanical Building, which was constructed in 1885. Throughout all of his work on campus, he involved students throughout the analysis, design and construction, forming what was essentially the first senior capstone design class.



The faculty and students of the Department of Civil and Environmental Engineering gratefully acknowledge the generous contributions from Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) and Barr Engineering Co.

Rolla C. Carpenter Senior Design Award Winners, Spring 2022

Team 12: GLA Engineering Services

Left to Right: Madeline Robison, Bridget Pliska, Tammy Le, Grant Gardella, Phyllis Feldpausch, James Guest, Emily Spranger



Computer Science and Engineering

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Tommy Hojnicky



Luke Sperling

Graduate Teaching Assistants

CSE 498 Collaborative Design

CSE 498, Collaborative Design, provides the educational capstone for all students majoring in computer science. Teams of students build software systems for a variety of clients.

During the capstone experience, students

- design, develop, debug, document, and deliver a comprehensive software system,
- work in a team environment,
- become proficient with software development tools and environments,
- develop written and oral communication skills,
- build and administer computer systems, and
- consider issues of professionalism and ethics.

Our clients are local, regional, and national including Ally Financial, Amazon, Anthropocene Institute, Atomic Object, Auto-Owners Insurance, Bosch, CSAA Insurance, Dow, Ford Motor Company, General Motors, Google, Kellogg's, Kohl's, Lockheed Martin Space, Magna, Meijer, Microsoft, Mozilla, MSU Federal Credit Union, Rocket Companies, Roosevelt Innovations, RPM, Stryker, TechSmith, Union Pacific, United Airlines, Urban Science, Vectorform, Whirlpool, and Volkswagen.

Ally Financial Ally Employee Recognition Platform

Headquartered in Detroit, Michigan, Ally is one of the top 25 financial holding companies in the United States and a leader in digital financial services. Ally offers financial products for consumers, businesses, automotive dealers, and corporate clients in their commitment to developing platforms and digital experiences for a variety of needs.

Ally takes pride in their organization culture. They believe the ability to influence change comes from the people and community that are found within their business. Ally puts a strong emphasis on such company values so their employees continue to flourish from the positive impact of a healthy work environment.

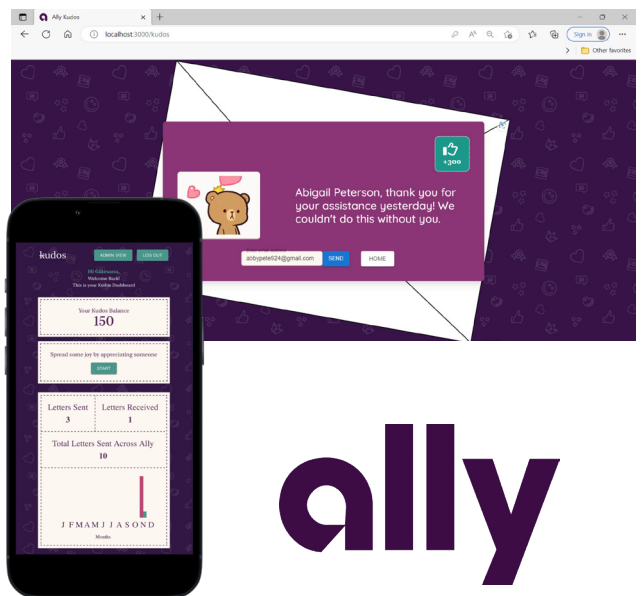
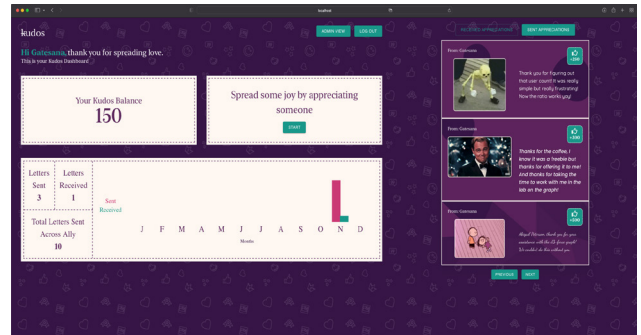
Ally employees use our web application, Ally Kudos, as an intuitive way to strengthen the connections among coworkers. Employees log into Ally Kudos to send recognitions and 'Kudos' points to their coworkers. Kudos can be sent for anything ranging from a coworker sharing their hot chocolate to someone giving guidance and training to a less experienced coworker.

Our application shows users their messages sent and received over time along with their current Kudos points, which they can redeem for rewards.

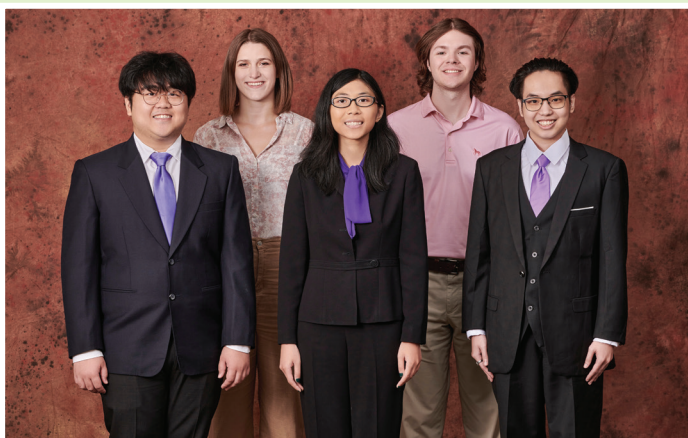
When sending Kudos, users type a personalized message or use suggested phrases for ideas. With added touch-ups to the message such as gifs and text styles, our application offers a more fun and rewarding experience that improves upon basic thank-you emails.

Having pleasant interactions between one another boosts company morale and overall productivity. Ally Kudos enhances the appreciation Ally employees share with one another.

Ally Kudos is written in HTML, CSS and JavaScript and is powered by the React framework. Our web app interacts with employee data using Sequelize and Express to connect to AWS RDS and offers machine learning capabilities using Python.



ally



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Amazon

Amazon Review Confidence Tool

Amazon, founded by Jeff Bezos in July 1994, is renowned for its influence in the electronic commerce industry. Amazon initially started as an online marketplace for books but quickly expanded into a multitude of product categories and is currently one of the world's largest online retailers.

With over 300 million active customers interacting with their online platform, Amazon is trying to ensure that users have the most authentic, reliable, and trustworthy shopping experience. To safeguard their product standards, Amazon has developed a review framework in which customers can get insights and feedback on products while shopping. However, with the multitude of reviews, there is an ever-growing problem of review legitimacy.

Our Amazon Review Confidence Tool combats this legitimacy problem by conducting product review analysis to calculate review authenticity within a visually intuitive browser extension and web application.

Users have access to a browser extension that displays confidence scores for each review of a selected product. The Review Confidence Tool then calculates an adjusted total average rating after filtering reviews with low confidence scores, enabling users to get a more accurate rating without low legitimacy reviews.

The tool is also equipped with a web application that provides a visually intuitive summary of review authenticity. This solution reduces customer confusion and preserves sellers' reputations within two easy-to-use applications.

The tool's infrastructure is built entirely on Amazon Web Services, referencing the AWS Well-Architected Framework to create a responsive and scalable environment. The serverless web app uses AWS Amplify, Lambda, and DynamoDB to minimize unnecessary overhead, and Amazon SageMaker is the tool's all-in-one solution to machine learning.



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Anthropocene Institute Public Opinions on Nuclear Energy from Social Media

The Anthropocene Institute is an organization that partners with researchers, governments, experts, and investors to address the climate change crisis. The organization provides support to projects related to clean energy, anti-pollution efforts and climate innovation and takes care of any political or financial barriers they may experience.

The Anthropocene Institute is an advocate for nuclear energy as it has the potential to play a crucial role in the fight against climate change and the transition to clean energy. However, the public is divided when it comes to this energy source. Furthermore, public debate on this issue is often plagued with misinformation and confusion.

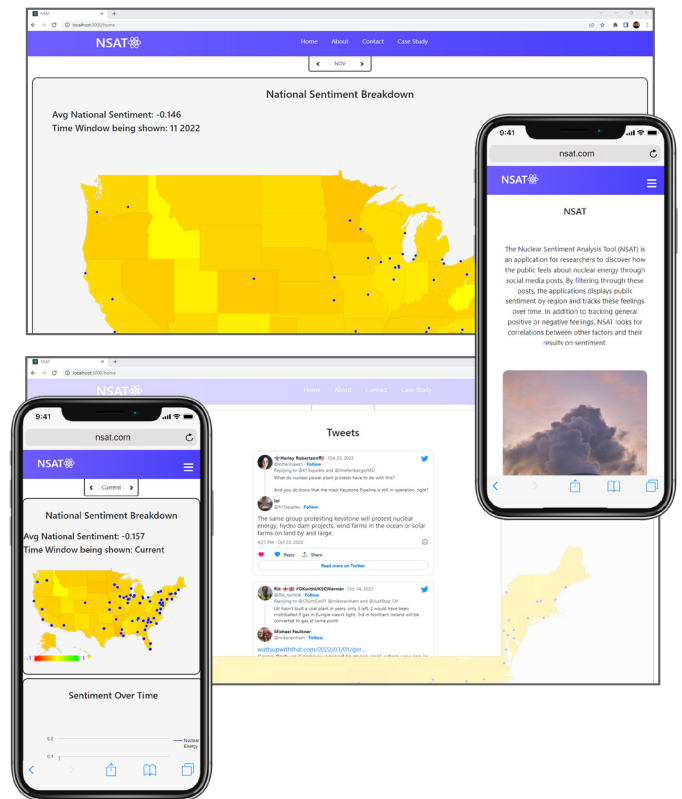
Our Nuclear Energy Web Application tackles this problem by providing users with an easy way to view public opinion on nuclear power with easy-to-read charts and graphics within one simple web application.

Our application collates and analyzes public opinion information from social media posts on Twitter. This information is presented on an attractive dashboard, which provides users with several easy-to-use web pages of data visualizations.

Users can see geographic trends in opinion using an interactive map that illustrates opinion in each state. The dashboard also contains several charts and graphs to help visualize more general data. The dashboard is updated constantly ensuring all data is fresh and up to date.

Through this application, the Anthropocene Institute can utilize a constant flow of formatted, visualized data to further their mission of creating a better, greener world.

The front end is built using HTML, JavaScript, React and the Google Charts Library. The back end is built using Python, Google Cloud Platform and the Twitter API.



Anthropocene Institute



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Atomic Object Custom Data Visualization Dashboard

Atomic Object is a custom software design and development consultancy that builds mobile and web apps, creates device IoT software, and provides cloud capabilities to their clients. They are an employee-owned organization with branches in Ann Arbor, Chicago, and Grand Rapids.

Each Atomic Object office has a dashboard displayed on a television. This dashboard highlights important individual employee metrics such as billable hours and employee blog-post due dates. This dashboard is essential to keep track of employee metrics, but it is currently outdated and needs to be reworked to increase efficiency.

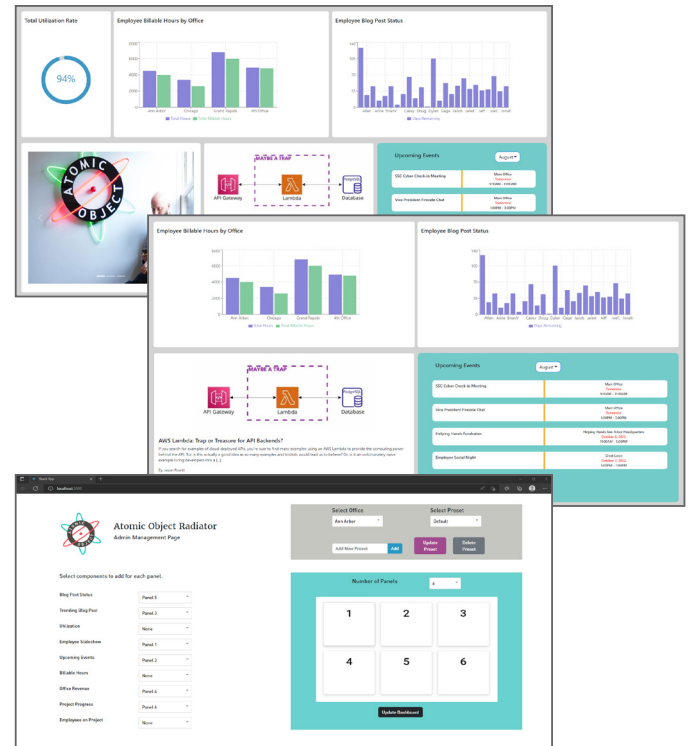
Our Custom Data Visualization Dashboard enables users to view this important employee data more easily and effectively than ever before within a new, attractive application.

This dashboard includes blog post deadlines and billable hours, and many other components including an events calendar, trending blog posts, and charts highlighting revenue and utilization rates.

Our admin page enables Atomic Object employees to customize each office's dashboard separately. Employees can edit a dashboard by turning on and off displays as they choose. The admin page provides a few preset combinations to display components from specific categories.

The built-in presets include Financial, which shows the financial metrics, and Social, which includes company events and an employee spotlight. The Default preset shows a combination of the two. Employees may save their edits as new presets to make changing visualizations easy.

Our dashboard is a React application that uses HTML/CSS, JavaScript, and Bootstrap for the front end. For the back end, we combine internal data from Atomic Object pushed to our Firebase database with Google Sheets data and user preset information.



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Auto-Owners Insurance A-O Merch Search

Auto-Owners Insurance is a Fortune 500 mutual insurance company that provides automotive, home, life and commercial insurance to nearly 3 million policyholders in 26 states. Auto-Owners Insurance is headquartered in Lansing, Michigan.

Auto-Owners offers company merchandise that their associates can purchase to support and represent the company.

Currently, the purchasing process revolves around paper and pencil order forms. Similarly, when an Auto-Owners administrator wants to analyze purchase data, they must parse the paper records manually, which can be a daunting task.

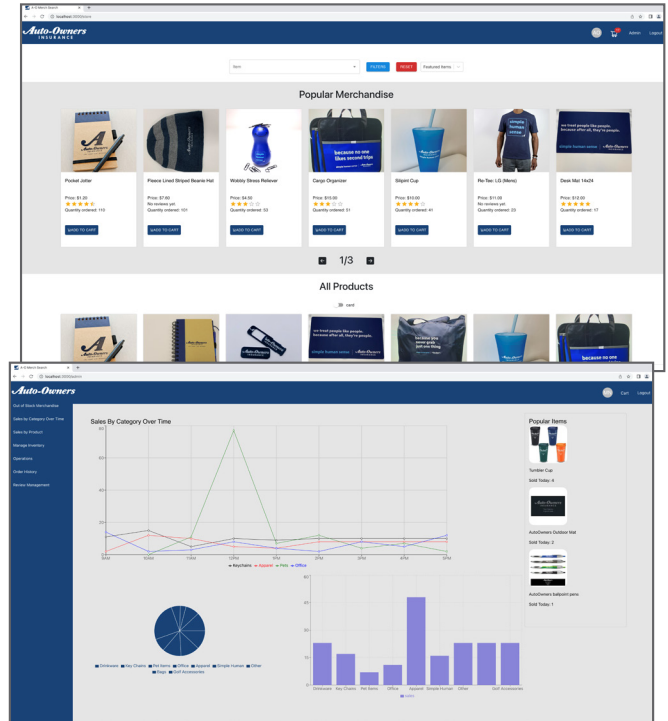
Online shopping has become increasingly popular in the last decade, providing a better shopping experience for consumers and an easier way to keep track of purchase data. Auto-Owners is looking for a way to modernize their 'merch' shopping experience.

Our A-O Merch Search is a web application that functions as an online store and improves the process of purchasing company merchandise for Auto-Owners associates. In addition to purchasing items, associates have the option to read and write reviews for items and view recommended items to help them choose a product that best suits their needs.

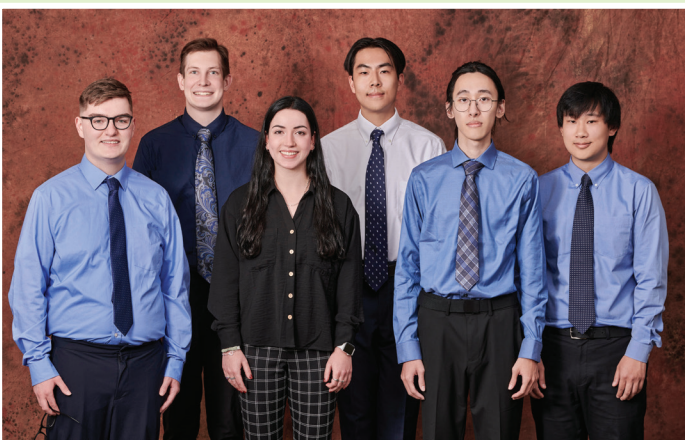
Auto-Owners associates use our system to filter, browse and purchase company merchandise from their personal devices using any browser. Purchase history data updates as orders are placed, enabling administrators to see real-time trends for popular items and categories.

Our system improves the efficiency of analyzing purchase data for Auto-Owners administrators by generating relevant graphs and charts.

Our A-O Merch Search system uses React for the front end, Spring Boot for the back end, and Microsoft SQL Server for hosting the database.



Auto-Owners
INSURANCE



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CSAA Insurance Group

Synthetic Image Generation via Random Noise

CSAA Insurance Group, headquartered in Walnut Creek, California, is one of the largest AAA insurers in the country. They offer home, auto, and other lines of insurance to seventeen million people in twenty-three states and the District of Columbia.

In the span of a few short years, the insurance industry has become information driven, meaning CSAA requires large quantities of data to compete. However, data is difficult to access due to how it is typically captured, privacy concerns, and the relative infrequency of losses.

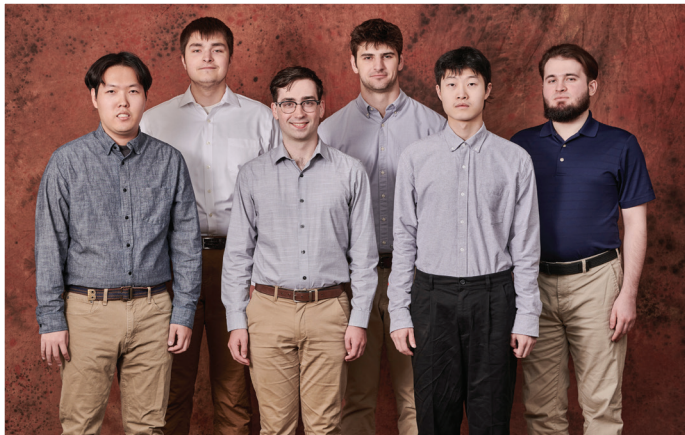
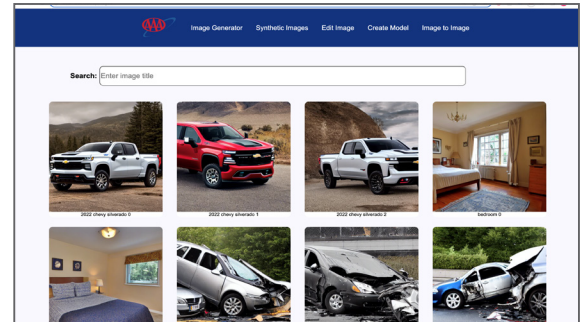
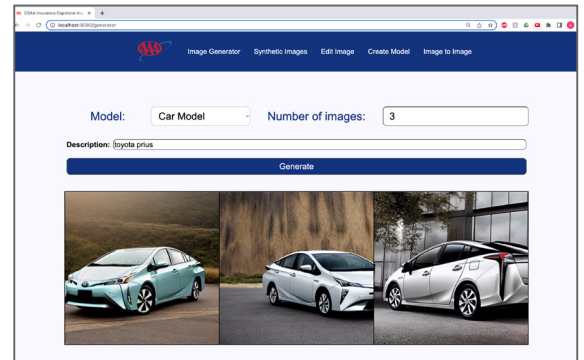
Our Synthetic Image Generation via Random Noise system provides an easy-to-use web application for CSAA data scientists to generate realistic image datasets. Our robust system is able to generate an image dataset for any subject of interest while eliminating privacy concerns, as the generated images are completely synthetic and do not depict any real people or vehicles.

Our application is a one-stop shop for all dataset generation needs. Users submit a text description of the images to generate, select the number of images desired, and quickly receive the dataset.

In addition to generating useful synthetic datasets, our system enables CSAA data scientists to update current dataset generators, as well as create new synthetic image generators quickly and effortlessly.

CSAA data scientists use our datasets for a variety of purposes, including providing concern-free data to CSAA's third-party partners, improving the claims process for losses without documentation, and general insurance data needs.

Our web application utilizes Python Flask along with HTML, CSS, and JavaScript. The Stable Diffusion and Glide Diffusion models that our software uses are trained and run in Amazon Web Services EC2 instances with dedicated GPUs. The resulting datasets are stored in an AWS S3 Bucket.



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General Motors

Augmented Reality Utilizing IoT Technology

General Motors is one of the top automotive manufacturers, selling over 6 million vehicles annually worldwide. GM is headquartered in Detroit, Michigan, and is known for brands such as GMC, Buick, Chevrolet and Cadillac.

As augmented reality becomes more accessible to large companies, new ways of utilizing this technology emerge, from remote training to visualizing 3D models in real time. GM has explored many possible corporate implementations of augmented reality, yet one unexplored area is augmented reality interacting with hardware.

Our Augmented Reality Utilizing IoT (Internet of Things) Technology is an augmented reality headset that facilitates virtual interaction with the physical world. Our system employs the headset as a replacement for a physical key allowing access into restricted areas and content.

When a user needs access to a locked container, they put on the headset and open our application. A holographic button is displayed directly in front of the user that shows the status of the physical lock.

Once the button is pressed, the lock receives a signal to unlock, and the holographic button reflects this new status. Inside the container is a physical QR code that the headset scans. This QR code generates a hologram in the visual field of the headset to instruct the user in completing their task (shown on the right).

Our software integrates augmented reality with physical devices and demonstrates the viability of augmented reality and its uses for General Motors.

Our front end consists of an Unreal Engine 4.27.2 program running on a Microsoft HoloLens 2. The back end is a Flask server hosted on a Raspberry Pi. The server controls a Servo motor that is connected to a sliding deadbolt.



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Google

Android Exploit Fuzzing Analysis

Google is a Fortune 500 technology company headquartered in Mountain View, California. It specializes in creating connected products such as its search engine, smart devices, and advertising services. One of its most widespread products is the Android mobile operating system, which runs on upwards of 3 billion devices worldwide.

Due to the vast number of Android devices currently in use, Google needs to guarantee optimal performance and quality in their software. To achieve this goal, Google developed a bug detection tool called Syzkaller. This tool uses a process known as fuzzing, which enables engineers to detect bugs by passing random inputs into the target program.

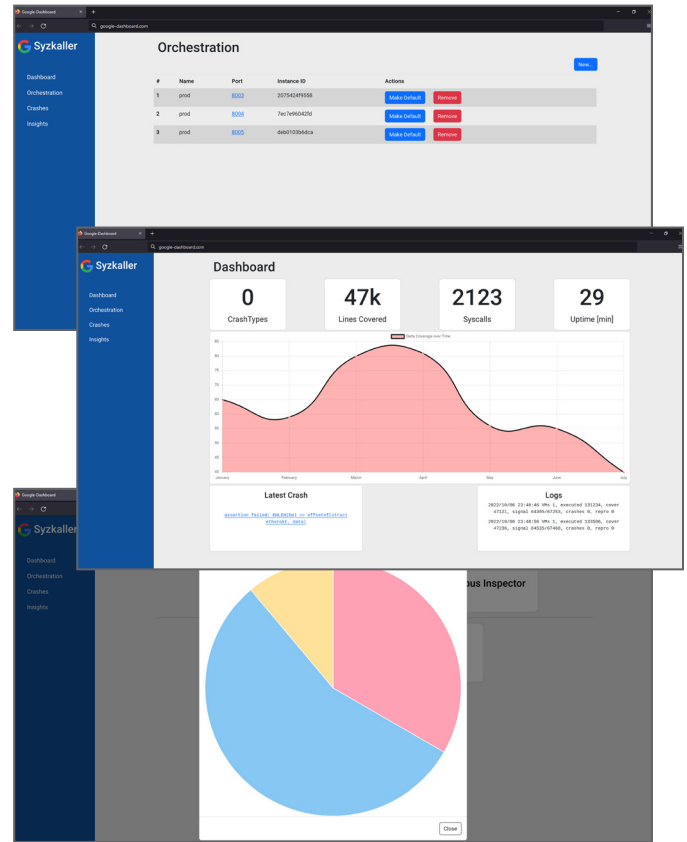
Our Android Exploit Fuzzing Analysis tool utilizes Syzkaller to test Android software for bugs and displays the metrics on an intuitive dashboard for analysis by Google professionals.

The home page of the dashboard displays a snapshot of a Syzkaller fuzzer with the intent of giving engineers an overview of fuzzer performance. This overview is complete with attractive visualizations of analyzed data in the forms of charts and graphs.

The orchestration tab enables the user to stop and start Syzkaller instances with unique configurations. Our tool also displays unusual behavior found by the fuzzer on the crashes tab.

The insights tab provides an in-depth visualization of a fuzzer's performance, which enables engineers to find ways to improve the active fuzzers to detect more bugs. These features enable Google engineers to locate Android bugs that need to be fixed.

The back end uses a Node.js API to connect Syzkaller and the MySQL database that is hosted on the Google Cloud Platform. The API also manages Docker instances that contain Syzkaller fuzzers. The front end is written using Angular 14 and utilizes our API for the dashboard.



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Kellogg's Templatize R Development via Design Thinking

Kellogg's, one of "America's Most Trusted Brands," is a leading producer of snacks and cereals. The Battle Creek, Michigan company produces popular items such as Pop-Tarts, Cheez-Its and Frosted Flakes with the assistance of its 31,000 employees.

Kellogg's has a market presence in 180 countries and interacts with an abundance of customers. The Kellogg's Global Business Services (GBS) team ensures communication between employees and customers remains mutually beneficial and accessible. The GBS team achieves this through a large suite of applications.

With many applications focused on features and use cases, it is inevitable that some of them may no longer have the official Kellogg's look and feel.

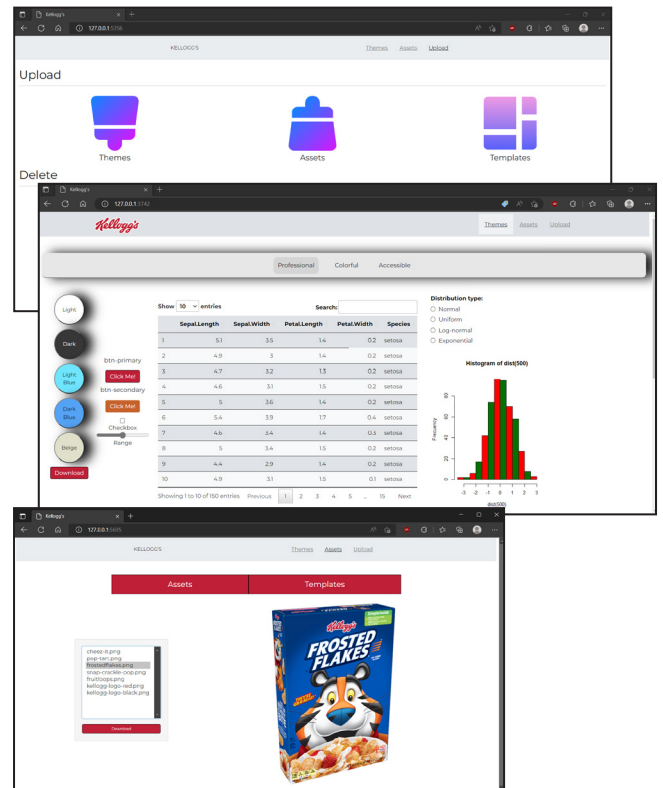
Our Templatize R Development via Design Thinking system provides a platform to help Kellogg's employees create new applications and update existing applications while conforming to all of Kellogg's current design requirements.

Employees can preview and download various standardized application elements by using a series of dashboards housed on our platform. This removes the need for developers to manually confirm that they are conforming to all requirements.

Our theme-previewing system displays common webpage elements and themes, which enables developers to quickly decide on a predefined look for their next application and not worry about design standards.

Using our app, Kellogg's employees can unite the look and feel of the GBS applications by applying consistent themes and branding material to upcoming projects and applications, thereby producing a seamless company image.

Users access the dashboards via a web app built in R, with R-Shiny for the user interface. The data is stored in MySQL, and the themes are created using CSS.



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Kohl's Backstage's Back Alright

With over \$15 billion in sales, Kohl's is the second largest department store chain in the United States. Headquartered in Menomonee Falls, Wisconsin, Kohl's has 1,161 stores across 49 states and employs nearly 100,000 people.

Like many other retail stores, Kohl's has had to adjust to a significant increase in online sales in recent years. This greater online presence is supported by Kohl's software developers who work on several projects at a time, each using multiple applications.

It has become cumbersome for the software developers to manage their different projects as they navigate through all of the related applications.

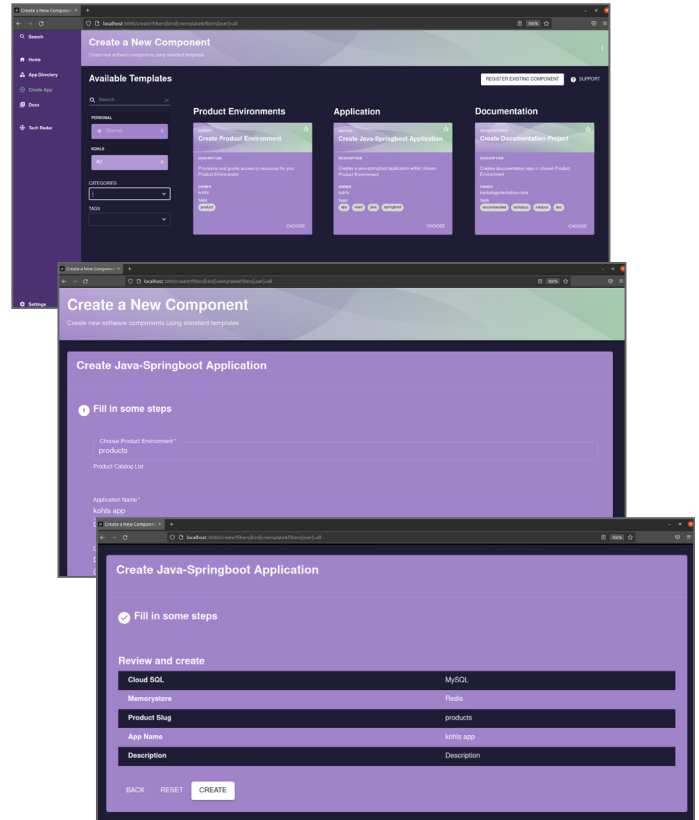
Our Backstage's Back Alright system provides a developer portal, which is a hub for the tools most frequently used by Kohl's software developers.

There are two main functionalities in the system which provide developers a way to quickly and intuitively see the statuses of all their projects and kick-start new development projects with our easy-to-use development templates.

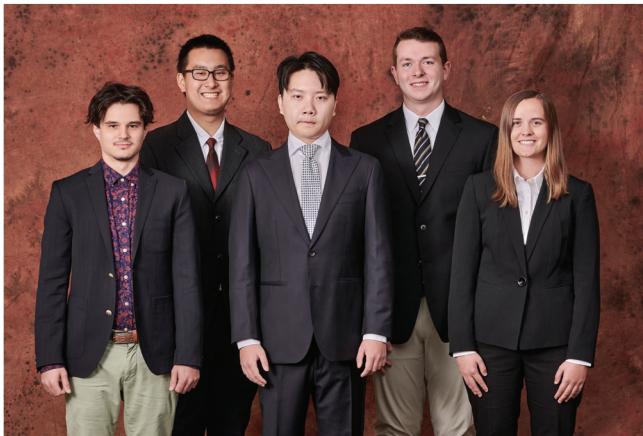
The system enables developers to quickly view all of the projects and related information on a single page.

Another page of our system streamlines creation of new projects. Developers simply specify what type of project they want and the programming requirements, and the system automatically creates the project, allowing developers to focus on other tasks.

TypeScript and React form the front end of our system. The back end is connected to external technologies including GitLab, Dynatrace and OpenShift.



KOHL'S®



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Lockheed Martin Space LiDAR and Image Fusion for Autonomous Navigation

Lockheed Martin Space, headquartered in Denver, Colorado, employs over 16,000 people to develop satellite systems, spacecraft, and space probes.

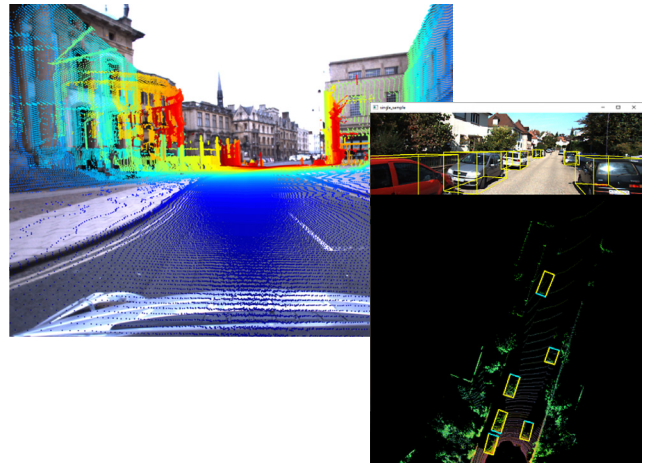
Recently, in a partnership with General Motors, Lockheed Martin Space is endeavoring to develop a transportation solution for NASA's upcoming Artemis mission in the form of the Lunar Mobility Vehicle (LMV).

In the LMV's navigation of the lunar environment, an accurate sensor system is essential to ensure safe traversal. Such a sensor system has different system requirements than a typical autonomous vehicle in that it must be redundant, performant, and capable of operating in the lunar domain.

Our LiDAR and Image Fusion Solution for Autonomous Navigation enables the LMV to detect the lunar environment by providing a lightweight and redundant software solution capable of running on the vehicle's onboard systems. By utilizing both LiDAR data and stereo-camera data, our solution accurately detects its environment. Additionally, our robust system can maintain effective operation in scenarios where a sensor fails through a redundant imaging setup.

Given the nature of the LMV, our system exists in an environment with limited computer systems and resources. Optimizing our fusion solution and underlying detection software guarantees its functionality in this restrictive environment.

In practice, our system is a network of ROS nodes, each node being a discrete computation module. Our LiDAR and stereo-image data are fused into a singular point cloud in the system and then fed through a YoloV4-based 3D object detection model for inference using the ONNX runtime. The entire system runs on an NVIDIA Jetson TX2, with Imaging-Source cameras and Intel Realsense LiDAR sensors providing data.



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Magna Dashboard for Data Visualization

For more than 65 years, Magna has been delivering innovative solutions tackling the automotive industry's toughest challenges. As a mobility technology company and North America's largest automotive supplier, Magna's capabilities span across the entire vehicle, working with all major global automakers including BMW, Nissan and GM.

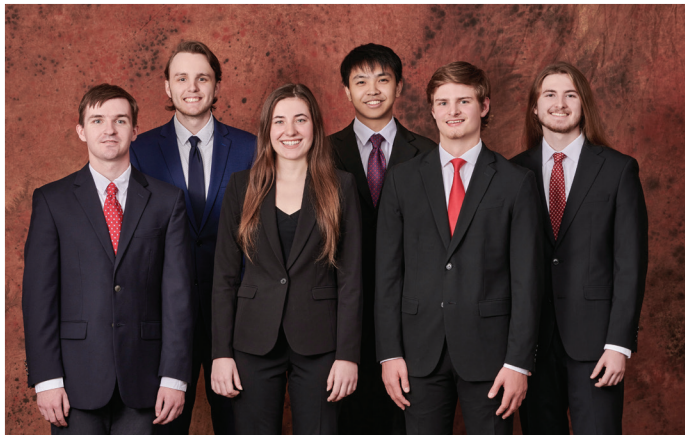
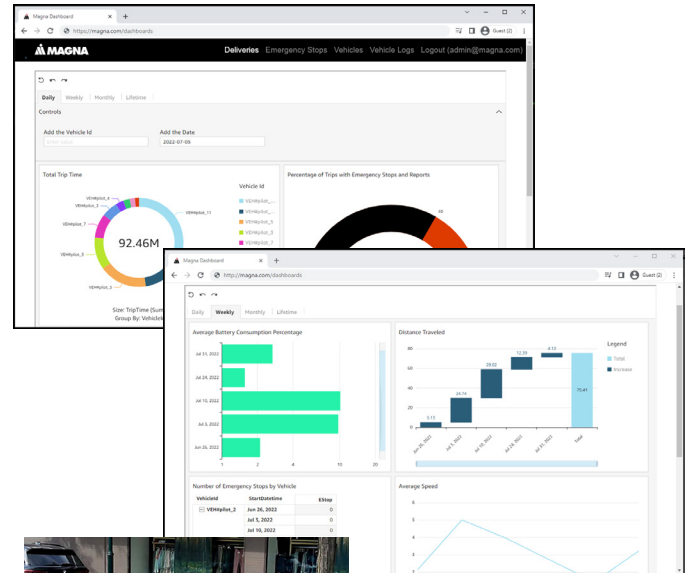
With the goal of significantly reducing last mile delivery costs and carbon emissions in cities, Magna built an all-electric, autonomous delivery robot, leveraging hardware and software from Magna's automotive products. The delivery robot is a pilot program and has delivered hundreds of pizzas since March 2022.

Magna monitors the performance of these robots and collects vast amounts of raw data, which can be challenging to understand and interpret. Our Dashboard for Data Visualization system presents this data in ways that make it easier for Magna engineers to organize, understand and interpret.

Magna employees and their partners access the dashboard from their company website and see the simplified data of the fleet on a daily, weekly, monthly or lifetime basis. These dashboards show trends in the data for things such as battery consumption and travel distance.

Our software shows clear trends, thereby enabling Magna engineers to implement any necessary modifications to improve efficiency of the fleet.

Magna acquires the data on its fleet through the vehicle sensors and GraphHopper routing API. Magna holds this data in an Amazon Web Service (AWS) database. The data is pulled into MySQL by a Python script, which sends information to Amazon QuickSight, where the dashboards are created. The dashboards are integrated into Magna's website, hosted by AWS, and coded using the Vue.js framework.



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Meijer

Meijer Simply Give Automation

Meijer is a Midwest supermarket chain headquartered in Grand Rapids, Michigan. Pioneers of the supermarket concept, Meijer has over 250 stores across six states.

Simply Give is a signature program that partners with local food pantries to feed hungry families and has raised over \$75 million. Customers have the option to purchase \$10 Simply Give donation cards in-store or during an online order, which are converted to food-only gift cards and donated directly to local pantries. Meijer wants to extend the reach of the Simply Give program and analyze the community's support toward local pantries.

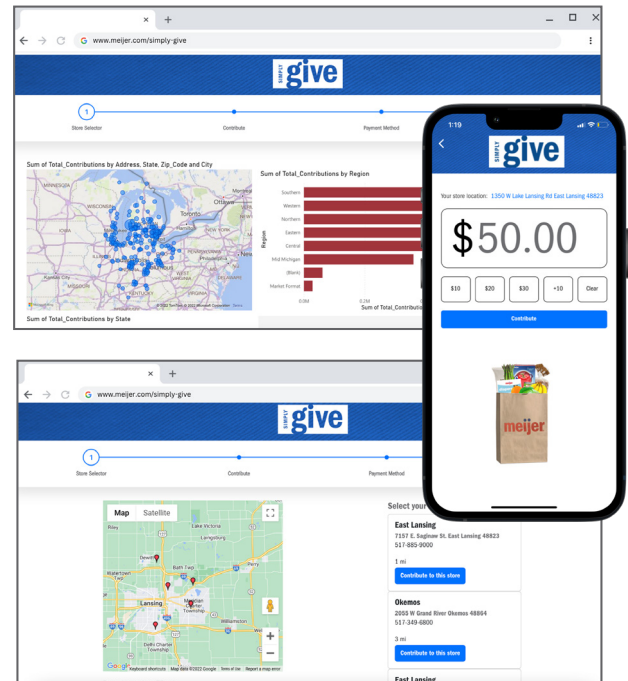
Our Meijer Simply Give Automation system is a standalone digital giving option, enabling customers to make Simply Give contributions directly to the Meijer store of their choosing. Our app makes it possible for anyone to contribute any amount from their phone or computer.

Users pick the Meijer location they want to contribute to and view the specific food pantry partnered with each store. This gives users the option to contribute to any community, which was previously not possible. No account is necessary, however users with mPerks accounts can sign in to use saved payment methods and easily contribute to their home store.

Contribution data is analyzed automatically, and produces analytics reports for Meijer employees. This helps Meijer identify issues and make corrective actions for the Simply Give program.

Simply Give Automation increases the program's digital customer contribution and expands the ability to digitally market the program to provide additional assistance to communities.

Our system is a web and mobile app. The front ends are developed with ReactJS and React Native, respectively. Our back end is written in Node.js and is connected to an Azure SQL database.



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Michigan State University Mobile App for Remote Recording

Michigan State University's Sociolinguistics Lab in the Department of Linguistics, Language, and Cultures hosts a research project called Michigan Diaries, which records changes to the lives and languages of Michiganders.

During the COVID-19 quarantine, MSU Linguistics needed a way to maintain their research safely. This led to the creation of MI Diaries, a way to remotely record and transcribe audio. As more researchers and programs realized the value in remote data collection, new features were added, including notes, photos, etc. More niche cases arose and the MSU Linguistics program found that the application had unexpected limitations that would require native software solutions to fix.

Our Mobile App for Remote Recording is a flexible solution that enables subjects to easily record sound, add images, and upload data directly to a server for research purposes. Our solution is a redesign of existing software with an emphasis on user experience and customization.

Our solution facilitates all sound-based research with a modular design that enables researchers to easily toggle features on or off. The simple and intuitive user interface makes it easy for anyone to record and upload samples for research. Users can record their audio, select pictures on their device, and upload content to the server with just a few clicks.

Customizing the application for any kind of research is as simple as copying the codebase and changing just a few lines of code.

Our application makes it easy for researchers to gather large amounts of multimedia data without programming knowledge, increasing data collection efficiency and speeding up research.

Our software is built in Kotlin for Android and Swift for iOS. The existing server-side pipeline is used to ensure seamless transition between versions.



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Microsoft Making STEM Papers Accessible to ASL Users

Microsoft is a multinational and industry-leading technology company best known for developing numerous operating systems, software, and online computing service platforms. Microsoft is also an active supporter of open-source development, as they hold a firm belief that contributing to open-source projects greatly accelerates innovation.

A roadblock that slows down the progress of this innovation is the lack of English-to-ASL translation for STEM-related words and other technological jargon. Those who sign with ASL that graduate high school have the reading comprehension of a 4th grader on average, making it harder to contribute to scientific studies.

Our Making STEM Papers Accessible to ASL Users system gives ASL users an easily-accessible resource that both translates scientific words of the reader's choosing and gives them suggestions for words they might be interested in translating.

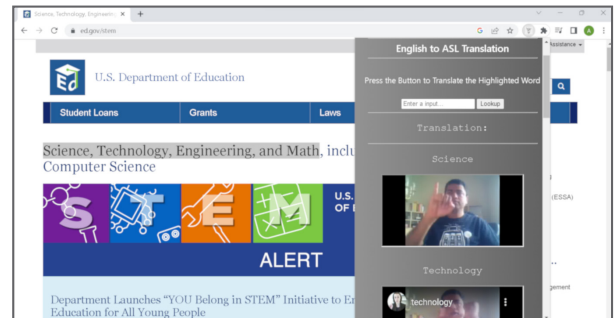
Our translator takes the form of a Google Chrome extension. It is accessible on a wide variety of webpages, increasing its usability.

Words are selected by highlighting them on the page with the mouse before activating the extension. Once the word is selected and the extension is activated, a video of that word's ASL translation is embedded inside a pop-up.

Words that do not have translations can be manually highlighted to show the user a similar word's ASL translation video. If similar enough words do not exist, a link to YouTube search results for that word's translation is displayed.

Our software makes it quick and seamless for ASL users to translate words from English to ASL, improving reading comprehension of ASL users.

The front end of our translator is written in HTML, CSS, and JavaScript. The back end is written in Python. The front end is connected to the back end via Flask.



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MSU Federal Credit Union Digital Transformation of Member Data

Established in 1937, MSU Federal Credit Union (MSUFCU) has been serving Michigan State University and the greater Lansing area for over 84 years. With over 20 branch locations statewide, 331,000 members, and managing nearly \$7 billion in assets, MSUFCU strives to help its local communities thrive and achieve financial freedom.

To encourage community engagement and outreach, MSUFCU partners with local businesses by offering discounts and rewards to MSUFCU members through a program known as Local Loyalty.

The benefits are mutual for both members and businesses; MSUFCU members have access to rewards and discounts – keeping their MSUFCU cards top-of-wallet, while local businesses gain free exposure and generate more business.

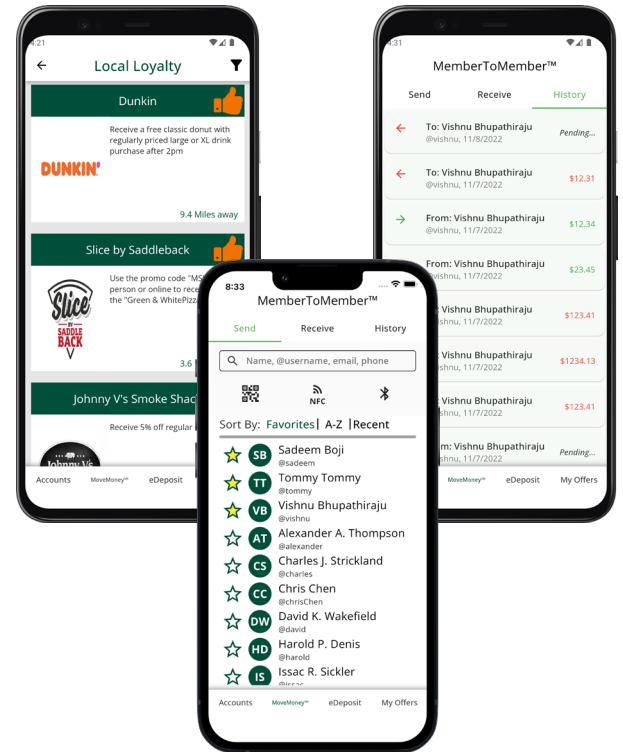
Our Digital Transformation of Member Data mobile application enhances these benefits by increasing awareness of the Local Loyalty program and providing members with a more robust member-to-member fund transfer experience.

Our application analyzes a user's transaction history and suggests partner companies that provide similar services to businesses where members are already shopping.

For example, if a member goes to an out-of-network coffee shop regularly, our application sends a notification suggesting a locally-partnered coffee shop offering a similar service at a discount if they use their MSUFCU card.

MSUFCU members can also use our improved fund transfer system, which now includes usernames, QR code scanning for physical device readers, and NFC tap-to-pay functionality.

Our application is available on Android and iOS devices. It is built on the Flutter SDK, using the Dart programming language to deploy on both platforms. It connects to a remotely hosted MySQL server whose data is analyzed with Python.



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Roosevelt Innovations Provider Anomaly Analytics Toolkit

Roosevelt Innovations, LLC is the first technology solution to deliver a simple, seamless, and smart platform for health insurance companies. With industry-leading claims processing capabilities, Roosevelt can transform operations, enabling insurance carriers to focus exclusively on their customers and growing their business.

With advanced machine learning techniques, Roosevelt Innovations performs analysis that identifies potentially anomalous attributes of healthcare provider claims for review. A key focus of this analysis is the identification of providers who may be engaging in fraud, waste, and abuse (FWA) activities. When found, providers potentially engaging in FWA are added to a manual watch list that places their future claims under scrutiny.

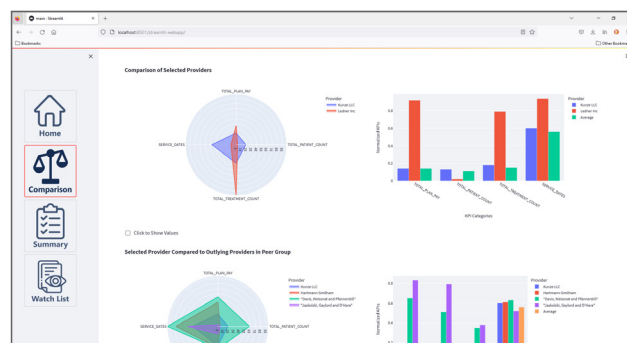
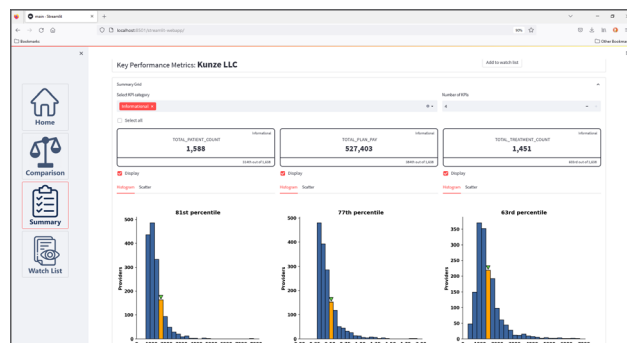
Our Provider Anomaly Analytics Toolkit streamlines this process by compiling the data sources and visualization tools necessary for FWA analysis into an interactive web application.

Upon opening the app, users are presented with a table of providers flagged as potentially problematic by machine learning algorithms. From this table, the user selects providers of interest and navigates to either a summary or comparison view for further investigation.

The summary view automatically displays data for a single provider, while the comparison view visualizes user-specified fields for multiple providers. Users leverage this information to confirm or deny potentially anomalous behavior.

By optimizing the identification process of problematic providers, our toolkit effectively reduces carrier vulnerability to FWA while improving the expected quality of care and cost of insurance for members using the Roosevelt platform.

Our toolkit is written in Python with Streamlit as the front-end framework. Data is stored in a Snowflake database and the outlier identification models are developed using scikit-learn and PyTorch.



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Roosevelt Innovations DSL IDE Test Harness

Roosevelt Innovations is a software company that creates solutions for insurance providers. The team at Roosevelt Innovations started at Delta Dental of Michigan, where they produced software that enabled Delta Dental Plans Association to insure over 83 million Americans. Roosevelt Innovations branched off from Delta Dental of Michigan to create company-agnostic software for all insurance providers.

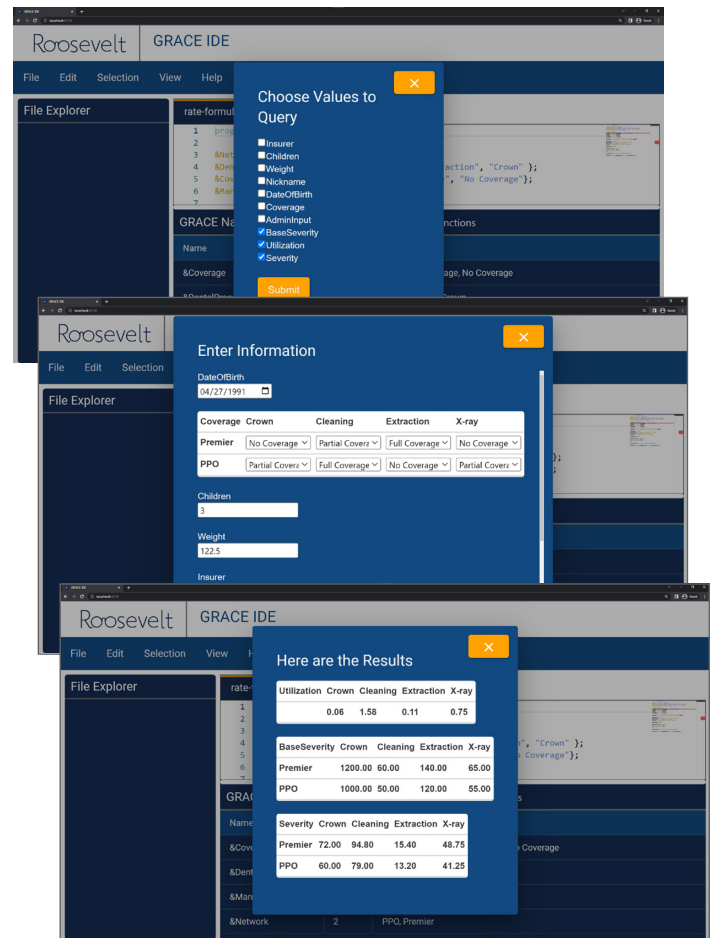
A ubiquitous challenge faced by insurance companies is accurately assessing risk. Actuaries and underwriters develop complicated formulas involving many factors, which must be updated frequently to appropriately charge for coverage. A common solution to this problem utilizes complex spreadsheets that actuaries and underwriters must learn and maintain to calculate their coverage rate.

Our DSL IDE Test Harness reimagines how actuaries and underwriters assess risk and facilitates the calculation of rates. Our application extends Roosevelt Innovations' revolutionary approach to rate calculation by providing a way for actuaries and underwriters to test their formulas quickly and conveniently.

Using our software, testing a formula is as easy as selecting it, entering the appropriate information, and clicking 'Submit.' After submitting their data measurements, a rate calculation is displayed to the user.

Our application streamlines the process of developing, testing, and distributing formulas used by insurance companies among actuaries and underwriters. This enables companies to appropriately assess risk, which ensures that they remain profitable.

Our application's front end is built using Angular and dynamically displays input fields when a test is run. The back end utilizes a Java microservice that provides the rate calculation files and performs the calculation once the input is provided.



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RPM

RPM Drive™ Mobile App Extension and Enhancements

RPM is an international logistics corporation which specializes in end-to-end transportation of freight and automobiles. On a monthly basis, RPM's carriers deliver 40,000 automobiles and 15,000 freight shipments. The company has headquarters in Royal Oak, Michigan and in Amsterdam, Netherlands.

The logistics and shipping industry is extremely competitive and dynamic, with carriers ranging from one-man operations to mega fleets. Thus, building carrier relationships is critical. While on the road, carriers use their phones to locate deliveries, making RPM's app an integral part of its business.

Our RPM Drive Mobile App Extension and Enhancements system improves the in-app experience for carriers, thus increasing client retention.

Our innovative bidding system provides an opportunity for carriers and RPM to negotiate the optimal price for each shipment through an intuitive, elegant and interactive bid engine. Carriers see shipment details, bid on preferred shipments, check auction status, and receive notifications on their bid status.

The suggestion page displays personalized shipments for carriers in one place, eliminating the hassle of manually finding loads that meet their criteria. An accompanying search page gives carriers the freedom to refine a lookup.

The rewards program incentivizes client loyalty. Users accumulate rewards points as they complete well-executed shipments. Drivers are able to select from a selection of gift card offerings, redeem their points in app, and receive their gift card virtually.

Our system utilizes C# and Xamarin to enable platform-agnostic development on the front end. The back end employs tools and databases from Microsoft Azure, and Python's scikit-learn library enables our machine learning models.



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Stryker

Technology Driven Inventory Optimization

Stryker is a Fortune 500 company that provides world class medical equipment to hospitals worldwide. From surgical equipment to neurotechnology, Stryker impacts more than 100 million patients annually.

With so many medical kits being shipped internationally, Stryker must ensure that every single kit is accounted for and tracked in their system, which requires a reliable history of transactions to determine the progress of each kit in the supply chain.

Our Technology Driven Inventory Optimization increases transparency throughout every step of the delivery process using a web application.

When a user opens the dashboard, they are shown statistics about all medical kit deliveries along with a map of their locations. This map is updated in real time and can be selected for a more in-depth view. GPS sensors attached to each medical kit provide up-to-date location data.

Statistics such as shipment history and status are viewable from the dashboard. To ensure the shipment history is secure, transactions are logged on the blockchain which provides safeguards against malicious actors. Moreover, to take further precautions against potential inaccuracies, all transactions written to the blockchain are processed automatically based on GPS location. This helps eliminate the potential for human error and increases the overall accuracy of inventory.

Stryker personnel use the dashboard and map view together to identify any problems that have occurred during shipping to address them immediately.

Our software provides much-needed transparency during each step of delivery of medical supply kits, increasing efficiency and aiding in discovering any problems as soon as they occur.

The front end of the web app uses ReactJS, while the back end is built on AWS's Amazon Managed Blockchain Service. Pebble sensors are responsible for sending location data which is queried by AWS AppSync and stored in a DynamoDB table.



stryker



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Targets' Tip Sharing Advice on Academic Harassment

Targets' Tip is a start-up headquartered in Okemos, Michigan. Founded by Morteza Mahmoudi, Targets' Tip was created to provide support for targets of academic harassment and supply data on the incidences, types, and contextual behaviors of academic harassment to improve the overall academic organizational health.

Academic harassment is a serious issue that affects all disciplines and people. One main issue is a lack of reliable and easily accessible resources available for targets of academic harassment.

Our user-friendly Sharing Advice on Academic Harassment software mitigates this problem by enabling targets to connect with those who can support them and provides options for users: as a target or survivor of academic harassment, and as a professional advisor.

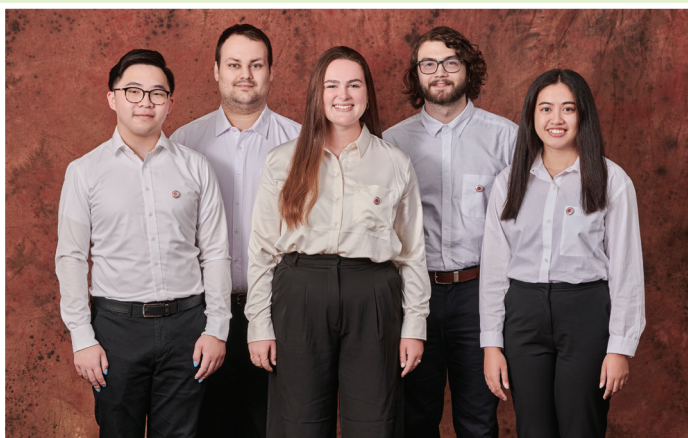
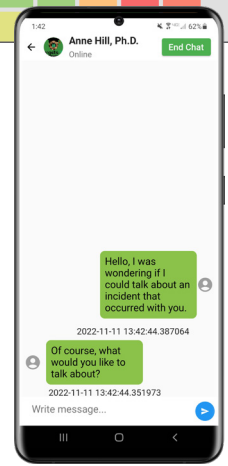
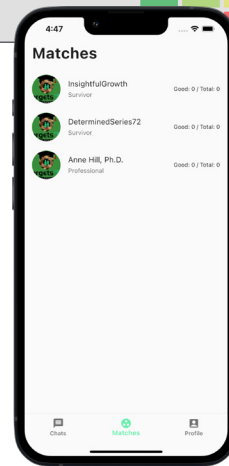
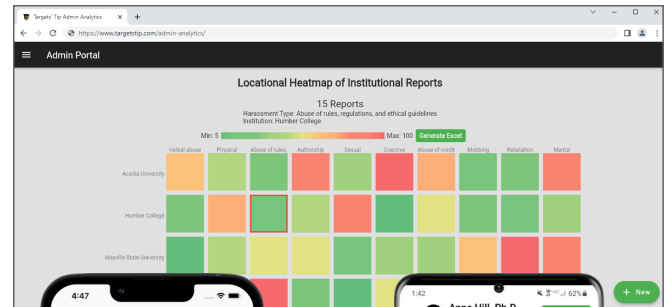
Professional advisors are required to produce credentials in order to be approved by a system administrator.

After users on the platform sign up for an account, they select which specific types of harassment they are either struggling with or for which they can offer advice.

Based on the user's selections and an advisor's rating, the platform proposes matches for a target with an advisor or vice versa. The user requests to connect with one of their matches, and upon approval from the match, can chat online. After a conversation, the target is asked to rate their advisor, which factors into the rating of their advisor, helping future targets pick their match.

While keeping user data secure, Targets' Tip collects instance data and feeds it into a customizable dashboard for administrators to view. This system is separate from the public platform.

Our application is available to access online and natively on iOS and Android. The front end is written in Dart utilizing Flutter while the back end utilizes Firebase.



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TechSmith

TARA: TechSmith Asset Recommendation Assistant

TechSmith is the global leader in screen recording and screen capture software and solutions. The company's mission is to empower people to create remarkable videos and images that help share knowledge and information. TechSmith's flagship products, Snagit and Camtasia, have more than 73 million users worldwide.

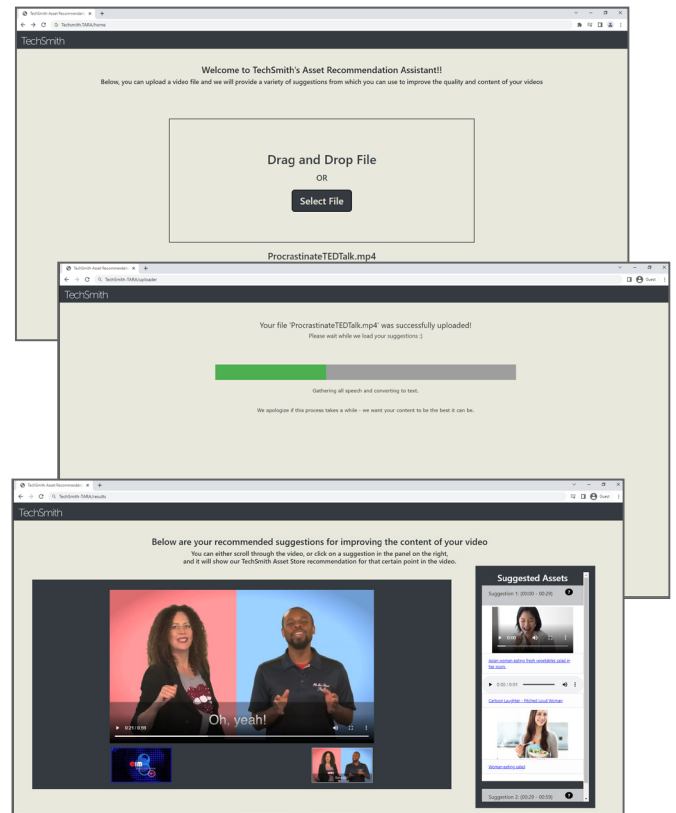
TechSmith provides users with the software to easily create video content, but not everyone is great at the editing process or familiar with the features the TechSmith Asset Store provides. The procedure of converting raw footage to something that captivates an audience can be very time-consuming. Even with thousands of pieces of media from the asset store, users struggle to find the right material to help upgrade the quality of their content.

Our TARA: TechSmith Asset Recommendation Assistant web application enables users to efficiently edit their video or audio content by providing them with curated material from the asset store. This saves time and ensures that the provided assets complement the original content.

When a user uploads video or audio to the website, the file is split and analyzed for keywords. Each segment is associated with suggestions from the TechSmith Asset Store. The suggestions display the name of the asset, a short description of the material itself, and a corresponding link to its location in the asset store. The assets can be downloaded with the provided link.

Our software makes it easy for users to quickly create high-quality videos by suggesting assets for inclusion, cutting the time spent searching the asset store for appropriate files.

Our web application is made using HTML, JavaScript, and CSS. Text data is extracted using Microsoft Azure's Speech Services API and Cognitive Services Computer Vision. Keywords are extracted from the text using Gensim. Our web application, file storage and database are hosted on Microsoft Azure.



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Union Pacific Mobile Train Handling Simulator

Union Pacific, founded in 1862, is the leading railroad transportation company in North America. With over 32,000 miles of track, 8,000 trains and 30,000 employees, Union Pacific plays a major role in the transit of goods throughout the nation.

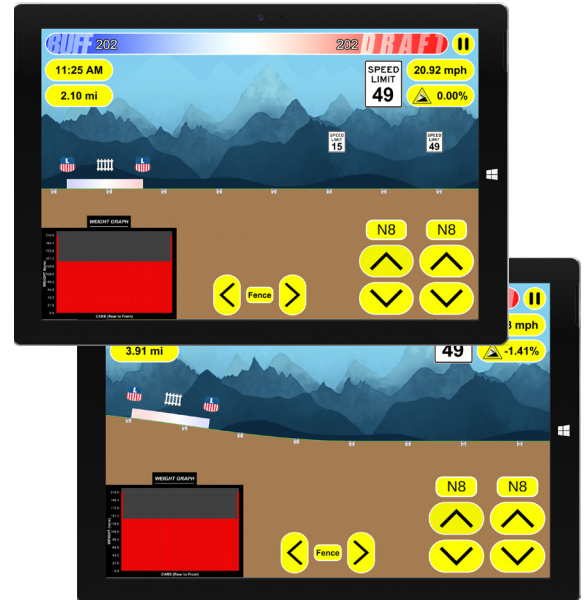
Traditionally, trains were powered by one locomotive group at the front, whereas contemporary trains can have up to three locomotive groups throughout. This is known as distributed power. Distributed power requires the engineer to manage the throttles of each locomotive group in order to maintain a delicate balance between the train cars, a task that becomes more difficult as terrain changes over the train's route.

Locomotive engineers today have a heavy responsibility, overseeing many tons of cargo and many passengers. To make sure engineers are trained properly, there is a pressing need for accurate and accessible distributed power training simulators.

Our Mobile Train Handling Simulator lets users control an expansive collection of real-world trains over realistic terrains. Users interact with throttle and brake controls for up to three locomotive groups and try to minimize the push (buff) and pull (draft) forces between cars of the train. Our system uses cutting-edge physics simulation and comprehensive train conditions to ensure the simulations are realistic and informative.

With intuitive controls and simple two-dimensional visuals, our simulator is realistic and easy to use. This makes it an accessible solution for locomotive engineers while avoiding costly resources such as proprietary and stationary train hardware.

The simulator is developed with Unity, a software development environment and game engine. Additionally, our system incorporates a proprietary train physics API from PS Technology, a Union Pacific subsidiary. This makes our simulator highly accurate, warranting its use in training locomotive engineers.



BUILDING AMERICA®



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United Airlines Data on Demand App

Headquartered in Chicago, Illinois, United Airlines serves as one of the largest commercial airlines in the world. While maintaining a workforce of over 84,000 employees and a fleet of more than 850 aircraft, United Airlines also provides immense passenger service with thousands of flights to over 350 global airports daily.

The Airport Operations Safety Leadership team at United Airlines often finds it useful to access raw data on employee injuries and aircraft damages on demand. However, the team is currently unable to access data in a timely manner during key conversations. This information is also not accessible on mobile devices.

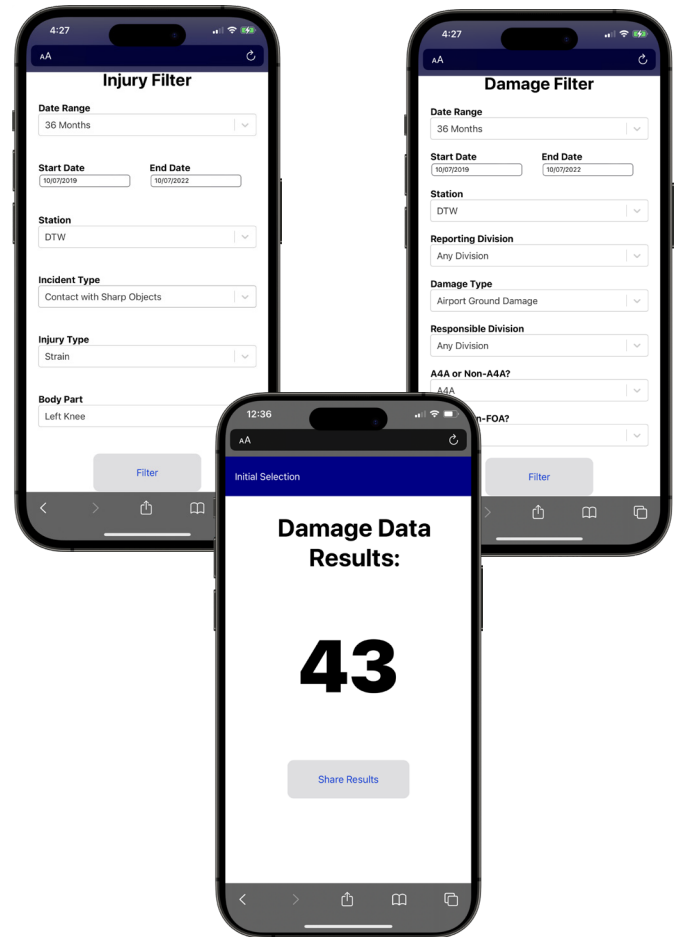
Our Data on Demand App delivers raw data to the fingertips of Airport Operations Safety Leadership via a robust mobile website.

Airport Operations Safety Leadership can quickly access the website and select the desired data domain, either injuries or damages, to initiate their analysis. Upon choosing a data domain, the user can provide filterable conditions regarding the occurrence, such as a date range, a location, and the status of investigations. This enables Airport Operations Safety Leadership to immediately view the total number of incidents accordingly.

In search of more information on specific incidents, the user can click the resulting figure indicating the total number of occurrences, and a table of incidents with deeper information corresponding to the figure is displayed. The user can share this data along with the associated filter options via email.

With our system in place, United Airlines can ensure and maintain a safer workplace environment for its employees.

Our Data on Demand App is written in ReactJS, an open-source Java Script framework. The data is being accessed via a REST API, which is developed using Node.js.



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United Airlines Audit Management System

United Airlines, based in Chicago, Illinois, has been one of the most important airlines in the United States for almost a century, flying over a hundred million passengers each year on its fleet of over 850 aircraft.

Maintaining this incredible fleet requires constant maintenance, and United Airlines has a network of vendors across the globe to keep its planes in good condition. Vendors repair and replace airplane parts with frequent inspections by United Airlines' auditors, who make sure each vendor is following the best practices.

Our new Audit Management System makes this process easier for auditors with the implementation of a virtual portal that enables auditors to move smoothly through the list of audits and checklists, reducing the chance for mistakes.

Auditors access our app on an iPad when visiting vendors. During the audit, they can log any issues directly on the iOS app and keep track of the progress they have made.

Our iOS app saves an audit and automatically uploads it to our website accessible by the vendors so the vendor associated can respond to any issues found by the auditor. After the vendor responds, our iOS app displays their response next to the respective finding on the audit.

Historical audits for the vendor are always shown, so that auditors can quickly view past errors, assess the fixes, and be confident that all issues are properly resolved.

Online audits are standardized, so any auditor can easily compare and understand information from past audits, further decreasing the risk of inconsistencies.

With the Audit Management System in place, United Airlines can make sure that the airline is safer than ever.

Our application is written in Swift and connects to a back-end database through an API hosted by Amazon Web Services.



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United Airlines

Efficacy Testing within United's Cornerstone LMS

United Airlines is the world's third largest airline with a fleet of over 850 aircraft that fly a total of 4,500 flights a day to more than 300 cities across five continents. To maintain this fleet of aircraft, United Airlines has 41 instructors helping to shape the students into capable aircraft technicians.

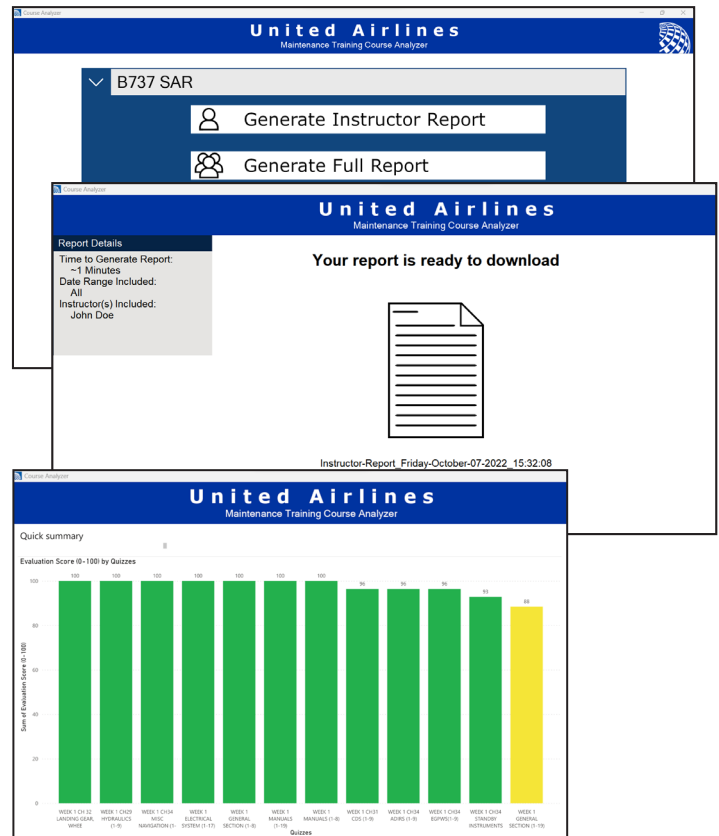
Nothing is more important to United Airlines than safety, so having a crew of well trained, professional technicians is essential. Technicians learn plane and airport maintenance through United Airlines training courses. To increase instructor quality and technician training, it is imperative that United Airlines has up-to-date statistics about courses and instructors.

Our system provides a way for United Airlines to ensure the content of the 737 SAR course is accurate, and that instructors are continuing to effectively train United Airlines aircraft technicians on the Boeing 737 aircraft and all its variations.

The system enables users to generate reports from course data. This report analyzes important factors such as whether course materials contain relevant information, student performance metrics, if questions are worded properly, and the performance of the instructors' teaching.

The application takes the course content results along with the course preparation materials, and outputs a statistical breakdown for United Airlines to review. Each exam is assigned a score from 0 to 100, which helps instructors color code the exam performance with Traffic Light Protocol.

Our course analyzer is built within Python. For the front end, Tkinter is utilized along with Python packages like NumPy and Pandas. The course learning materials and exam results are hosted on Microsoft SharePoint. Data visualization and statistical analysis can also be viewed using Microsoft Power BI dashboards.



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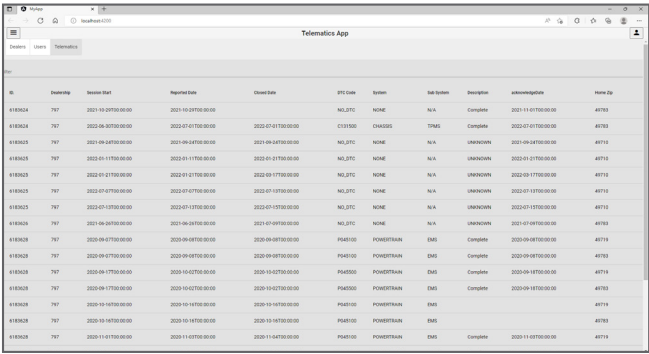
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The front end of our Dealership Parts and Service Telematic Insights application is built using Angular, Typescript, HTML, and CSS. The back end uses the .NET Core 6.0 framework APIs in C# that are connected to a SQL Server database.



URBAN SCIENCE™



David Michael
Detroit, Michigan

Vectorform Time Cube

Founded in 1999, Vectorform is headquartered in Detroit, Michigan. Vectorform is an invention company that prides itself on its expertise and talent to solve complex technological problems. They combine a variety of technologies such as the Internet of Things, augmented or virtual reality, and other emergent systems to develop solutions for their clients.

Vectorform employees are responsible for tracking their time while working on numerous projects throughout the day. It is important to keep totals of time that are accurate to both the company and client. Manual time tracking leaves room for errors while also being a tedious, time-consuming approach. Additionally, automatic trackers running on a computer can be privacy-invasive.

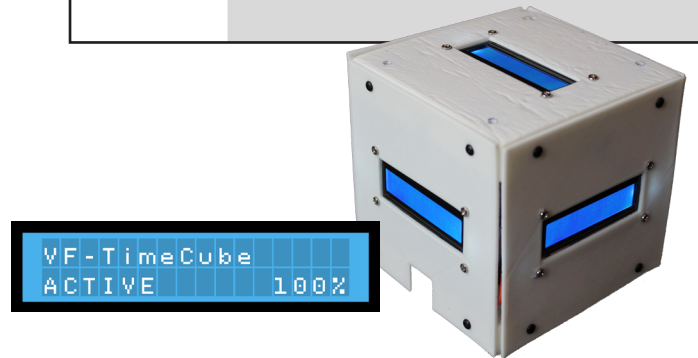
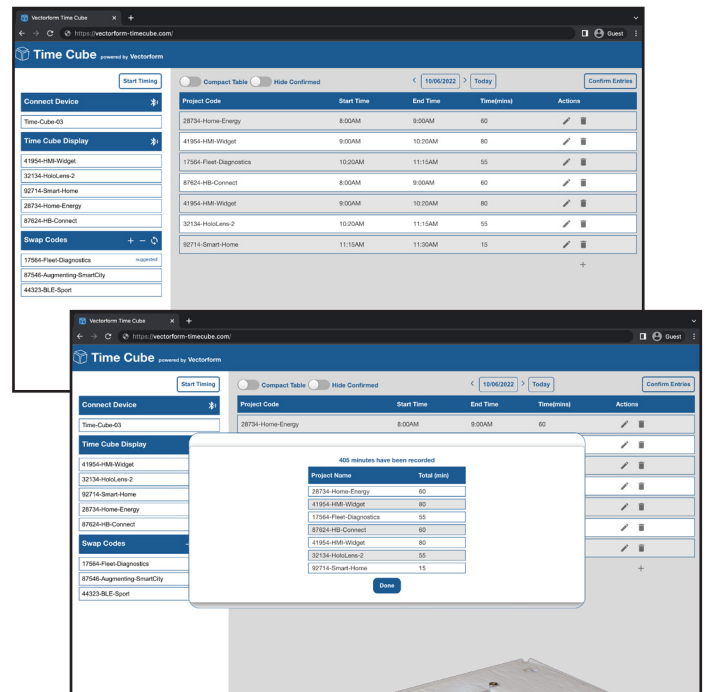
Our Time Cube system is a physical desktop device that tracks totals of time on projects with a flip of the cube.

Our web application populates the Time Cube with a task on each surface. From there the user starts timing and the device tracks the task facing up on the cube. By rotating the device, a new time entry begins and the web application updates automatically. Timing can be paused by flipping the cube upside-down, indicating a break.

Users can edit the data and correct any user error before confirming their time entries and sending the data to Vectorform's billing department.

Our system of tracking time provides employees with a fun, tactile approach to their workday. It incorporates manual and automatic processing to diminish the disadvantages of each process.

The web application incorporates ReactJS in the front end and utilizes back-end services including Node.js and SQLite. The Arduino MKR Wi-Fi 1010's firmware is written in C++ and communicates with our front-end system through Bluetooth Low Energy.



 **Vectorform**
an NTT DATA Company



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Volkswagen Group of America Volkswagen Electric Vehicle Recommender App

Volkswagen Group of America is the North American operation headquarters and subsidiary of the Volkswagen Group, one of the world's leading automobile manufacturers. They have 6,000 employees in the United States and sell their vehicles through a 1,000-strong dealer network.

Automotive industry analysts predict that by the year 2035, approximately 45% of all new car sales will be electric vehicles. The main concern new electric vehicle buyers have is “range anxiety,” defined as the fear of being stuck without fuel or a viable charging option, charging station availability, and charging timeframes.

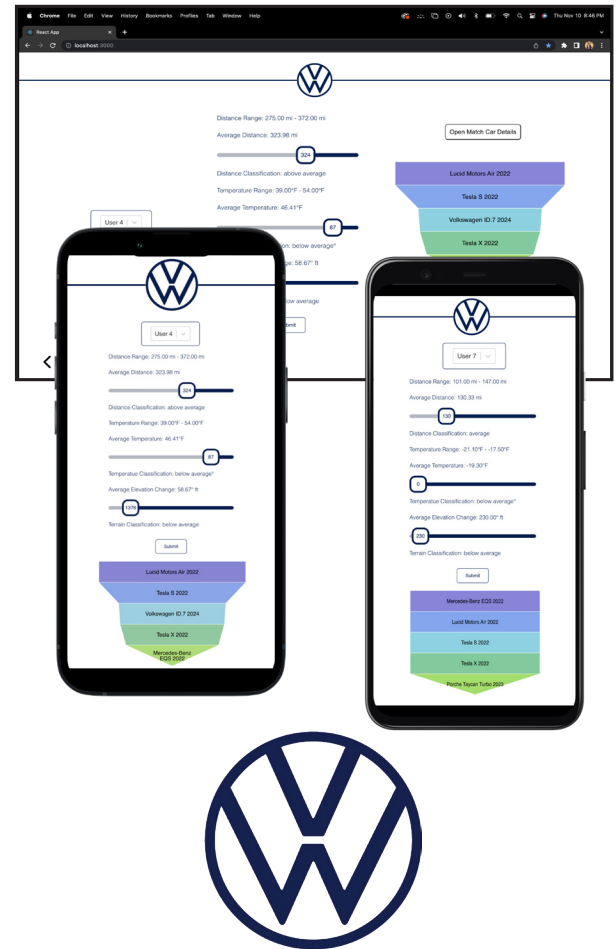
Our Volkswagen Electric Vehicle Recommender App quells buyers' fears by matching users to electric vehicles which best suit their custom driving profiles.

Users can either use their preexisting Volkswagen profiles or they can enter new preferences in the app to get recommendations for suitable electric vehicles. These profiles contain essential information about the conditions the user typically drives in. Many aspects of a driving profile affect a car's range, so factors such as local temperatures and elevation are considered.

The application also gives users the option to select aspects of vehicles they desire most. They can filter by certain characteristics such as car types, different horsepower ranges, and number of seats. While these options are not as pressing as range anxiety, they give buyers a choice.

Users are presented with attractive visualizations describing why the recommended vehicles fit their profile. Algorithm analysis is included to further showcase how and why each vehicle is suggested, and how they compare.

Our Volkswagen Electric Vehicle Recommender App is a reactive web-based application. Our system uses API calls for database communication and is written in Python, React, and Flask.



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Whirlpool Corporation Guided Recipe Augmentation

Whirlpool Corporation, headquartered in Benton Harbor, Michigan, is the world's leading major home appliance company with approximately \$22 billion in annual sales and 69,000 employees. Whirlpool's goal is to improve home life through the production of a variety of home appliances.

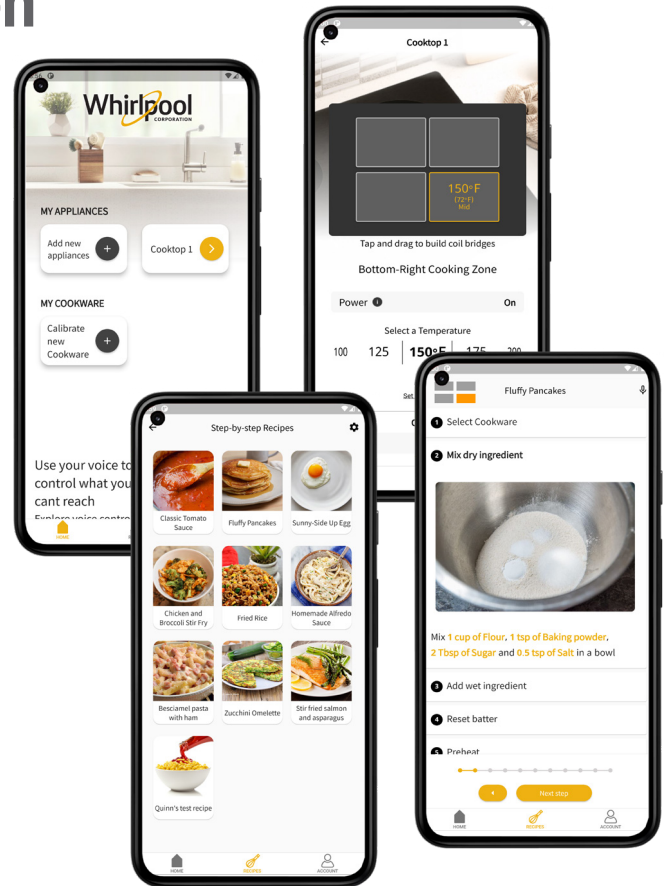
With this in mind, our Guided Recipe Augmentation system eliminates the variability of home cooking through the Assisted Cooking with Temperature (ACT) mobile application that guides users as they cook at home, ensuring they get the best results.

One of the largest hurdles a new home cook can encounter is properly managing the cooking temperature of their stovetop. The ACT mobile application converts traditional power level cooking into a more intuitive cooking experience using real temperature values to ensure the perfect meal every time.

Utilizing Whirlpool's induction cooktops, the ACT mobile application is able to seamlessly assist a home cook, step by step, through a recipe while automatically adjusting the temperature of the cooktop without any user intervention. Additionally, users are able to control the recipe instruction process with voice commands or gestures to command their mobile device back and forth between different recipe steps.

Our ACT mobile application streamlines the cooking process to alleviate the stress of home cooking, thus bringing it to more homes. All of the recipes are hand-crafted by Whirlpool's food scientists to ensure steps are simple and easy to follow.

The ACT mobile application is built using Dart, a programming language developed by Google for simultaneous Android and iOS development. Our application communicates with the induction cooktop via a WebSocket protocol. Lastly, storage is being handled using MongoDB hosted by Microsoft Azure.



Whirlpool



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Design Day Awards

CSE 498, Collaborative Design, is the senior capstone course for students majoring in computer science. Teams of students design, develop and deliver a significant software system for corporate clients. The CSE capstone teams compete for four prestigious awards. Here are the winners from the spring of 2022.

Auto-Owners Insurance Exposition Award



CSE 498 capstone teams present their projects on Design Day in a variety of ways. Teams create and set up an exhibit where they demonstrate their software systems and answer questions from Design Day attendees. Each team plays their project videos and answers questions for a panel of judges.

The CSE capstone team with the best overall Design Day performance is honored with the Auto-Owners Exposition Award, which is sponsored by Auto-Owners Insurance Company of Lansing, Michigan.

Team Michigan State University Linguistics
On-Premises Automatic Speech Recognition Pipeline



Kyle Reinhart, Jacob Caurdy
Eden Seo, Maria Irimie, Eason Ding
Presented by Tony Dean, Ross Hacker and Scott Lake

MSU Federal Credit Union Praxis Award



One of the hallmarks of CSE 498 capstone projects is that of praxis, the process of putting theoretical knowledge into practice. Teams apply a wide variety of information technologies to produce solutions to complex problems in areas such as business, engineering, computing, and science.

The CSE capstone team that engineers the software system that is the most technically challenging is recognized with the MSU Federal Credit Union Praxis Award, which is sponsored by MSU Federal Credit Union of East Lansing, Michigan.

Team TechSmith
ViSUI: Video Simplified User Interface



Jered Brophy, Averi Justice, Diego Marzejon
Jack Koby, Erika Zheng, Scott Isaacson
Presented by April Clobes and Ben Maxim

Spring 2022

While each of the awards has a principal focus, every winning team is required to deliver a comprehensive software system and to demonstrate outstanding communication skills by presenting, demonstrating and defending their work.

TechSmith Screencast Award



Each CSE 498 capstone team produces a video that describes and demonstrates their software product. Starting with a storyboard and a script, teams use Camtasia Studio to synthesize screen recordings, video, audio and other multimedia to produce their project videos.

And the TechSmith Screencast Award goes to... the CSE capstone team with the best project video. The award is sponsored by the creators of Camtasia Studio, TechSmith of East Lansing, Michigan.

Team United Airlines Airport Operations
Performance Scorecard Automation



Guanzhang Zheng, Noah Little
Danny Lee, Cynthia Trocinski, Griffin Klevering
Presented by Wendy Hamilton, Tony Lambert and David Norris

Amazon Sigma Award



The CSE 498 experience represents the capstone of the educational career of each computer science major. An intense semester of teamwork produces impressive deliverables that include a formal technical specification, software, documentation, user manuals, a video, a team web site, and Design Day participation. The resulting sum, the capstone experience, is much greater than the parts.

The capstone team that delivers the best overall capstone experience is recognized with the Amazon Sigma Award, which is sponsored by Amazon of Seattle, Washington and Detroit, Michigan.

Team Anthropocene Institute
Wildfire Risks Forecasting Tool



Andrew McDonald, Ben Miller, Nathan Woods
Jamie Schmidt, Jingxian Chen, Andrew Haas
Presented by Garret Gaw



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The Capstone Projects



Dr. Subir Biswas
Professor of
Electrical and
Computer
Engineering

Project Facilitators: Virginia Ayres, Shaunak Bopardikar, Sunil Chakrapani, Qi Hua Fan, Ming Han, Nihar Mahapatra, Daniel Morris, Lalita Udpa, Bige Unluturk, and Peng Zhang



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Bopardikar



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Mahapatra



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Udpa



Unluturk



Zhang

Presentation Schedule – Engineering Building, Room 2205

Time	Team Sponsor	Project Title
8:00 a.m.	MSU IPF Power and Water/Consumers Energy/Sartorius	Sustainable Energy Via Machine Learning
8:20 a.m.	MSU Solar Racing Team	Custom Motor Controller for High-performance Solar Cars
8:40 a.m.	Texas Instruments	Distributed Radar Sensing Networks
9:00 a.m.	Texas Instruments	ML Methods for Object Classification using Radar
9:20 a.m.	General Electric	Flight Simulator for Aviation
9:40 a.m.	Fraunhofer USA, Center Midwest	Control System for Microfluidic Electrochemical Sensing
10:00 a.m.	AMP Robotics	Robotic Grip System
10:20 a.m.	MSU Bikes Service Center	Black Box for Bikes
10:40 a.m.	Magna International Inc.	LWIR Sensor Array for High-Rate Temperature Control
11:00 a.m.	Magna International Inc.	Design of Automotive Camera using RGB+IR Sensor
11:20 a.m.	Magna International Inc.	Radio Frequency Power Transmission System

ECE 480 Senior Design

ECE 480 is required of all electrical engineering or computer engineering majors at MSU. It prepares students for the workplace, or for graduate school, including:

- Putting into practice the technical skills learned in the classroom, on industrially sponsored team projects, under faculty guidance, doing open-ended design, giving them experience in teamwork, project management, product life cycle management, intellectual property, accommodation issues and entrepreneurship;
- Polishing their communication skills – individual and team – on proposals, reports, résumés, evaluations, posters, web pages, and oral presentations.

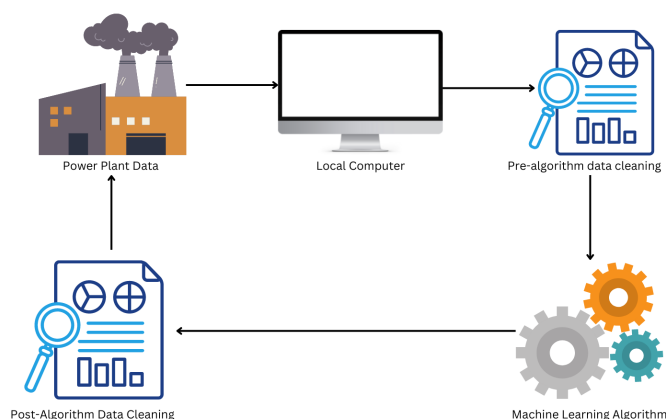
We gratefully acknowledge the support of this semester's project sponsors: AMP Robotics, Consumers Energy, Fraunhofer USA, Center Midwest, General Electric, Magna International Inc., MSU Bikes Service Center, MSU IPF Power and Water, MSU Solar Racing Team, Sartorius, and Texas Instruments.

MSU IPF Power and Water/Consumers Energy/Sartorius Sustainable Energy Via Machine Learning

Every year, Michigan State University expends approximately \$20M in fuel to supply 300 GWh of electrical energy and 2 billion pounds of steam to campus. This process involves burning large amounts of fossil fuels. These fossil fuels are not only getting more expensive but are also harmful to the environment and contribute to climate change. Due to the size and complexity of a powerplant, there are many sources producing waste. The steam cycle has many possible inefficiencies: low condenser vacuum levels, high levels of condensate depression, fouled heat exchangers, etc. Inefficiencies potentially exist outside the steam cycles, such as around campus buildings where plant steam is utilized for heat.

The goal of this project is to find these inefficiencies and increase overall plant efficiency by utilizing methods of machine learning. By using a data historian provided by the T.B Simon Power Plant, data-points will be collected, sorted, and utilized by a machine learning algorithm to provide a better picture of where losses or increased emissions occur in the plant. The machine learning program should help find correlations between data points that would be difficult for a human to see.

To combat the periodic price increases and improve overall sustainability, the T.B. Simon Power Plant has installed software to continually track thousands of data points related to the powerplant overall. The staff of the powerplant would like a machine learning algorithm to parse through this huge amount of data and hopefully make connections that would be difficult for a human to detect. With this increased understanding of the plant, it could be possible to increase overall plant efficiency. If the overall efficiency of the plant is increased, this will help offset the rising fuel costs and help Michigan State University lower its carbon footprint.



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MSU IPF Power and Water/ Consumers Energy/ Sartorius Project Sponsors

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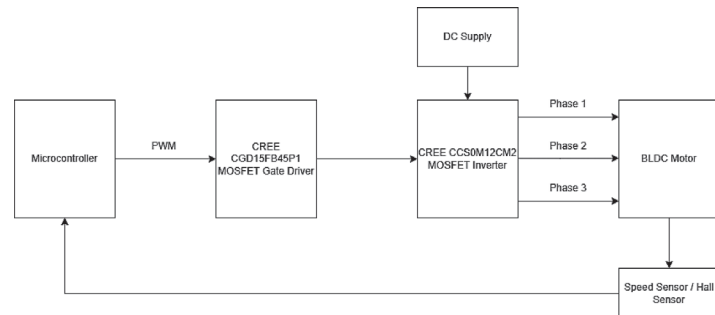
Project Facilitator

Dr. Lalita Udp

Michigan State Solar Racing Team

Custom Motor Controller for High-performance Solar Cars

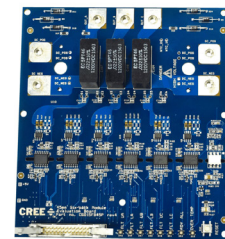
The MSU Solar Racing Team is interested in a proprietary motor controller unit that can be utilized in the solar car. The task is to design, build, and program a controller with implementation of the correct sensors and hardware to meet these requirements. The motor will be a 3-phase brushless DC motor that will communicate via Computer Aided Network (CAN). This controller also needs to be able to regulate output of torque based on a throttle signal. Each of these criteria will need to be met, while packaging the controller in an ergonomic way.



Teensy 4.1



MOSFET



CREE Gate Driver / Inverter



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Michigan State Solar Racing Team Project Sponsor

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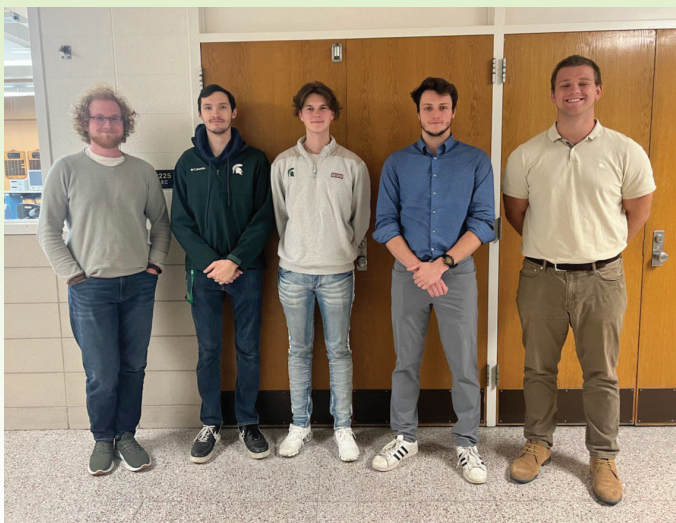
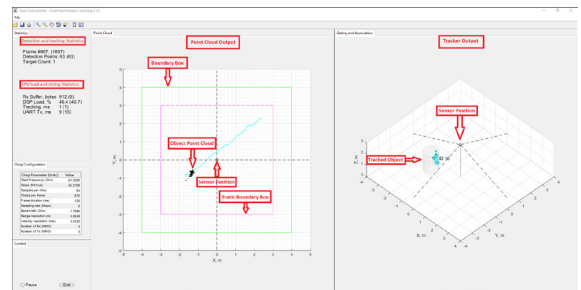
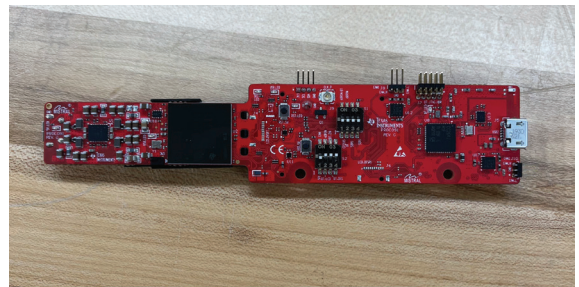
Texas Instruments Distributed Radar Sensing Networks

Texas Instruments was founded in 1930 and is headquartered in Dallas, Texas. They are a global semiconductor company that designs, manufactures, and tests analog and embedded processing chips. Their main goal is to lower the cost of electronics through their advancements in Integrated Circuit (IC) technology.

Tracking with cameras is becoming less accepted, as people are not as comfortable being tracked when their identity is involved, due to advancements in facial recognition. In addition, cameras become increasingly less effective and more expensive when being used to track in the dark. Using radar, tracking can continue with less infringement on people's privacy and also mitigates the need for light at a cheaper cost.

The project goal is for a sensor network of Texas Instruments mmWave radar sensors to be able to seamlessly track a person from one sensor to another within global coordinates. Currently, mmWave tracking is only processed independently, which means that one person will show up as two targets between the two sensors.

Our design will have two mmWave sensors that send data to a centralized processing machine, where the data will be manipulated and converted to a single coordinate system. The data is then displayed in a 2D map of the tracked region on a Graphical User Interface (GUI). The GUI will allow for easy calibration of the sensors and data visualization.



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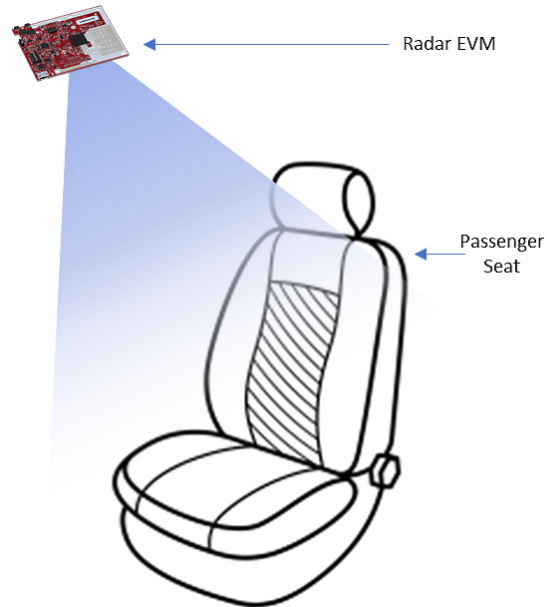
ML Methods for Object Classification using Radar

This project uses machine learning to classify an object in front of a radar sensor as live or not.

Our machine learning algorithms will observe unique patterns of objects using data collected by a Texas Instruments IWR6843ISK-ODS radar sensor evaluation module (EVM) and process that data with Python 3.7 and TI's mmWave SDK 3.6 to determine the object's nature using software.

Machine learning algorithms using Support Vector Machine (SVM), Convolution Neural Network (CNN), and Random Forest (RF) classifications will be developed and compared based on the accuracy of each algorithm.

The primary use case for this project is for detecting adults, children, and objects inside of a vehicle.



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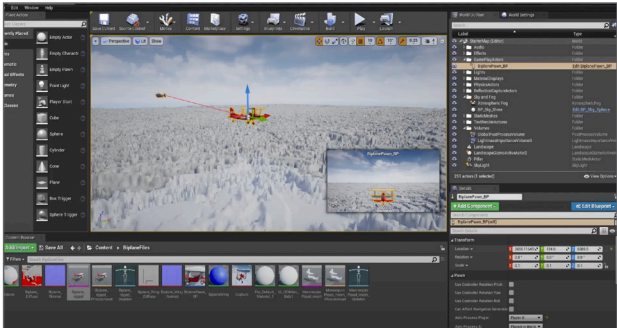
Project Facilitator

Dr. Nihar Mahapatra

General Electric Flight Simulator for Aviation

Assured Position, Navigation, and Timing (A-PNT) is the catchphrase adopted by the U.S. Department of Defense to describe systems that accurately estimate the state of a mobile platform in any operating environment. A-PNT has emerged as an outcome of adversaries using electronic warfare to deny Global Navigation Satellite (GPS) systems by jamming or spoofing satellite signals. Due to these hindrances, GE Aviation has developed a prototype PNT system that employs a novel image-based method of geolocation, Vision-Based Navigation (VBN) to overcome drawbacks of GPS systems. For this project, we will be developing a flight simulator that will employ Unreal Engine (UE) along with Robot Operating System (ROS) and other related plugins, to simulate the required flight and environment system using manual controls that will be used in the future for VBN system testing purposes.

The objective of the project is to develop a simulation of a fixed-wing airplane operating in a 3-D virtual environment suitable for demonstrating the benefits of a prototype multi-sensor PNT system. The simulation will be created through use of UE 4.27.2. The aircraft for testing the simulation, provided by GE Aviation is a Boeing 737-800. UE4 will implement the visual elements of the simulation, i.e. the fixed-wing airplane model and the photorealistic environment produced from an actual survey. The ROS plug-in will be used to implement the mathematical model of the vehicle flight dynamics. The flight simulation will be operated using manual controls, which includes the use of a control stick and a throttle, provided by GE Aviation. The final deliverable minimum of the project is a flight simulation that can display realistic environments and model the flight of the Boeing-737 in a mathematically correct manner, with the simulation being controlled manually using a control stick and throttle.



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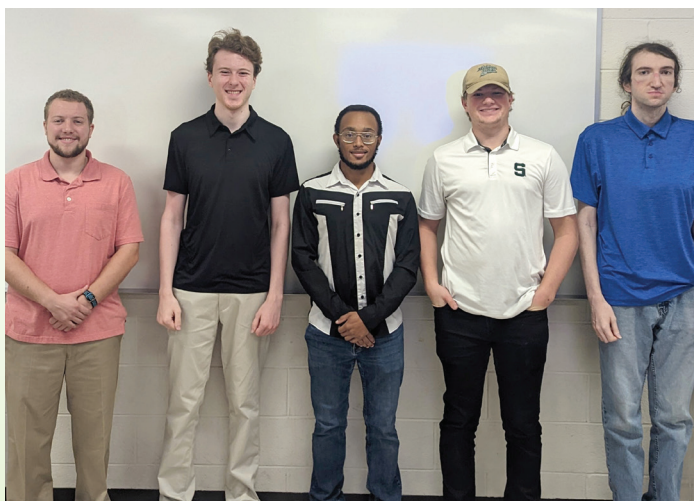
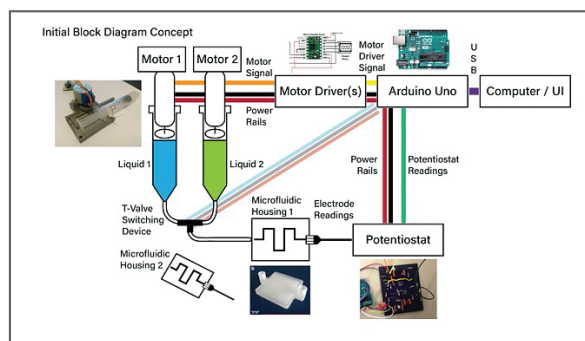
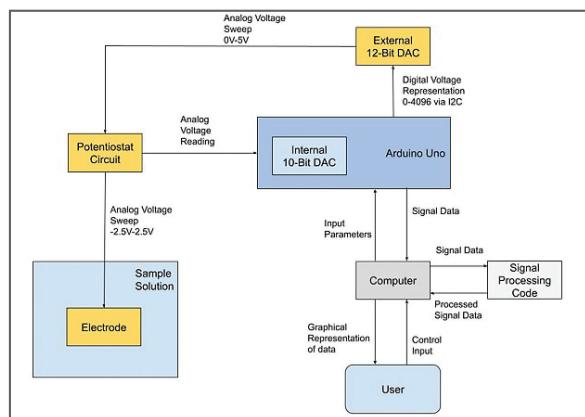
Dr. Shaunak Bopardikar

Fraunhofer USA, Center Midwest Control System for Microfluidic Electrochemical Sensing

Fraunhofer USA, Center Midwest is a research organization in East Lansing, Michigan that specializes in diamond and coatings technologies. These technologies are used in several ways in the development of electrodes for electrochemistry utilization. The electrochemical uses of these electrodes include testing water samples for possible contaminants using small sample sizes, which is the purpose of the microfluidic control system.

A previous team's design included a potentiostat circuit that, when connected to an electrode submerged in a water sample, used cyclic voltammetry to analyze the sample for potential solvents. The design also included a Graphical User Interface (GUI) when utilized with a computer. Because other testing methods are often single use, costly, and/or time-consuming, the design's goal was to create a reusable, rapid, and cost-effective water testing system.

Our design is to improve upon the previously designed system by integrating a syringe-pumped flow-controlled system, 5V power source, specialized interchangeable housings for both a diamond and a printed electrode, and increase the portability of the system. The pumped system includes two syringes: one holding fluid to be tested, and the other to hold cleaning solution. The testing fluid will be pumped across the electrode connected to the potentiostat and GUI. The GUI controls syringe selection and flow rate, pumping the fluid between $\mu\text{L}/\text{minute}$ and mL/minute . The 5V power source replaces a 9V battery, and the specialized electrode housings enable electrode replacement or exchange. The entire system housing is space-efficient and lightweight to provide maximum portability.



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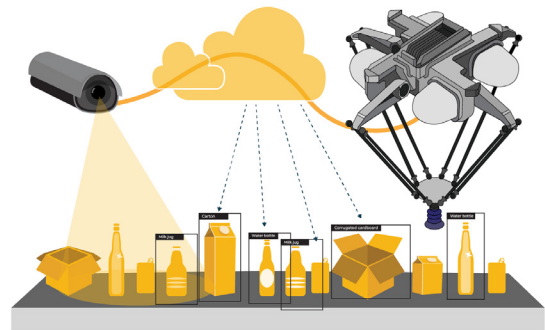
AMP Robotics Robotic Grip System

The MSU Recycling Center houses and uses an AMP Cortex Robotic sorting system that uses suction to organize recyclables from a moving belt. The system needs improved pick accuracy, which can be achieved through a tested successful algorithm. Our team is tasked with developing this algorithm and achieving a 95% successful pick rate.

The AMP Cortex robotic system, designated MRF-E (“murphy”), sorts category 1 (polyethylene) and category 5 (polypropylene) plastics from a moving trash belt. It is important to differentiate bad picks from good picks because the belt may contain a variety of other plastics and metals.

Success may be achieved through image processing, additional sensors, or integrated programming. We have chosen to achieve our goal by integrating the program and creating/improving on the current algorithm that MRF-E is using.

By doing this, we will be able to deliver what is requested of us in a timely manner, and meeting standards that AMP Robotics expects.



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Dr. Bige Unluturk

MSU Bikes Service Center Black Box for Bikes

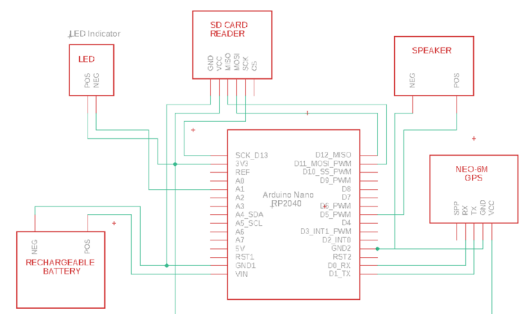
The MSU Bikes Service Center has been a part of the Michigan State University Community since 2003 when it started as a volunteer-run project. In 2006, it received funding from Michigan State University to open its doors at its present location on Farm Lane.

In 2021, MSU was recognized with a Gold Level Bike Friendly University award from the League of American Bicyclists. In keeping with its bike friendly environment, our team has partnered with the MSU Bikes Service Center to create a device capable of detecting bike incidents.

Due to the heavy traffic associated with MSU students, faculty, staff and visitors commuting to and from class, bike incidents have become a common problem. This is understandable when one considers that the fall 2022 enrollment of MSU topped out at an astonishing 50,023 students.

Our team's goal is to develop a weather resistant device that is mounted discretely on a bike. This device will then be based around an Arduino Nano microcontroller that will have the ability to track certain parameters such as acceleration, orientation of the bike (gyroscope), and GPS location to help determine if a crash has occurred.

Overall, the device we create will enable these incidents to be recorded, allowing MSU to take a deeper look into the more accident-prone locations around campus, which could ultimately lead to improvements in infrastructure around campus to help increase safety for both riders and non-riders.



Michigan State University

Team Members

(left to right)

Kyle Lawson
Farmington, Michigan

Tony Doyle
Manitou Beach, Michigan

Ethan Gleason
Empire, Michigan

Emma Stanavich
Chelsea, Michigan

Tyler Vo
Holland, Michigan

MSU Bike Service Center

Project Sponsor

Tim Potter
East Lansing, Michigan

Project Facilitator

Dr. Sunil Chakrapani

Magna International Inc.

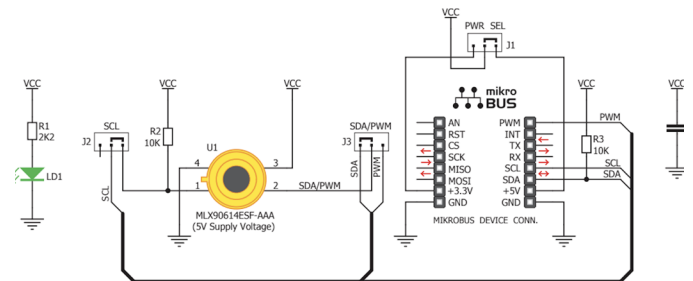
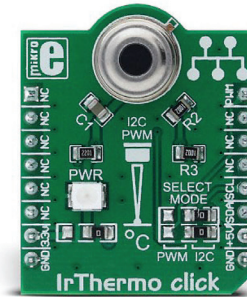
LWIR Sensor Array for High-Rate Temperature Control

Magna International Inc., founded in 1957 is a Canadian parts manufacturer for automakers. Magna is the largest automobile parts manufacturer in North America. It produces automotive systems, assemblies, modules, and components which are supplied to major automotive companies.

Temperature control is very important to electronics as it enables the device to maintain an operating temperature that will not cause damage. Our project involved the temperature control of LED lights, which has an automotive application in the headlights of vehicles. Currently, thermistors are being used to monitor and control temperature within circuit designs for this application, however they are not perfect and can vary greatly by design. They also display a continuous upward slope in temperature when in reality the temperature is not increasing linearly.

Our project is to design and test a high-rate temperature sensor for electronic assemblies based on Long-Wave Infrared Array (LWIR). The system's heat dissipation and high-rate control will initially be simulated using MATLAB Simulink. The sensor hardware will then be integrated to a circuit that dissipates enough heat for characterization and according to simulations. For this project, the team goal is to be able to test and show that the temperature control unit is able to take data at a higher sampling rate and respond more quickly to changes in temperature when compared to a conventional system that uses a thermistor. In order to confidently compare the two and validate our work, the team will simulate and physically test both thermistor and sensor circuit designs.

With the successful completion of this project, Magna International will be able to consider implementing thermal sensors into future designs in place of thermistors.



Michigan State University Team Members (left to right)

Isabella Cureton
Northville, Michigan

Erin McAlinden
Livonia, Michigan

Griffin Forrester
Traverse City, Michigan

Kevin Chen
Troy, Michigan

Zhifeng Ji
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Magna International Project Sponsor

Daniel Carballo
Rochester Hills, Michigan

Project Facilitator

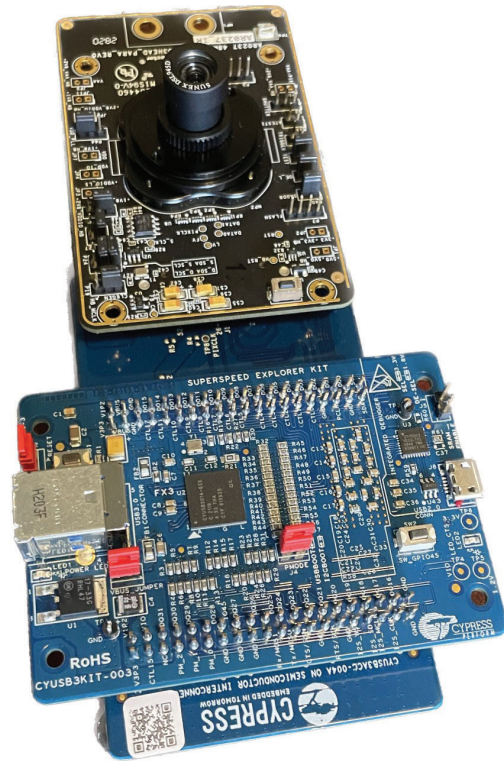
Dr. Peng Zhang

Magna International Inc.

Design of Automotive Camera using RGB+IR Sensor

Magna International Inc., founded in 1973, is a leading parts designer for automotive manufacturers. Headquartered in Aurora, Ontario, Magna has hundreds of manufacturing operations and develops dozens of different products worldwide. Magna has been working on automotive technologies for decades, and became one of the first companies to develop rearview cameras for automakers. In recent years, this drive for innovation in the automotive industry has led Magna to look into RGB+IR technology for automotive camera applications.

This project has dived deeper into whether RGB+IR technology has a net benefit over traditional RGB technology. The specific emphasis was on whether the RGB+IR sensor had a net benefit over traditional RGB cameras in low-light environments. Important components included the ability to distinguish objects or people in the collected images. By collecting additional data for Magna, this group will finalize whether or not there is a net benefit to including IR technology in automotive cameras. This project also will determine any benefit of IR technology in low-light environments and any advantages presented over traditional RGB camera technology.



Michigan State University

Team Members

(left to right)

Aidan Fadool

West Bloomfield, Michigan

Bryan Clarke

Ludington, Michigan

Nick Dehoek

Grandville, Michigan

Jonathan Cherson

Shelby Township, Michigan

Leo Crepeau

Beverly Hills, Michigan

Magna International

Project Sponsor

Daniel Carballo

Rochester, Michigan

Project Facilitator

Dr. Qi Hua Fan

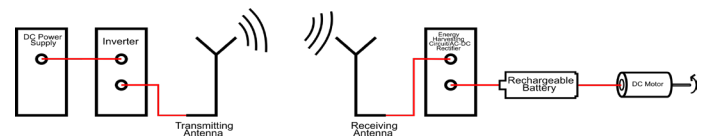
Magna International Inc.

Radio Frequency Power Transmission System

Since 1957, Magna International Inc. has prided itself on developing technologies, systems and concepts that make vehicles safer and cleaner, while serving communities, the planet and, above all, people. They are a leading global automotive supplier with 341 manufacturing facilities and 89 product development, engineering and sales centers in 28 countries. Magna International develops and manufactures products and systems in the areas of body exteriors and structures, including power and vision technologies, seating systems, powertrain systems, electronics, mechatronics, interiors, and control modules.

Magna International approached our team with the task of designing a Radio Frequency (RF) system that allows power transmission through electromagnetic resonance. Electromagnetic resonance is highly demanded in many fields, as it can power multiple devices from one power source. In particular, the automotive industry is looking toward the use of RF-enabled wireless power transfer for low-power electrical devices within the cabin, such as seats and side mirrors. Currently, cables are used to make these power connections in vehicles, which takes up room in the cabin, interferes with other components, and raises concern over time with constant movement of the vehicle.

The goal of this project is to design an RF system that enables power transmission via a 12V supply. This will be done through transmitter and receiver antennas and be able to power two DC motors. Our team will verify this transmission of power and estimate losses by performing an efficiency of power evaluation for the electrical system. Magna International will consider our high-level proof of concept for future possibilities of being able to transmit power wirelessly through an RF transmission system.



Michigan State University

Team Members

(left to right)

Daniel Karczmarczyk
Warren, Michigan

Carter Mayfield
Plymouth, Michigan

John Murdoch
Lansing, Michigan

Jennifer Rousseau
Westland, Michigan

Elijah Savoie
Lansing, Michigan

Magna International

Project Sponsor

Hussein Farhat
Troy, Michigan

Project Facilitators

Dr. Ming Han

ECE Spring 2022 Awards

FIRST PLACE AWARD

Team NASA
Solar System Communication Network Project

Left to Right:
Yazon Mariya, Reece Reynolds, Robin Onsay,
Parshad Mashar



SECOND PLACE AWARD

Team AMP Robotics/MSU Surplus Store &
Recycling Center

Left to Right:
Austin Anthony, Katie Albus, Sephyr Rahgozar,
Jacob Honer, Sam Church, Jarrett Blumke



THIRD PLACE AWARD

Team GM
Autonomous Vehicle Fluid Level Sensor

Left to Right:
Jeremy Molargik, Andrew Mackoul,
Ishmael Fasina





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ME 412 Heat Transfer Laboratory

Yuping Wang
Academic Specialist
Department of Mechanical Engineering

Getting to Know Cooling Towers

Chilled water is needed in many thermal systems, from large industrial plants to small HVAC units, to help discharge the waste heat. Cooling towers, which can provide a continuous supply of chilled water, also vary in size and are employed in various applications. Those commonly seen are the large hyperboloid concrete structures in a powerplant or smaller metal device on a rooftop. In this project, students in ME 412 are expected to understand the operation of cooling towers through two parts of work. For the major part, each team will design, build, analyze, and test a small-scale simple cooling tower. The objective is to provide sufficient cooling to a warm water stream. For the secondary part, each team will choose a specific type of cooling water supply unit and conduct a review on its design, application, technology, operation, and performance. On the testing day, a testing station with instrumentations for flow and temperature measurements will be available and each team will have 15 minutes to set up, demonstrate, and test their device. In addition, they will also prepare a PowerPoint slideshow or video clip for the audience to explain their design decisions, fabrication, operation and analysis of their device.

Competition Schedule

Time	Station	Team Members
8:00	A	Kyle Anulare, William Cilia, Katie McMillan, Spencer Stefani
	B	Al Hezam Aiyash, Amber Bliven, Jake Cuffaro, Greg Koenigsknecht
8:15	A	Bill Altier, Joseph Deschaine, Richard Lin, Abdulhamid Salem
	B	Evan Backer, Jack Beison, Kyle Hellems, Peter Phan, Kyle Zerafa
8:30	A	Parker Morris, Ryan Peters, Sophie Weitzel, Lesheng Zeng
	B	Frederick Bruner, Parker Grover, Tommy McGowan, Mark Zummallen
8:45	A	Connor Anderson, Aidan Dettweiler, Ethan Keppy, Zihan Zhang
	B	Cameron Dork, Jaclyn Duff, Connor Laubach, Lucas Russell, Trent Treppa
9:00	A	Jahzeel Alcantar Gallegos, Nick Crane, Michael Gertley, Andrew Pieper
	B	Gianna Andriacchi, Justin de Coster, Charley Jiang, Evan Lamb, Zhe Liu
9:15	A	Ali Mohammed Al Brahim, Nathaniel Clarke, Patrick Marchal, Nick Montpas
	B	Dylan Gumbinger, Austin Lowien, Aisyah Mahira, Tung Nguyen
9:30	A	Ryan Bartlett, Faith Call, Henry Horak, Noah Moyer, Meghan Parkinson
	B	Jacob Cristofori, Sarthak Gupta, Saeha Lederle, Joe Wanza
9:45	A	Thomas Burgess, Eric Douglas, Van Duong, Mitchell Essenmacher, Connor Trask
	B	Alejandro Castillo, Keerthi Kothapally, Jeffrey Li, Anjali Patel, Jihoon Song
10:00	A	Jennifer Blowers, John DiBella, Julia Fox, Jonathon Lewis, Thomas Supal
	B	Bashhar Byrourthy, Sean Cornellier, Kailey Head, Jack Konitsney
10:15	A	Beth Caldwell, Atticus Crimmins, Eric Ernvall, Daniel Vance, Zach White
	B	Jeremy Balzer, Nathan Kowalski, Tung Nguyen, Cole Treece
10:30	A	Erin Chynoweth, Jacob Demski, Bryn Dittmar, Miguel Jarquin-Lopez, Maddy McKown
	B	Seth Gower, Rob Paquette, Donnie Schuster, Alex York
10:45	A	Erik Liu, Tyler Marshall, Suven Sinha, Stephen Tamboer
	B	Matthew Davidson, Alex Feige, Luke Willemsen, Paul Williamson
11:00	A	Dino Iovtchev, Anthony Pero, Shamit Topiwala, Tommy Wierzbicki

ME 470 Mechanical Design & Manufacturing II



Michael Lavagnino
Academic Specialist
Department of
Mechanical Engineering

Ping Pong Player

The goal in this project is to design a machine that can propel twelve ping pong balls across a ping pong table as a volley to the right side (four balls), left side (four balls), and as a serve (four balls). The teams will utilize mechanisms such as 4-bar linkages, gear sets and cam-follower systems, as well as, a provided motor. Students will utilize materials and manufacturing capabilities from the Manufacturing Teaching Laboratory, including premade components. The competition will be based on accuracy of the mechanism and a bonus trick shot to get a ping pong ball in a cup.

Time	Team	Station	Team Members
8:00	1	A	Kathleen Dewan, Aaron Hopson, Bryce Houser, Eyob Mamo, Sophie Weitzel
	1	B	Connor Anderson, Edmond Hashem, Jacob Huskin, Kevin Upcott, Wade Varney
8:10	2	A	Derek Hanson, Jonathan Jenkins, Jake Rutkowski, Luke Schmidt, Jake Stanesa
	2	B	Christian Giggy, Zachary Lang, Evan Petersen, Najmi Rahim, Nicholas Sarver
8:20	3	A	Xiaoqui An, Sohan Gupta, Greg Koenigsknecht, Calum Walton, Siyuan Zhang
	3	B	Jack Konitsney, Keerthi Kothapally, Chak Sing Kwok, Zoe Quinn, Gus Scheier
8:30	4	A	Nicholas Coubard, Joe Kouchoukos, Justin Miller, Anthony Montemayor, Jack Salisbury
	4	B	Artik Chowdhury, Vaibhav Himthani, Zhe Liu, James Tanay
8:40	5	A	Shane Beers, Mitchell Bjorne, Ross Davis, Connor Michel, Mitchel Semeyn
	5	B	Jonathan Elias, Jacob Keller, Nathan Kramer, Patrick Mullaly, David Smith
8:50	6	A	Henry Horak, Ayaan Rajabali, Joey Rheume, Austin Shepp, Logan Wells
	6	B	Jyotiraditya Chavan, Ryan-Cristofer Curamen, Brady O'Shea, Jacob Rupprecht, Lucas Russell
9:00	7	A	Brandon Esquivel, Miles Grimes, Peter Olszewski, Ryan Pawlowski, David Shim
	7	B	John Andres, Brendan Doane, Ravi Mody, Jihoon Song
9:10	8	A	Kylie Carbary, Parker Grover, Emily Holman, Deaven Kim
	8	B	Bashhar Byrourthy, William Cilia, Christian Jaraczewski, John Klein, Dawu Liu
9:20	9	A	Al Hezam Aiyash, Longfei Bao, Matt Candela, Zachary Carpenter, Thanh Mai
	9	B	Sarthak Gupta, Zach Kranstz, Matt Phelan, Frank Rhoades, Lingyi Zhao
9:30	10	A	Valentin Borjas, Rachel Paul, Jessica Ray, Kevin Roche, Connor Witham
	10	B	Yusuf Abbas, Faith Call, Augusto Cucala, Parker Hatherley, David Levasseur
9:40	11	A	Jack Beison, Tyler Paparella, Khush Patel, Sarah Walrath, Paul Williamson
	11	B	Michey Atnafe, Ashley Bolt, Matthew Lipscomb, Austin Tait, Val Vargas
9:50	12	A	Edward Kim, Nicholas Lauinger, Kyle Roland, Tom Seaman, Jack Whitcomb
	12	B	Nick Dodge, Nolan Houghteling, Ciara Regan-Moore, Joe Watza, Showgo Yoshida
10:00	13	A	Thomas Burgess, Nathan Jansen, Nathan Phelps, Haosen Sun, Kai Thin
	13	B	Taku Benson, Dylan Huck, David Knapp, Noah Shephard, Connor Trask
10:10	14	A	Erin Denby, Adam Fox, Noah Gilman, Kylie Kuskowski, Jordan Piatek
	14	B	Andrew Culver, Jon Droste, Kyle Hellems, Joe Nelson, Minh Nguyen
10:20	15	A	Andrew Flight, David Olawale, Matthew Price, Gus Tsalas

10:45 a.m. – 11:45 a.m.: The top teams compete in a tournament style competition.

The Capstone Projects



Dr. William Resh
Professor of Mechanical Engineering

Faculty Advisors: Giles Brereton, Lik Chuan Lee, Norbert Mueller, Ranjan Mukherjee, Elisa Toulson, Sharon Xiao



Brereton



Lee



Mueller



Mukherjee



Toulson



Xiao

Presentation Schedule – Engineering Building, Room 1202

Time	Team Sponsor	Project Title
8:00 a.m.	Cleveland-Cliffs, Inc.	Train Depress Scrap Awning
8:30 a.m.	Cleveland-Cliffs, Inc.	Train Depress Scrap Awning
9:00 a.m.	Kautex Textron	EV Battery System Impact Plate Design
9:30 a.m.	Toyota Motor North America	Frontal Area Scanner
10:00 a.m.	Toyota Motor North America	Automotive Child Restraint Detection Sensor
10:30 a.m.	Adventures in Training with a Purpose	Directed Steps: Quick Release Handle Design
11:00 a.m.	Adventures in Training with a Purpose	Directed Steps: Ambulation Aid

ME 481 Mechanical Engineering Design Projects

ME 481 is a required course for mechanical engineering majors at MSU. The course provides students with a team-based capstone design experience in which they:

- Use the technical expertise, communication skills, and teaming methodologies they have learned throughout their mechanical engineering curriculum, together with their creativity, to solve real world problems
- Collaborate with practicing engineers to address problems sponsored by industry
- Develop new products or redesign existing products to reduce costs or enhance reliability and functionality
- Interact with large, medium, and small companies in the automotive, defense, aerospace, consumer products, and agricultural industries, and with US government agencies.

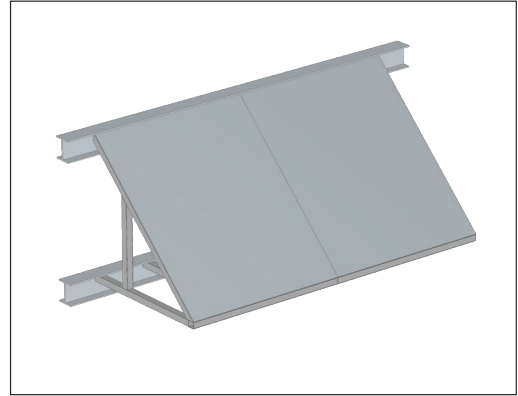
We gratefully acknowledge the support of this semester's project sponsors: Adventures in Training with a Purpose, Cleveland-Cliffs Inc., Ingham ISD, Kautex Textron, Michigan AgrAbility, MSU Adaptive Sports and Recreation Club, MSU College of Engineering, Steelcase Inc., Toyota Motor North America, and UV-C Safe Inc.

Cleveland-Cliffs, Inc.

Train Depress Scrap Awning

Cleveland-Cliffs, a fully integrated steel mill located in Burns Harbor, Indiana, is the largest flat-rolled steel company in North America and a leading supplier of automotive-grade steel. As a fully integrated mill, Cleveland-Cliffs handles all parts of the manufacturing process for their steel coils: mining iron ore pellets out of the ground, melting them down, and casting slabs of steel. These steel slabs are then rolled into sheets and wound up into coils, which can weigh upwards of 80,000 pounds. Cleveland-Cliffs is committed to environmental sustainability and conservation, so in the event that a piece of steel is scratched or damaged it is collected as scrap that is later recycled and cast into a new coil.

Prior to being recycled, all scrap is collected into a pile in a scrap room, where it is then picked up by a large magnet and dropped into train cars. Occasionally, pieces fall into a gap between the car and the wall, where they are out of reach of the magnet. An employee has to pick up the pieces manually, which is hazardous because the pieces are both sharp and heavy. To solve this problem, our team designed an awning that hangs over the gap and deflects scrap into the train car, ensuring the area underneath remains clear. The awning was designed to attach to existing supports in the scrap room and to be able to withstand loads up to 2,000 pounds. It was also designed as a ten-foot section that can be easily repeated for the full, 50-foot length of the train depress. Because of the large size, special care was taken to keep the awning as simple and cost-effective as possible while maintaining a strong structure. By implementing this awning, Cleveland-Cliffs is not only able to keep their employees safer but also maintain production speeds as no time is spent waiting for scrap to be retrieved manually.



Michigan State University

Team Members

(left to right, top to bottom)

Michael Strong

Jackson, Michigan

Robert Walston

Highland, Michigan

Sean Cornellier

Novi, Michigan

Charley Jiang

Fujian, China

Gianna Andriacchi

Chicago, Illinois

Cleveland-Cliffs, Inc.

Project Sponsor

Lauren Hart

Burns Harbor, Indiana

ME Faculty Advisor

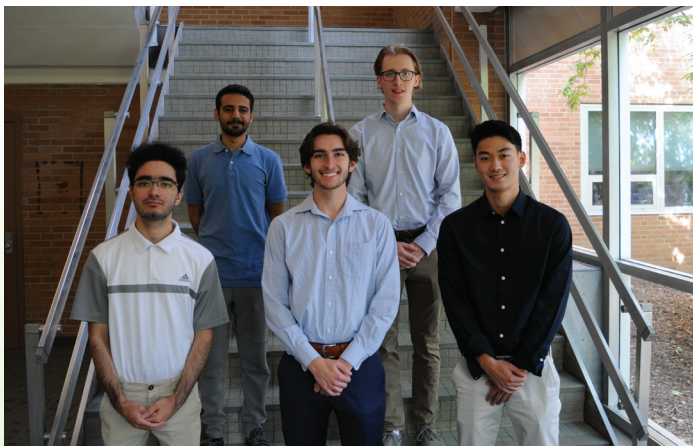
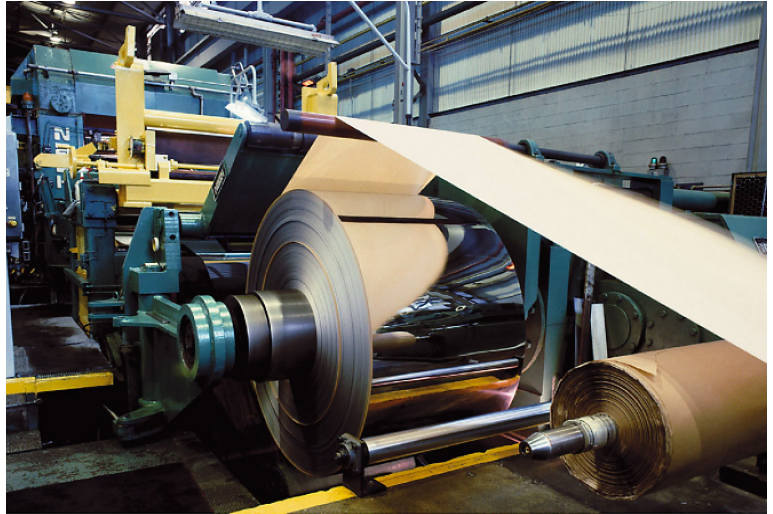
Dr. Norbert Mueller

Cleveland-Cliffs, Inc.

Train Depress Scrap Awning

Cleveland-Cliffs is the largest flat-rolled steel company in North America and the largest supplier of automotive grade steel in the U.S. The company is a fully integrated steel mill from mined materials, to primary steelmaking, to downstream stamping, tubing, and tooling. The main goal is to become North America's leader in steelmaking sustainability by reducing waste, improving water conservation, and reducing carbon emissions by 25% by 2030. Cleveland Cliffs sells mostly steel coils, and the average weight of a coil is between 50,000 and 80,000 pounds.

Our project focused on improving the process for recycling scrap steel. When recycling scrap pieces of steel to melt and insert back into the process, a large magnet picks up scrap pieces and drops them into a train car. Occasionally, the pieces of steel fall between the train cars and the wall. Originally, the fallen pieces would need to be manually retrieved. Our project focused on designing an awning to remove the need to send a person to retrieve the stray pieces. The awning would be attached between the wall and train car to deflect pieces of steel that would have fallen into the gap between the train and wall back into the train. For the scrap awning we made CAD drawings, FEA tested it with 1,000 pounds of weight, and made it as safe as possible.



Michigan State University

Team Members

(left to right, top to bottom)

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Kyle Pawlowski

Clinton Township, Michigan

Sepehr Hosseinkhani

Canton, Michigan

Cole Treece

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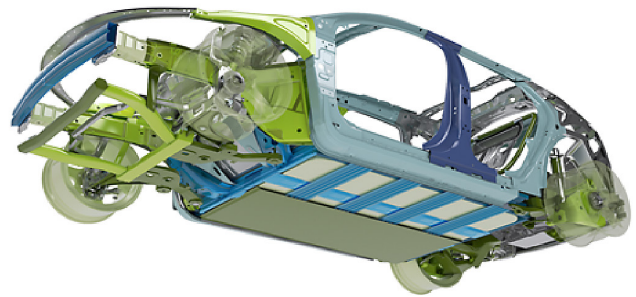
Dr. Sharon Xiao

Kautex Textron

EV Battery System Impact Plate Design

Kautex Textron is a Tier One automotive supplier engaged in the manufacturing and development of traditional and hybrid fuel systems, thermoplastic composite, composite-metal hybrid battery systems, etc. With the growing demand for electric vehicles, automotive companies are introducing new electric vehicles in their portfolios and increasing their production of electric vehicles. The battery system is one of the most essential components in an electric vehicle. Thus, protecting the battery system from hazards while driving in different road conditions is the utmost priority to increase the safety, longevity, and performance of electric vehicles.

Our project was to design an impact plate to protect an electric vehicle battery system from road hazards and rough terrain. Various combinations of material types, material thicknesses, and impact energies were used to analyze the performance of the impact plate. The goal was to minimize the weight, cost, and deflection of the plate while at the same time maximizing the impact energy the plate can withstand. Different materials, thicknesses, and impact energy values were used to determine the optimal solution to ensure that the battery has the best protection. Ansys Workbench was utilized to simulate the trials that aided in the determination of the design with the most optimal combination of variables.



Michigan State University

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(left to right)

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Spencer Stefani
Grosse Pointe Farms, Michigan

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Troy, Michigan

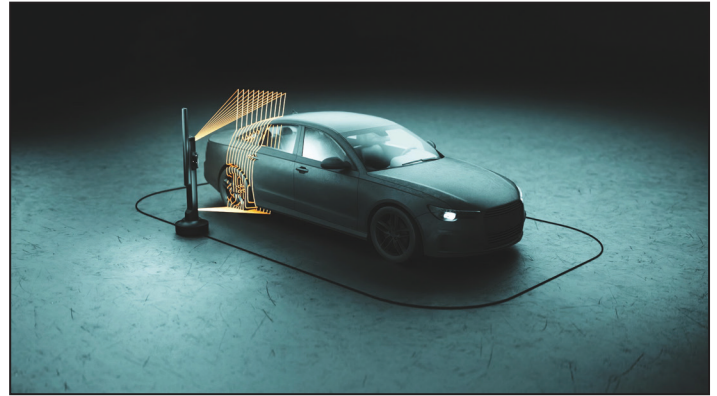
ME Faculty Advisor

Dr. Giles Brereton

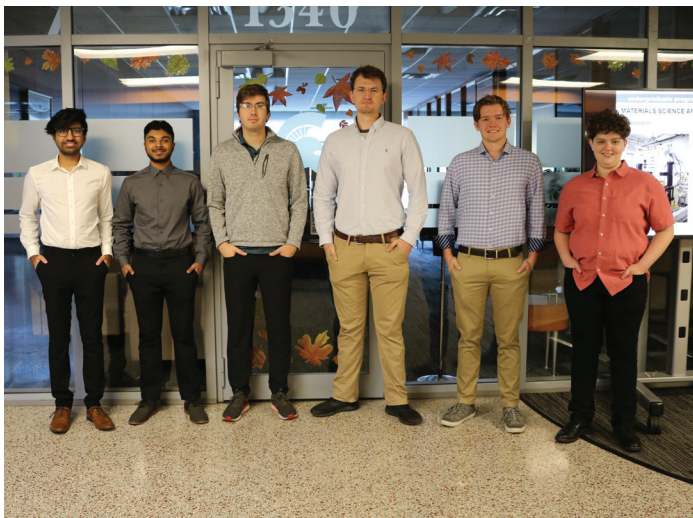
Toyota Motor North America Frontal Area Scanner

Toyota Motor Corporation is a multinational car manufacturer that was incorporated in 1937 in Japan, where the multibillion dollar company is currently headquartered. Toyota is one of the world's leading automotive manufacturers, boasting a production rate of around ten million vehicles per year. Toyota strives to pilot the future of mobility and provide society with the safest and most responsible ways of travel. With this mindset, Toyota has become globally known for its dependable, durable, and high-quality cars, vans, and trucks. The performance division within Toyota's Research and Development sector is responsible for validating designs to ensure that they are reliable and exceed expectation. Furthermore, a prevalent design challenge that Toyota and competing companies face is understanding and reducing the effects of drag on a vehicle. For an object moving through a fluid, such as air, a key factor in the total amount of aerodynamic drag produced by the object is the vehicle's front facing area.

The project was to develop an automated system to determine the frontal area of a vehicle through optical or laser sensors. The system needed to minimize error, maximize efficiency, and be easily portable. Our team addressed these requests from Toyota to further improve the accuracy and time efficiency of a vehicle frontal area scanning system.



TOYOTA



Michigan State University

Team Members

(left to right)

Shamit Topiwala
Macomb, Michigan

Suven Sinha
Barrington, Illinois

Ethan Keppy
Waterford, Michigan

Frederick Bruner
Lowell, Michigan

Evan Backer
Kalamazoo, Michigan

Ash McKesson
Walkerton, Indiana

Toyota Motor North America

Project Sponsors

Nic Evans
Ann Arbor, Michigan

Aditya Ghawre
Ann Arbor, Michigan

Jesse Rydell
Ann Arbor, Michigan

ME Faculty Advisor

Dr. Ranjan Mukherjee

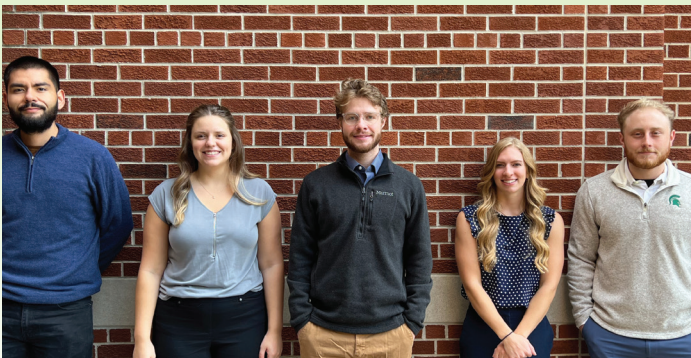
Toyota Motor North America Automotive Child Restraint Detection Sensor

Toyota's vision is to "lead the future mobility society, enriching lives around the world with the safest and most responsible ways of moving people." From roadside assist to pre-collision systems with pedestrian detection, Toyota has prioritized safety when designing its vehicles. Always innovating and looking for new ways to add additional safety to their products, it is now searching for a way to further protect families and their infants on the road and in the backseat.

With this mission in mind, our team focused on designing a sensor system that detects the presence and type of passenger. Specifically, our sensor system determines if there is a rear-facing child restraint installed in the backseat of a vehicle. Toyota does not currently have a frontal airbag system in the backseat; however, this may change with the move to autonomous vehicles. Proper identification of the occupant will enable the car to signal how this airbag should deploy in the presence of a crash. Current frontal airbag systems, like those for the front passenger seating position, can pose a significant risk for children in car seats, particularly when rear-facing. With this sensor system installed, the car will signal the airbag to deploy with less force or not deploy at all. Not only does this system increase infant safety during crashes, but it also relieves some issues with regards to the seatbelt alert system. Most vehicles manufactured after September 1, 2002 are required by law to use low anchor tethers for child safety restraints called "LATCH" hardware. This hardware does not typically come with any type of sensing system. Occasionally, if a car seat is installed with the LATCH hardware and not a seatbelt, a signal is sent notifying the driver that there is a passenger that needs to be buckled. This alert signal can be an annoyance to the driver. With our new sensor system in place, this signal can be avoided if a rear-facing safety seat is installed properly using the anchors and buckles.



TOYOTA



Michigan State University

Team Members

(left to right)

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Michoacán, Mexico

Amber Bliven
Tecumseh, Michigan

Caleb Holtschlag
Bay City, Michigan

Madysyn McKown
Flushing, Michigan

Kainnon Vilminot
Howell, Michigan

Toyota Motor North America

Project Sponsor

Jennifer Pelky

Saline, Michigan

ME Faculty Advisor

Dr. Elisa Toulson

Adventures in Training with a Purpose

Directed Steps: Quick-Release Handle Design

Founded in 2015, Adventures in Training with a Purpose (ATP) was created to confront health and movement-related issues within underrepresented communities who lack the resources necessary to receive proper paid rehabilitation. ATP is a nonprofit 501c(3) organization with the idea of working towards a society where no individual must be held prisoner by the limitations of their health. Adventure represents a journey that has no intention or guarantees but holds the promise that it will be meaningful and eye opening. Training enables individuals to strengthen both their mind and body, giving them more freedom of movement.

Our Quick-Release Handle serves the purpose of providing freedom to patients with movement issues. For these patients, a fall can cause serious injury. While operating ambulation aids, patients will often find themselves caught up in them when falling. Our design serves to remedy this issue by releasing the forearm cuffs from the ambulation aid to allow patients to extend their arms and catch their fall. With our design, ATP clients will be able to regain their independence using crutches that prioritize their safety.



Michigan State University

Team Members

(left to right)

Parker Morris

Rochester Hills, Michigan

Elco Blanco

Rochester Hills, Michigan

Qixian Chen

Beijing, China

Nicholas Montpas

Flushing, Michigan

Hyun Kim

Troy, Michigan

Adventures in Training

with a Purpose

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Wexford, Pennsylvania

ME Faculty Advisor

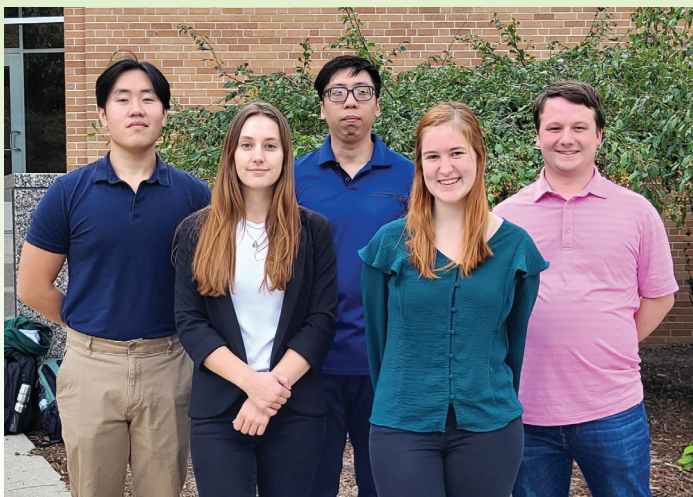
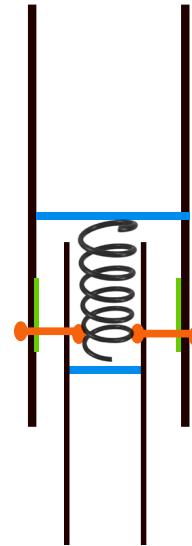
Dr. Elisa Toulson

Adventures in Training with a Purpose

Directed Steps: Ambulation Aid

Adventures in Training with a Purpose (ATP) is a non-profit organization that aids people in refining their bodies, minds, and souls. Their focus is on those who lack insurance coverage for long-term pain and disabilities. Their mission statement declares that no one should be held back due to physical or mental health limitations and should be able to improve one's quality of life through physical training. It is also important to ATP to give back to veterans and active military.

For this project, ATP is looking to help their clients that are not able to walk due to paralysis or neuromuscular deficiencies, through the development of a new type of crutch. Currently, when not using a wheelchair, the clients move forward by using large amounts of body strength to bring themselves up and forward. The goal of this project is to make movement without a wheelchair easier. The crutch has been in development for some time, including by past design project groups. The crutch is made up of three different sections: the handle, the middle, and the foot. This project focuses on the middle section. The proposal for the middle portion is to incorporate a spring in order to conserve energy and help the clients be able to push off the ground more easily while walking. It is also important to make sure to keep this part light and slim so that it is easy to move while in use. The middle portion then needs to be combined with other groups' efforts in order to make sure the three parts can all work cohesively as one crutch. Our team primarily focused on a couple different clients with differing levels of movement in their upper extremities. Once the test clients are able to use the crutch easily, the design will be adapted to work with anyone who may have issues walking.



Michigan State University

Team Members

(left to right)

Jackey Tran

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Erin Chynoweth

Davison, Michigan

Tung Nguyen

Ho Chi Minh City, Vietnam

Victoria Saxton

Saline, Michigan

Evan Lamb

DeWitt, Michigan

Adventures in Training

with a Purpose

Project Sponsor

Jon Kolb

Wexford, Pennsylvania

ME Faculty Advisor

Dr. Lik Chuan Lee

The Capstone Projects



Dr. William Resh
Professor of Mechanical Engineering

Faculty Advisors: Andre Benard, Farhad Jaber, Tom Pence, Harold Schock, Indrek Wichman, Neil Wright



Benard



Jaber



Pence



Schock



Wichman



Wright

Presentation Schedule – Engineering Building, Room 1220

Time	Team Sponsor	Project Title
8:00 a.m.	Ingham ISD	Ready Student Lift
8:30 a.m.	Ingham ISD	Device to Facilitate Self-Installing Foot-Ankle Brace
9:00 a.m.	Steelcase, Inc.	Threaded Fastener Backout Detection
9:30 a.m.	Michigan AgrAbility	Adjustable Modular Tractor Step System
10:00 a.m.	UV-C Safe, Inc.	Germicidal Transaction Portal
10:30 a.m.	UV-C Safe, Inc.	Home Application

Mechanical Engineering Design Program

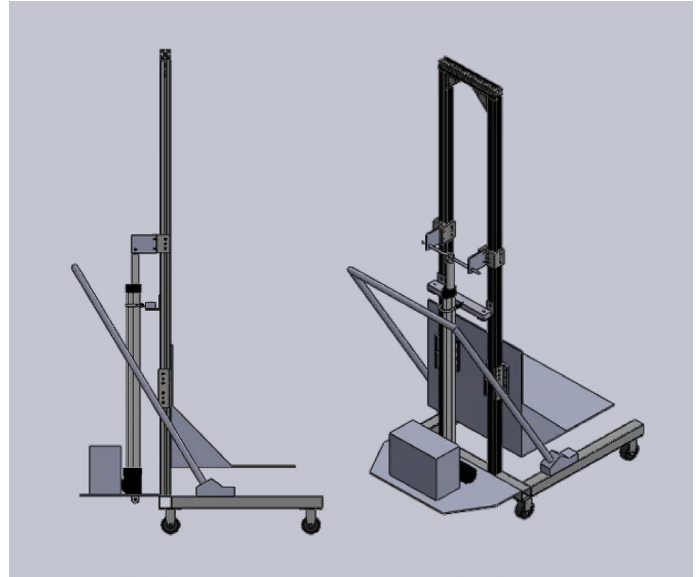
Mechanical engineers make the world move and provide the energy for it to do so. One goal of the MSU Mechanical Engineering Program is to educate engineers who are prepared to lead, create, and innovate as their professional or graduate careers evolve. The Mechanical Engineering Design Program is the key element of the curriculum that supports this goal. There are five required design courses in the program which provide our students with eight hands-on team-based, 'design, test and build' projects, and numerous opportunities to practice and refine their written, oral, poster, and video presentation skills. The Design Program in Mechanical Engineering has attracted national recognition on many occasions and helps to distinguish the ME program as one of the best in the country.

The ME faculty who supervised ME 481 design teams this semester are: Seungik Baek, Andre Benard, Giles Brereton, Abraham Engeda, Farhad Jaber, Manoochehr Koochesfahani, Lik Chuan Lee, Norbert Mueller, Ranjan Mukherjee, Ahmed Naguib, Thomas Pence, Sara Roccabianca, Harold Schock, Elisa Toulson, Indrek Wichman, Neil Wright, Sharon Xiao, and Mohsen Zayernouri.

Ingham ISD Ready Student Lift

Ingham Intermediate School District (Ingham ISD) is a shared community resource that creates networks of support and enhances education for all learners in the service area. Ingham ISD has been partnered with Michigan State University's Department of Mechanical Engineering for multiple semesters. Ingham ISD's mission is to lead and serve to enable achievement and success of all learners. We plan to aid in this mission by improving upon the lift to create a more inclusive environment for students with disabilities.

This Ready Student Lift is a continuation of a spring 2022 design project. The project originally began as a lift for a particular student but has since evolved to be used for students with limited use of their limbs. This project came about out of a need for a safer, easy-to-use lift that could be easily maneuvered in the home or school setting. This lift will allow a single staff member to lift students without putting excess strain on their body. It will help staff to move students from their wheelchair to a classroom chair or toilet, which will allow students to fully participate in class activities. The goal of this project is to improve the current design and to ensure that it is safe to use. The lift specifications are that it must be able to lift a student weighing up to 150 pounds to a height of 30 inches. The lifting mechanism is a linear actuator which is operated by a remote control and powered by a 12-volt battery. Improvements were made to the frame to increase the structural integrity. Safety features were added to prevent pinch points and to ensure safe operation. Anti-tipping mechanisms were added to provide increased stability during the lifting process. These modifications increased the safety and usability of the lift while maintaining a small footprint, which will make it ideal for use in a school environment.



**Ingham Intermediate
School District**

A Regional Educational Service Agency



Michigan State University

Team Members

(left to right)

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Mert Ozmete
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Saaha Lederle
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Ingham ISD

Project Sponsors

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Joanne Janicki
Mason, Michigan

ME Faculty Advisor

Dr. Tom Pence

Ingham ISD

Device to Facilitate Self Installing Foot-Ankle Brace

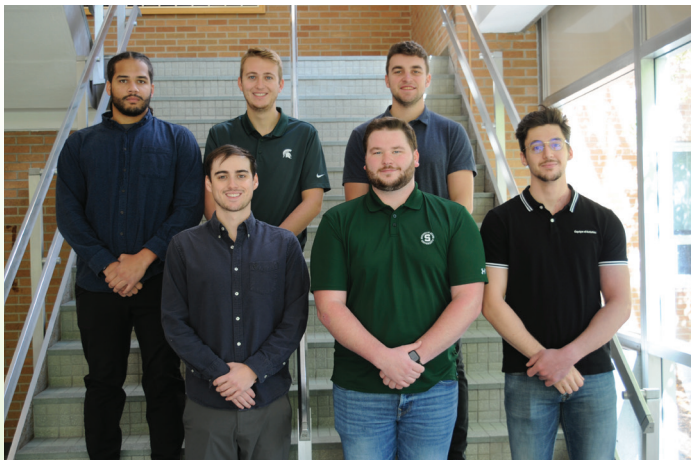
Ingham Intermediate School District is a regional educational service agency that works with 12 schools across seven counties, providing support for preschoolers, students with special needs, their families, and educators. They collaborate with these schools through hundreds of programs and services to give every student a chance to succeed as a learner. One group of students they work with are students who require physical therapy due to physical limitation. Ingham ISD therapists work with students in the local districts to help them achieve independence with functional tasks.

Our team was asked to modify and improve a device that would hold an ankle foot orthosis (AFO) steady while a user is attaching the brace to themselves. The project was assigned to help one particular student who had developed Rapid Onset Dystonia Parkinsonism. This device allows him to safely insert his foot into his brace and use the other side of his body to secure the brace himself. It has been designed such that it can be employed universally by users with a multitude of conditions that would require an AFO. At the request of Ingham ISD, the device has been modified such that it can be mobile and more stable, as well as having the ability to adjust the angle of the orthotic rest plate. To make the device more mobile, a set of easy-lock wheels was added to the bottom of the device. An easy-turn knob system was added to adjust the height and allow for more variation in the possible set heights. The angle adjustability was improved by adding a pin system to allow the device to be secured at a desired angle and the stability was improved by using aluminum for support items in the scissor jack.



**Ingham Intermediate
School District**

A Regional Educational Service Agency



Michigan State University

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Matthew Davidson
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Daniel Vance
Romeo, Michigan

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Ingham ISD

Project Sponsor

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Mason, Michigan

ME Faculty Advisor

Dr. Farhad Jaber

Steelcase, Inc.

Threaded Fastener Backout Detection

Steelcase Inc., headquartered in Grand Rapids, Michigan, offers products in furniture, architecture, and technology aimed to help people reach their fullest potential. Steelcase has a vast product portfolio, including but not limited to seating solutions, tables, desks, and storage solutions. The furniture developed by Steelcase is inspired by innovative research in workspace design. A critical step in designing furniture is ensuring a product will not fail during customer usage. Steelcase performs furniture testing and validation at their Innovation Center in Grand Rapids.

Steelcase has been experiencing issues with threaded fasteners backing out, causing failures during customer usage. This problem is prevalent in a variety of different furniture products and has yet to be easily replicated at Steelcase's Innovation Center. Due to Steelcase's large product portfolio, our team was tasked with creating a universal test fixture and method capable of reproducing bolt backout. The test method must also consider a variety of different threaded fasteners, joint designs, and materials.

Understanding the different fastener types along with their properties, fastening orientations, locking mechanisms, and joint types were all critical to determining the appropriate test method. Testing methods considered were cyclic loading, alternate cyclic loading, and vibrational stressing.

Steelcase was also interested in improving their testing methods by investigating a virtual method that will simulate threaded fastener backout, eliminating physical testing at Steelcase's Innovation Center to a modeling method such as Finite Element Analysis. Therefore, investigating possible methods was also important for this project.



Steelcase®



Michigan State University

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Dorr, Michigan

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Steelcase, Inc.

Project Sponsor

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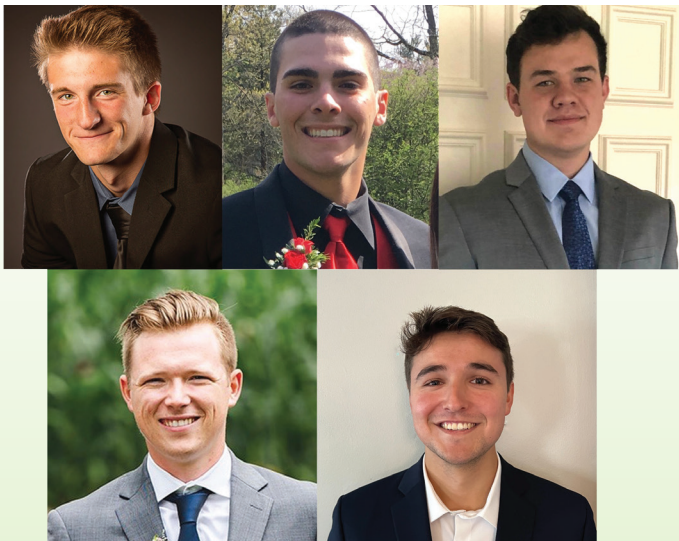
ME Faculty Advisor

Dr. Andre Benard

Michigan AgrAbility Adjustable Modular Tractor Step System

Michigan AgrAbility provides services to farmers around Michigan with disabilities, illness, or aging conditions so they can continue to work. Through the partnership with Michigan State University and Easterseals, Michigan AgrAbility wanted to develop an easier and less expensive way for aging farmers around Michigan to get into their tractors. The bottom steps of farm tractors are typically 22" above the ground. While this is necessary to maintain high ground clearance, it is almost impossible for a farmer with a leg or back injury to climb into the tractor.

Our team was tasked with perfecting a preliminary prototype of an adjustable modular tractor step system that could be an after-market product installed on tractor ladders to help farmers with disabilities continue to do the work they love. The step system is designed to hold over 400 pounds and be robust enough to withstand the farm terrain. The top plate that bolts to the underbody of the operator station floor was designed to be adjusted in two planes in a such way that the system can be easily adjusted based on the type of tractor until the optimal angle of the 2"x2" spine is found. The individual tractor steps were developed with three pinholes. The pinholes allow the steps to be adjusted to find the optimal step angle based on the angle of the spine coming off of the operator station floor. The 2"x2" spine was designed with an inspiration from an adjustable weightlifting bench. The grooves in the back side of the spine will allow the steps to be moved based on the individual farmer's needs and once the optimal step height is found, the grooves in the spine coupled with the pin in the steps will lock the steps in place. The team's adjustable modular tractor system will help make sure farmers with leg injuries, arthritis, and other disabilities can continue working.



Michigan State University Team Members

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Michigan AgrAbility Project Sponsor

Ned Stoller
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ME Faculty Advisor

Dr. Indrek Wichman

UV-C Safe, Inc. Germicidal Transaction Portal

UV-C Safe is a company that uses ultraviolet light with wavelength up to 400 nanometers to disinfect products, surfaces, and air from germs and viruses. The goal of the UV-C Safe products is to minimize the spread of germs and viruses and create a safe environment to prevent the spread of diseases. The Germicidal Transaction Portal uses a UV-C Safe light that can be attached to sneeze guards at transaction points to make them safer.

The Germicidal Transaction Portal helps sanitize the area its light is directed at without any human interference or effort. The goal of our team was to increase accessibility to this product due to its efficiency in limiting viruses and bacteria transmission in crowded places. To ensure that the product serves as many people as possible, we designed a holder that can be attached to most of the commercial sneeze guards that are on the market. The design was created to be simple in terms of installation and mounting, since the UV-C Safe light is going to be installed by the consumer.



UV-CSAFE.COM
MAKING TRANSACTIONS SAFER



Michigan State University

Team Members

(left to right)

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Abdulkareem Alasmari
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Renad Alhassani
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UV-C Safe, Inc.

Project Sponsor

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Grosse Pointe Park, Michigan

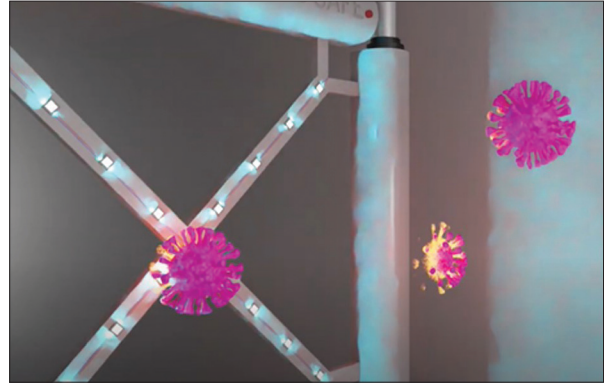
ME Faculty Advisor

Dr. Harold Schock

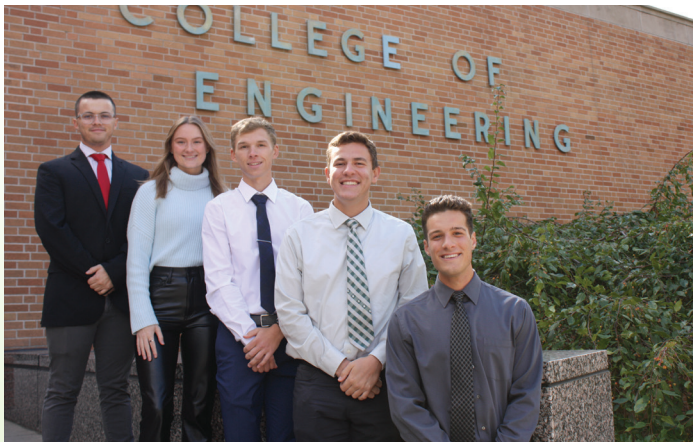
UV-C Safe, Inc. Home Application

The COVID-19 pandemic has brought a drastic increase in sanitation efforts and methods to combat the spread of germs and viruses. UV-C Safe's mission is to create the most innovative quality-of-life solutions. By engaging in a multifaceted, technology-based, non-pharmaceutical, pandemic countermeasures within the fields of research, design, manufacture, and sale of photon and proton management solution technologies, UV-C hopes to mitigate the impacts of epidemics and prevent future pandemics. One such technology is UV-C. Ultraviolet light in the C Spectrum, or UV-C, is energy rich light with a wavelength of 10 nanometers to over 400 nanometers used to clean air and the surfaces of objects.

Our team was tasked with designing a mounting solution for UV-C lighting technology to be used within a standard home cold air return. Placing UV-C lighting in this area allows for the passing air to be disinfected and safer. The design was to be simple and flexible in mounting options, as cold air returns vary greatly from household to household. We focused on designs that would have minimal blockage of airflow together with a large quantity of the air being exposed to the disinfecting UV-C light. Additionally, our design was to have the lighting face into the HVAC ducting, as UV-C can be potentially harmful to the eyes, so safety was a very important design factor. The ideal version of this product was cost-effective and easily installed by the user.



UV-CSAFE.COM
MAKING TRANSACTIONS SAFER



Michigan State University

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UV-C Safe, Inc.

Project Sponsor

Rik Hudechek

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ME Faculty Advisor

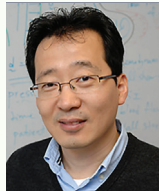
Dr. Neil Wright

The Capstone Projects



Dr. William Resh
Professor of Mechanical Engineering

Faculty Advisors: Seungik Baek, Abraham Engeda, Manoochehr Koochesfahani, Ahmed Naguib, Sara Roccabianca, Mohsen Zayernouri,



Baek



Engeda



Koochesfahani



Naguib



Roccabianca



Zayernouri

Presentation Schedule – Engineering Building, Room 1300

Time	Team Sponsor	Project Title
8:00 a.m.	MSU Adaptive Sports & Recreation Club	Roller Hockey Sled Mobility: Phase III
8:30 a.m.	MSU Adaptive Sports & Recreation Club	Inclusive Sports Wheelchair: Phase VII
9:00 a.m.	MSU Adaptive Sports & Recreation Club	Sled Hockey Transfer Platform: Phase VI
9:30 a.m.	MSU Adaptive Sports & Recreation Club	3-Wheel Drive System for Scooter: Phase I
10:00 a.m.	MSU College of Engineering	Mobile Storage for Easels
10:30 a.m.	MSU College of Engineering	Easel Storage Cart Design

Mechanical Engineering Design Program Awards

The Mechanical Engineering Design Program makes two project awards on Design Day. The most significant award is the Thomas Alva Edison Design Award—a medal—given to each member of the ME 481 Capstone design team that produces the most outstanding technical design project. This award considers the team's performance over the duration of the project, their presentations, the project solution, and prototype quality.

A second ME 481 Capstone award is given to the team that gives the best technical project presentation. The importance of communication of scientific and engineering ideas cannot be understated, and it is for this reason that we make the ME 481 Project Presentation Award. Award winners typically will have built an impressive prototype which forms the basis for a very clear and effective presentation of the project background and its solution, often incorporating live or video demonstrations of its functionality.

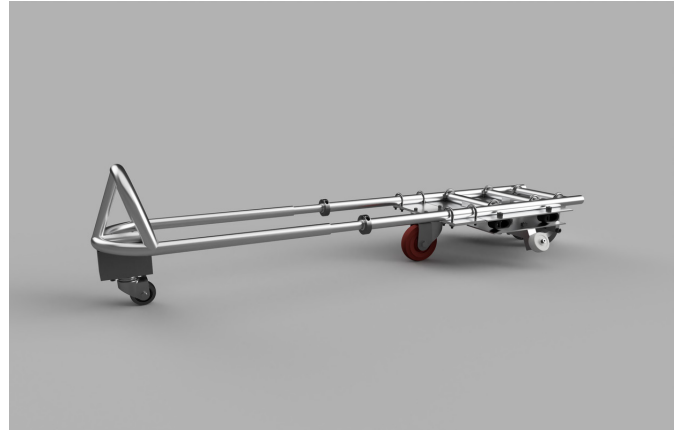
The ME Design Program also presents the Leonardo da Vinci Machine Design Award to the winners of its ME 470 Machine Design competition. The specific design problem and criteria for this competition change from semester to semester.

MSU Adaptive Sports & Recreation Club

Roller Hockey Sled Mobility: Phase III

MSU's Adaptive Sports & Recreation Club is a free program offered to people who have physical disabilities so they can participate in a range of adaptive sports and games. The club was founded in 2014 and has been a leading program in creating a safe and enlightening environment for those with disabilities, and able-bodied volunteers, enabling them to experience sports from an inclusive perspective. The club also promotes a healthy lifestyle and promotes self-esteem in its participants.

Our team's task was to improve the club's adaptive roller hockey sleds to become more inclusive and mobile for players in Demonstration Hall where practices and games are held. It is the club's goal to use these sleds instead of the wheelchairs being currently used. However, the previous design still needed significant improvement in order to accomplish desired mobility levels. This sled design expanded on the previous Phase II design. The motivations of our design changes were based on improving the mobility of the sled, the comfort levels of the user, and the inclusivity of the overall design. Our changes included removing excess material to decrease the weight of the sled, replacing select wheels with better alternatives, and improving the traction when used on the Demonstration Hall floor surface. Iterative design testing was conducted to assess the effectiveness of each of the design changes.



Michigan State University

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MSU Adaptive Sports & Recreation Club
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Piotr Pasik
East Lansing, Michigan

ME Faculty Advisor

Dr. Mohsen Zayernouri

MSU Adaptive Sports & Recreation Club

Inclusive Sports Wheelchair: Phase VII

The MSU Adaptive Sports & Recreation Club brings inclusivity to sports in the MSU and East Lansing community. Participants in this organization include individuals with physical disabilities, volunteers, and MSU project groups. The overarching mission of the MSU Adaptive Sports & Recreation Club is to provide opportunities for all individuals to experience the benefits of exercise including stress relief, increased physical health, and socialization. This program works to fight the societal limitations placed on individuals with physical disabilities by providing a supportive and welcoming community that is constantly innovating to create a place in sports for all people. While the MSU Adaptive Sports & Recreation Club has expanded opportunities in sports for many, there remains a gap in accessibility, particularly for ambulatory individuals with asymmetrical muscle function.

This project focused on the seventh phase of a customized tennis wheelchair for an ambulatory individual with asymmetrical functionality. Previous phases accounted for the needs of propulsion using the lower body due to the inability to rely solely on the arms. Additionally, the chair was designed to use the non-dominant arm for steering and braking to leave the dominant arm free for playing tennis. Safety mechanisms such as a seatbelt were also implemented. The seventh phase of the project focused on advancing the steering and braking systems to increase ergonomics and performance, as well as the propulsion system to increase practicality and efficiency. This phase of the project took the original state of the tennis wheelchair and advanced it to have increased personalization and effectiveness to meet the needs of the intended user more closely.



Michigan State University Team Members (left to right, top to bottom)

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MSU Adaptive Sports & Recreation Club Project Sponsor

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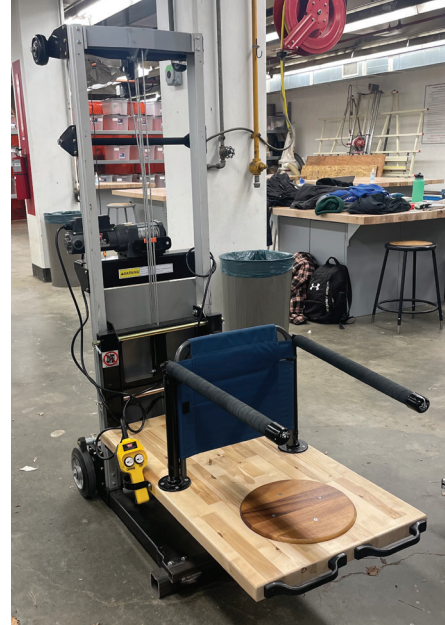
Dr. Ahmed Naguib

MSU Adaptive Sports & Recreation Club

Sled Hockey Transfer Platform: Phase VI

The MSU Adaptive Sports & Recreation Club, is an organization that includes athletes and individuals with physical disabilities as well as volunteers and members of the greater East Lansing community. Within the adaptive sports community, promoting a physical and socially accessible space is a continually evolving task. The club has established an integrated community through a variety of sports, including sled hockey. While constantly promoting physical health, social behavior, and psychological wellness through adaptive sports, the club strives to provide a self-determination approach focusing on athlete autonomy, competence, and relatability. By doing this, the club has provided members with increased independence and enhanced quality of life leading to success both in sports and in other domains.

Our team focused on creating a way to secure the sled to the platform, improve the grab bars to increase stability while mounting the transfer platform, and create a safety stop for the winch mechanism to ensure that if there is a malfunction, there will be no damage done to the system.



Michigan State University

Team Members

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Stevensville, Michigan

Max Wiedemann

Clarkston, Michigan

Austin Pollock

Lowell, Michigan

Grace Vennstra

Shelby Township, Michigan

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East Lansing, Michigan

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Dr. Seungik Baek

MSU Adaptive Sports & Recreation Club

3-Wheel Drive System for Scooter: Phase I

The MSU Adaptive Sports & Recreation Club serves the community by offering a variety of recreational sports for players with physical disabilities. Health and teamwork are promoted through the use of sports. Some of these recreational sports include wheelchair hockey, wheelchair rugby, and adapted track & field. Participants have access to three on-campus buildings dedicated to recreational activities. These buildings include Jenison Fieldhouse, the MSU Tennis Center, and Demonstration Hall.

With the harsh weather conditions of Michigan, it can be difficult for individuals who use mobility scooters to travel to their destination. Our team was tasked with prototyping a three-wheel drive system for an existing scooter (E-Wheels EW-36). The three-wheel drive system is easily replicable, universal, and reliable. Navigating harsh winter weather conditions will now be less stressful with the added traction and power the three-wheel system provides. Phase I is a great proof-of-concept that provides a concrete platform for future design teams continuing to improve this scooter to ensure that the individual has a reliable mode of transportation year-round.



Michigan State University

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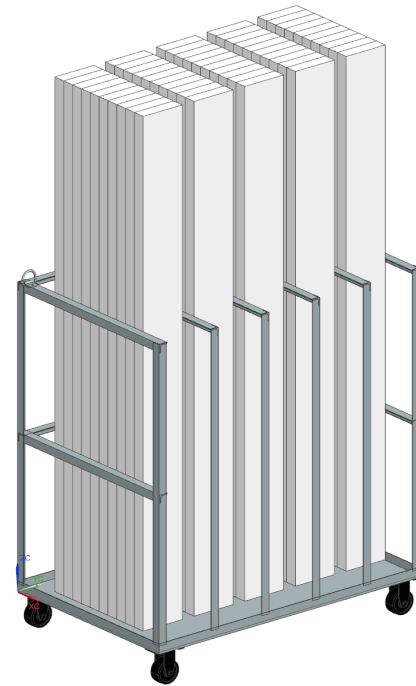
ME Faculty Advisor

Dr. Abraham Engeda

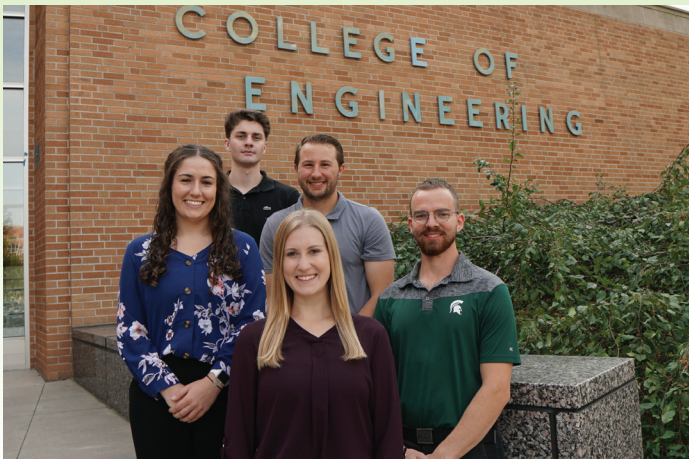
MSU College of Engineering Mobile Storage for Easels

Every semester, the College of Engineering hosts various events in which students present projects that they have been working on. One such an event is the graduate research symposium. Students create posters highlighting their projects or research and display these posters on five-foot-tall easels. The college has over 300 of these easels that are only used a few times per year for poster-centric events. They are stored in groups of fifty on repurposed carts (such as a cart formerly used to carry trays of food). All the carts were built with the sole purpose of moving fifty easels, with little attention to the users. Loading and unloading the carts is difficult and involves awkwardly lifting the five-foot easel over a four-foot railing. To be fully loaded, the current carts must be loaded very specifically.

Our team was tasked with designing a new cart to move the same number of easels with ease-of-use at the forefront of the design. This involved building a larger cart and not requiring the user to lift the easels over a railing. The storage facility where the easels are stored is not climate or rodent controlled. Rather than keeping the rodents out, the cart was designed to ensure any rodent visitors would be able to escape. Our team worked to design a cart that was simple and repeatable so future carts could be built based on this design.



College of Engineering
MICHIGAN STATE UNIVERSITY



Michigan State University

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Katie McMillan
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Meghan Parkinson
Rochester Hills, Michigan

MSU College of Engineering

Project Sponsor

Katy Colbry
East Lansing, Michigan

ME Faculty Advisor

Dr. Manoochehr Koochesfahani

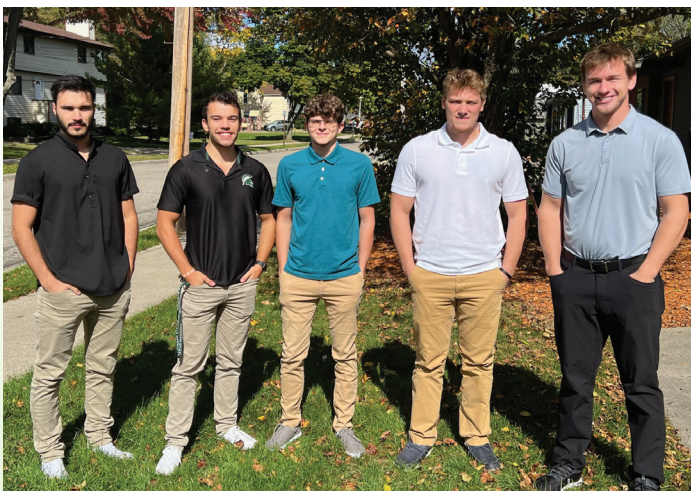
MSU College of Engineering Easel Storage Cart Design

The College of Engineering at Michigan State University is one of the oldest colleges on the campus, dating back to 1885. Its goal is to prepare students for the future challenges of business, industry, and academia. The College of Engineering is staffed with people from all around the world. They are valued for their leadership and teaching abilities, as well as extensive knowledge throughout engineering and the technological field. The College of Engineering consists of seven departments with eleven undergraduate degree programs and nine graduate degree programs.

The MSU College of Engineering owns 300 easels that are used for various poster symposia and other events a few times per year. One cart of 50 easels is stored in the Engineering Building, and five carts of 50 easels each are stored offsite in a “pod” that is not climate-controlled and tends to attract rodents. Presently, the easels are stored and transported in repurposed bakery racks, which do not meet their needs. Our project was to create a sturdy and portable cart design in which the easels can be accessed by people of varying heights. The easels need to be easy to remove and the carts need to be able to hold 50 easels/each.



College of Engineering
MICHIGAN STATE UNIVERSITY



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Connor Laubach
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Project Sponsor
Katy Colbry
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ME Faculty Advisor

Dr. Sara Roccabianca

Design Day Awards

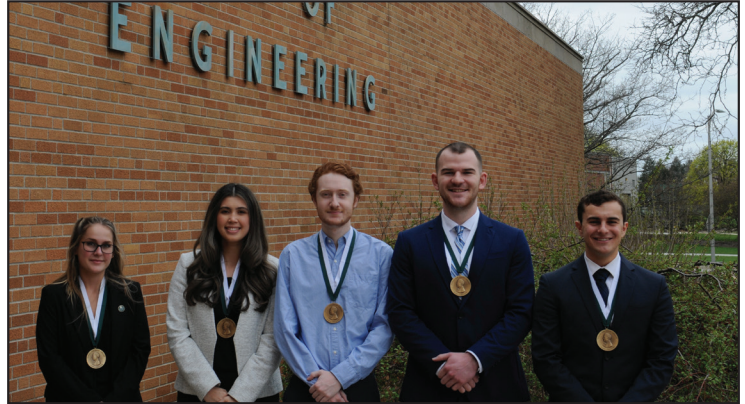
Spring 2022

ME 481 Edison Award:

The Edison Undergraduate Design Award is given to the ME 481 Design Team that is judged to have produced the best technical design project.

Team Adventures in Training with a Purpose: "Quick-Release Handle Design"

Left to right: Lila Ninotti, Vanessa Pariso, Joshua Woodford, Brian Hanton, Delano Dalfonsi

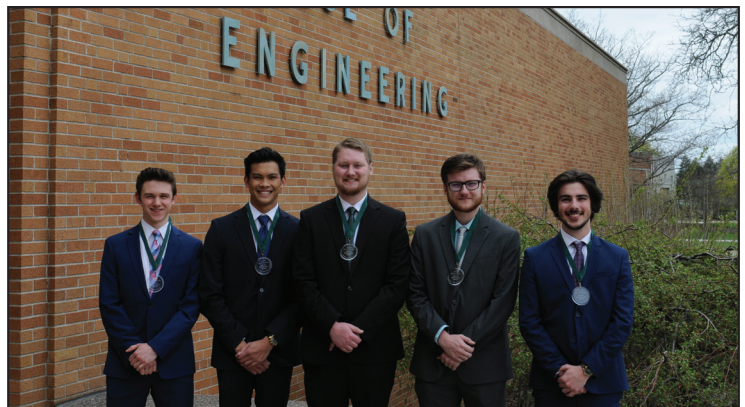


ME 481 Presentation Award:

The ME 481 Project Presentation Award for the best presentation of a design project.

Team Adaptive Sports & Recreation Club: "Increasing Hockey Sled Mobility"

Left to right: Cam DePauli, John Paul Dela Cruz, Cody Hayse, Griffin Yakey, Alex Toth



ME 470 DA VINCI AWARD

The Leonardo da Vinci Award was presented to the team with the best machine design.

Left to right: Abdul Salem, Justin de Coster, Jaclyn Duff, Beth Caldwell, Instructor Michael Lavagnino





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