MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY

Design Day

COLLEGE OF ENGINEERING

Fall 2013

GM

Executive Partner Sponsor

WE ARE THE DRIVING FORCE

WE ARE THE DRIVING FORCE
GENERAL MOTORS

Dear Students, Family Members, Company Representatives, Alumni, Faculty & Staff:

On behalf of General Motors, and in partnership with Michigan State University (MSU), it gives us great pleasure to welcome you to the beautiful MSU campus and to the MSU College of Engineering Design Day. GM is proud to partner with Michigan State University on this event, which highlights the talents and capabilities of many outstanding students.

Design Day demonstrates the intellect, ingenuity, teamwork and core engineering skills of current MSU College of Engineering students in delivering their Design Day projects. Without fail, the students provide inspiration to us all as they raise the bar on what can and should be possible. It also gives us great confidence that we have a bright future as these students move into the workforce and help shape the industry.

We wish everyone in attendance today a wonderful and exciting day here on the MSU campus. Along with family members, sponsors and representatives, GM congratulates the participants of today's event. Best of luck to all!

Sincerely,

Fred Killeen,
Chief Technology Officer, Information Technology, General Motors

LEAD. LEARN. DO BOTH AT GM.

WWW.CAREERS.GM.COM

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Welcome from the Dean

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

We wish you an enjoyable event as you experience our students and their amazing talents through presentations, competitions, demonstrations and posters.

We are pleased to welcome General Motors as our Design Day Executive Partner Sponsor for the first time. We thank Whirlpool for being our Design Day Directing Partner Sponsor for a second time. Our Design Day Supporting Partner Sponsors include ArcelorMital, Bosch, MSU Federal Credit Union, Norfolk Southern, TechSmith and USAA. 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.

Another exciting part of Design Day is the Dart Foundation Day of Engineering Innovation and Creativity for 7th-12th Grade Students, which involves some 200 local junior high and high school students. On Design Day, these future engineers explore design principles with hands-on projects requiring the application of their creativity and ingenuity.

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.

Dr. Leo Kempel

Acting Dean of the College of Engineering

Professor of Electrical and Computer Engineering

Michigan State University

Design Day Events Schedule
Friday, December 6, 2013

EVENTS	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon	1 p.m.
Audio Enthusiasts and Engineers		2nd Floor 2200 Hallway/Rm 2228 8:00 a.m. – Noon					
Sponsor Booths & Engineering Student Organizations		1st Floor Lobby and East Lobby 8:00 a.m. – Noon					
Entrepreneurship Corner		EB/Anthony Hall Lobby 8:00 a.m. – Noon					
ECE 101 Presentations			2nd Floor 2200 Hallway 9:00 a.m. – Noon				
EGR 100 Presentations			2nd Floor 2300/2200 Hallway 9:00 a.m. – 11:30				
ME 371 Demonstrations			1st Floor Room 1240 9:00 a.m. - Noon				
ME 412 Competition		1st Floor Room 1225 8:20 a.m. - 11:40 a.m.					
ME 471 Competition		1st Floor Room 1345 8:00 a.m. - 11:25 p.m.					

CAPSTONE COURSES							
All Capstone Posters for most projects		1st Floor 1300 Hallway 8:00 a.m. - Noon					
CE 495 Project Presentations		3rd Floor 3540 8:00 a.m. - Noon					
CSE 498 Project Presentations		3rd Floor 3405 A & B 7:30 a.m. - Noon					
ECE 480 Project Presentations		2nd Floor Room 2250 8:00 a.m. - Noon					
ME 481 Project Presentations			1st Floor 1200 Hallway/Rooms 1208 & 1220 8:30 a.m. - Noon				

OPENING, LUNCH AND AWARDS							
High School Opening			1st Floor Anthony, Room 1279 8:45 a.m. - 9:00				
High School Award			1st Floor Anthony, Room 1279 Noon - 12:15 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/SpartanEngineering

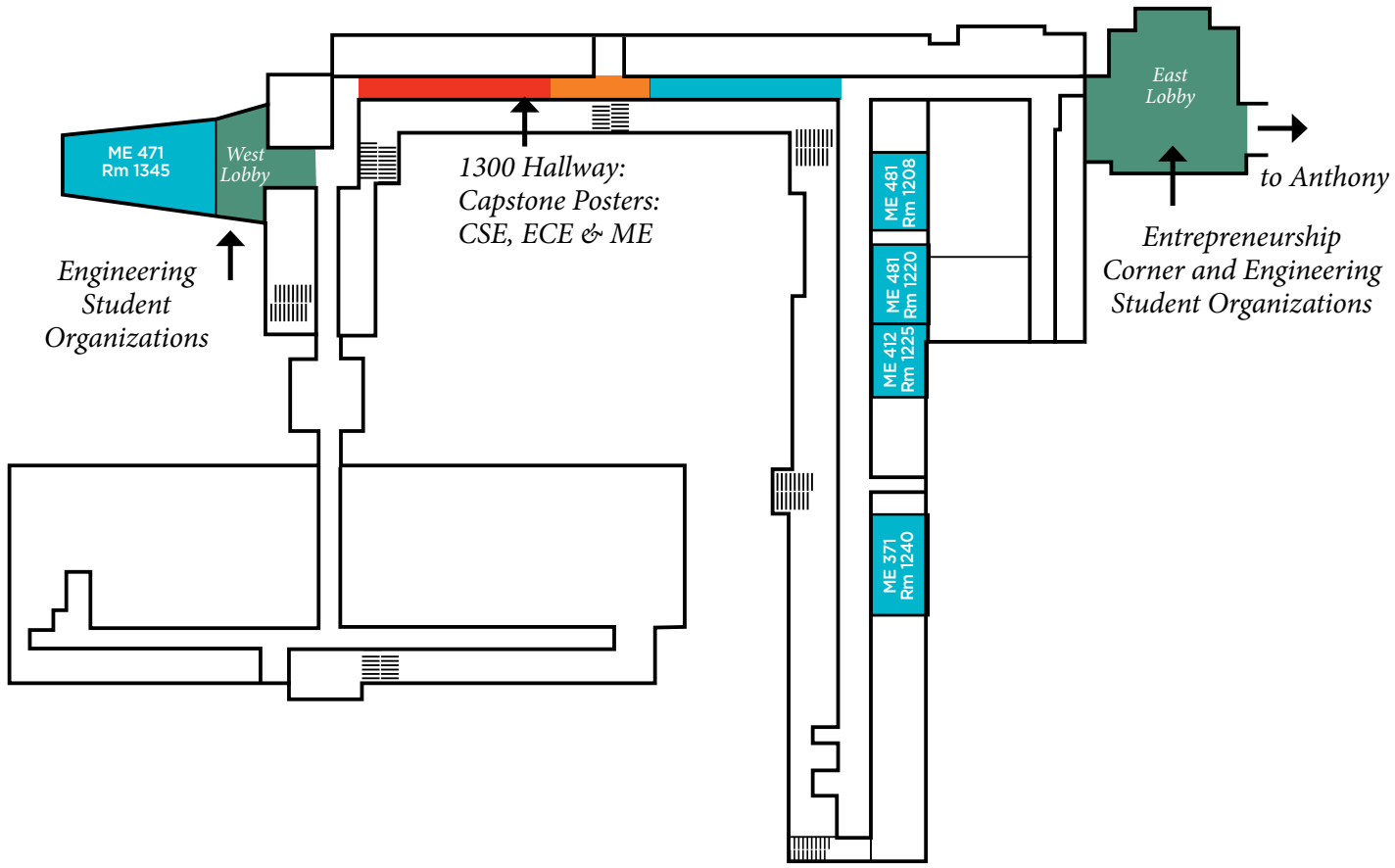
"Follow" the College: https://twitter.com/msu_egr_news

To stay up to date w/Careers in Engineering:

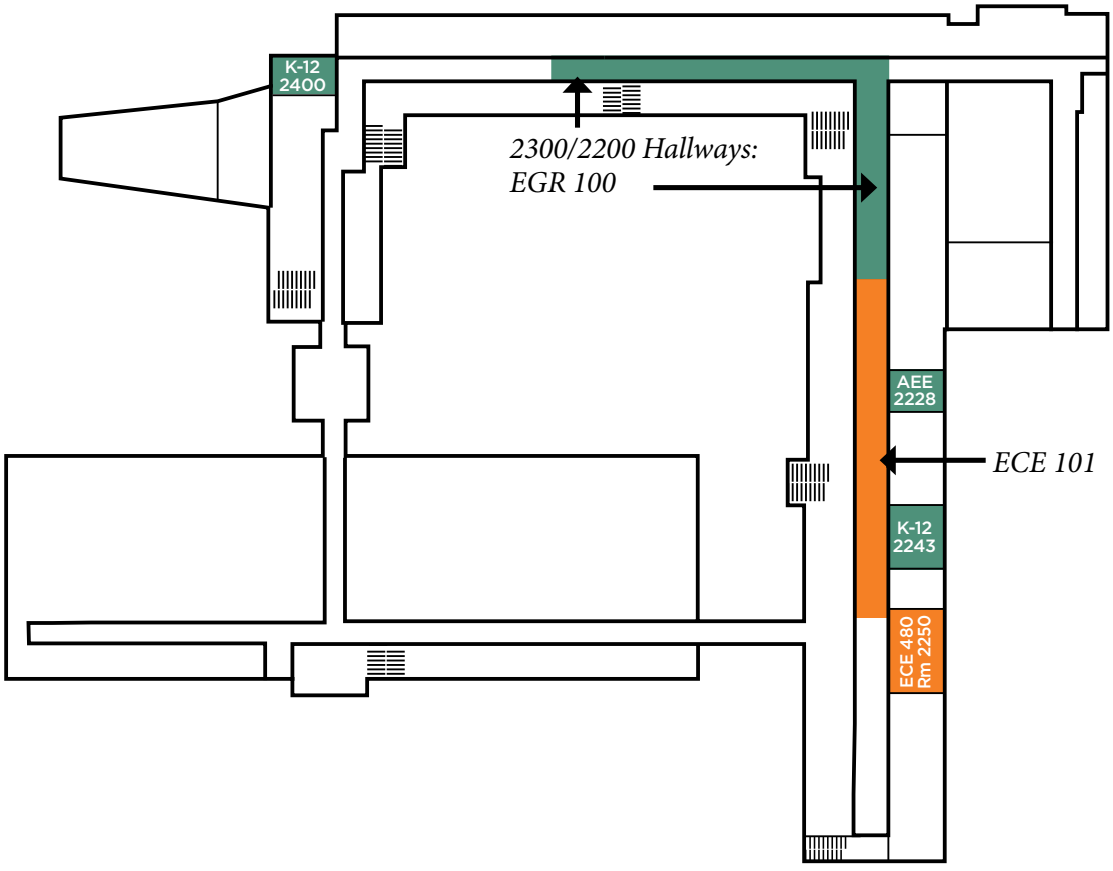
"Like" Us http://www.facebook.com/pages/The-Center-for-Spartan-Engineering/226159694117936

"Follow" Us: https://twitter.com/msuengineer

1st Floor Engineering

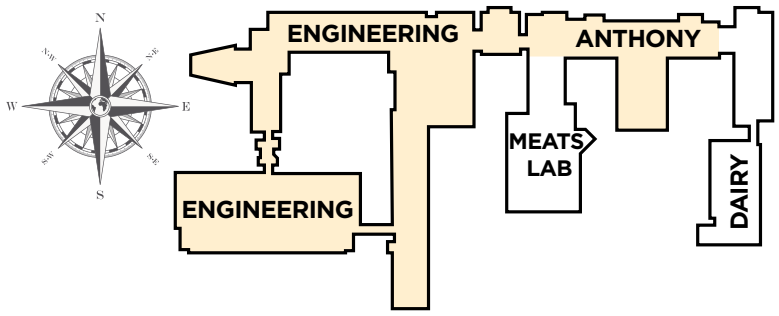


2nd Floor Engineering

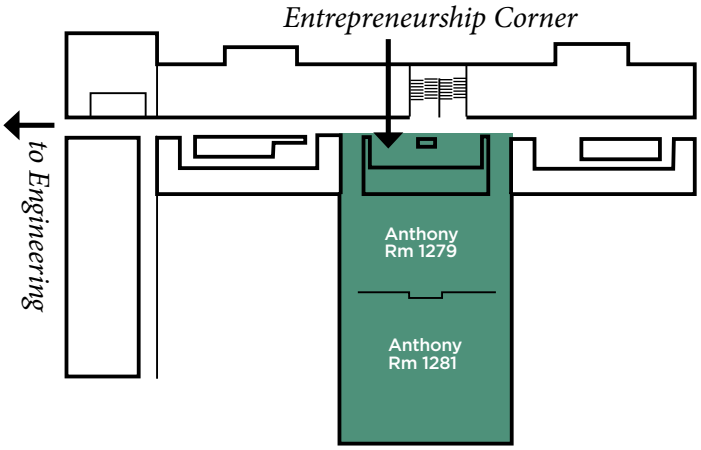


Design Day Floor Plans of the MSU Engineering Building

Overview



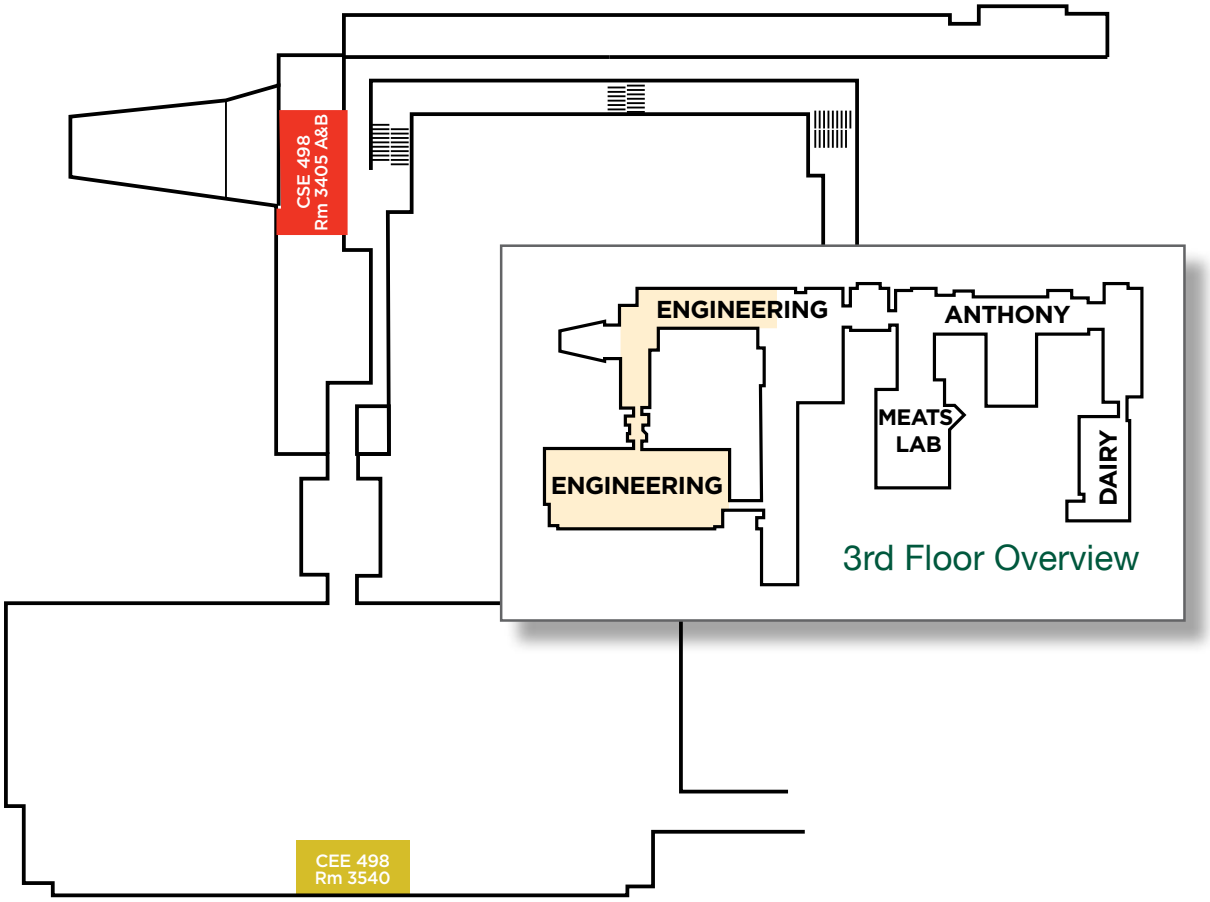
1st Floor Anthony



Color Legend:

- CEE
- CSE
- ME
- ECE
- Joint/Other

3rd Floor Engineering



Thank you!

Roy Bailiff, Department of Mechanical Engineering
Denise Barnsted, College of Engineering
Dean Buggia, K-12 Outreach
Career Peers, Center for Spartan Engineering
Linda Clifford, Department of Electrical and Computer Engineering
Kelly Climer, Department of Computer Science and Engineering
Judy Cordes, Women in Engineering
Sandy Christlieb, College of Engineering
Jeff Curtiss, College of Engineering
Cathy Davison, Department of Computer Science and Engineering
Division of Engineering Computer Services
Malcolm Doering, Department of Computer Science and Engineering
Ethan Fahy, K-12 Outreach
Bernadette Friedrich, Center for Spartan Engineering
Craig Gunn, Department of Mechanical Engineering
Leo Kempel, College of Engineering
Debbie Kruch, Department of Computer Science and Engineering
Kyle Liechty, Center for Spartan Engineering
Garth Motschenbacher, Center for Spartan Engineering
Mary Mroz, Department of Civil Engineering
Pat Mroczek, College of Engineering
Greg Mulder, Department of Electrical and Computer Engineering
Roxanne Peacock, Department of Electrical and Computer Engineering
Adam Pitcher, Department of Computer Science and Engineering
Jeanette Robertson, College of Engineering
Laura Taylor, Department of Civil Engineering
Norma Teague, Department of Computer Science and Engineering
Francie Todd, College of Engineering
Tom Wolff, College of Engineering
Brian Wright, Department of Electrical and Computer Engineering

Jill Bielawski, Editor, Design Day Book
Iain Bogle, Graphic Designer, Design Day Book

Thanks to you all for making Design Day a success.

Wayne Dyksen, Executive Director, Design Day

Jennifer Jennings, Director, Design Day

Dart Day of Innovation and Creativity

for 7th-12th Grade Students

Our Future Lies in Some Very Precious Hands...

At the Dart Foundation, we are committed to developing scientifically literate students in Michigan. We're proud to sponsor the MSU College of Engineering Design Day for pre-collegiate students.

Funded by the Dart Foundation

DART FOUNDATION℠

MICHIGAN STATE UNIVERSITY | College of Engineering

The Dart Foundation

Middle and High School Innovation and 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.

DART FOUNDATION

Office for Inclusion and Intercultural Initiatives

NSF

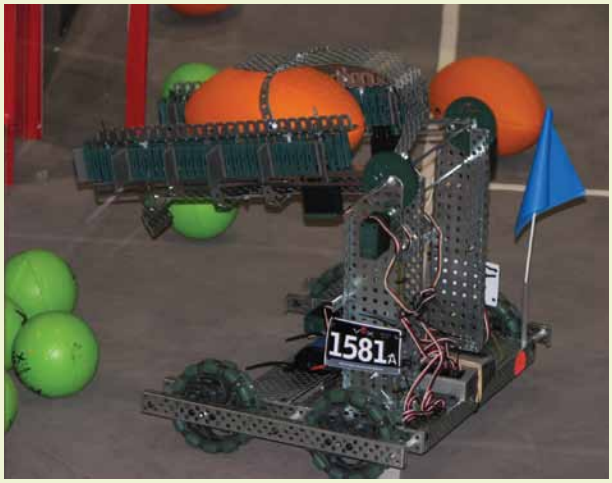
MOTOROLA

	Room 1279 Anthony Welcome all Schools	C.E./M.E. Team Build Room 2243	VEX Robotics Room 2400	1st & 2nd Floor Voting/ project viewing
8:45–9:00	All Schools 1 thru 6			
9:05–9:55		Schools 1 & 2	Schools 5 & 6	Schools 3 & 4
10:00–10:55		Schools 3 & 4	Schools 1 & 2	Schools 5 & 6
11:00-11:55		Schools 5 & 6	Schools 3 & 4	Schools 1 & 2
12:00–12:10	All students in Room 1279 Anthony for the awards ceremony. Lunch will immediately follow.			

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

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 a 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.

MEMBERS OF THE ORGANIZING COMMITTEE *for Innovation and Creativity Day, Fall 2013*

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

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

Russ Pline
Okemos High School and MSU Engineering Recruitment and K-12 Outreach Design Day Coordinator

Samantha Pohlen
K-12 Outreach Design Student Coordinator

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

LEAD. LEARN.
DO BOTH AT GM.

There's an unmistakable momentum happening at GM. Now, more than ever, we're poised to shape the future of tomorrow, today. From robust IT initiatives to shortened software development cycles, GM is defying convention to elevate the automotive industry as we know it. Bring your ideas and lend your experience to an international company that's as excited about your success as we are our own. Take the next step in your career at GM and discover what our employees already know — that together, there's no stopping us.

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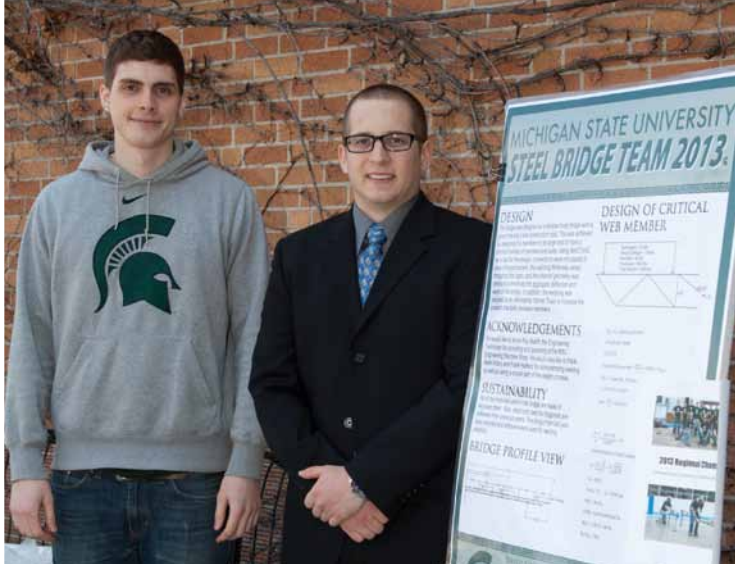
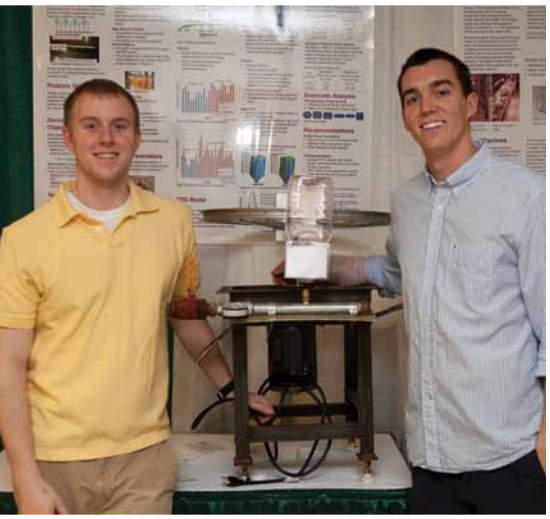

MICHIGAN STATE UNIVERSITY
STEEL BRIDGE TEAM 2013
DESIGN
DESIGN OF CRITICAL WEB MEMBER
ACKNOWLEDGEMENTS
SUSTAINABILITY
BRIDGE PROFILE VIEW




TechSmith


EXIT

EGR 100
Introduction to Engineering Design

Mr. Timothy Hinds
Academic Director

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. Nearly 800 students are enrolled in EGR 100 this semester.

For the final course project, the student teams were selected from six project types: (i) Robotics Challenge, (ii) Solar Car Competition, (iii) Cell Phone App Inventor, (iv) Thermal Insulator Design, (v) MSU Resource Center for Persons with Disabilities (RCPD) Designs, and (vi) Residential Initiative on the Study of the Environment (RISE) Projects. There were three RCPD projects including Assistive Tools for Understanding Multivariable Calculus, Basic Electronics Assistive Tools and Accessible MSU Campus Maps. The two projects for RISE were Green Roof Water Collection System and Green Roof Water Distribution System. Teams from each of the project types will display their prototypes at Design Day along with posters detailing their design concepts. Pre-college students will recognize the most outstanding projects with awards.

Spring 2013 EGR 100 Project Poster Award Winners:

l-r: (Pat Walton), Kun Qian, Jaaron Summers, Alexander Kendall, (Leo Kempel), Tianhang Sun, (Tim Hinds)

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

Ford Community Corps
UNION PACIFIC
MICHIGAN STATE UNIVERSITY RISE RESIDENTIAL INITIATIVE TO STUDY THE ENVIRONMENT
GE
Resource Center for Persons with Disabilities
Consumers Energy Count on Us
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The Capstone Projects

Faculty Advisors:
Professors Baladi, Haider, Kodur, Li, Likens, Lyles and Masten


Baladi


Haider


Kodur


Li


Likens


Lyles


Masten

Presentation Schedule – Room 3540

Time	Team	Room
8:00 a.m.	Team One	Third Floor Room 3540
9:20 a.m.	Team Two	Third Floor Room 3540
10:40 a.m.	Team Three	Third Floor Room 3540

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 work place 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, geotechnical, hydrological, pavement, transportation, and structural 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

PROFESSIONAL SEMINAR SPEAKERS

Michele J. Buckler, PE
Fishbeck, Thompson, Carr & Huber

Paul M. Davis, PE
City of Rochester Hills

Daniel G. Fredendall, PE
OHM Advisors

Ryan D. Musch, PE
Fishbeck, Thompson, Carr & Huber

Cheryl A. Kehres-Dietrich, CGWP
Soil & Materials Engineers, Inc.

Robert D. Rayl, PE
RS Engineering, LLC

Charles Rolfe, PE
OHM Advisors

Scott K. Stowitts, PE
Walbridge

Michael J. Thelen, PE
Soil & Materials Engineers, Inc.

Daniel Thome, PE
Nicholson Construction Company

Roy D. Townsend, PE
Washtenaw County Road Commission

Mark A. VanPortfleet, PE
Michigan Department of Transportation

Christian G. Youngs, PE
Michigan Department of Transportation

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.

Len Becker, PE
HNTB

Rick Chelotti, PE
Bergman Associates

Daniel Christian, PE
Tetra Tech MPS

Tim Greenleaf
Barr Engineering Co.

Andrew Hermiz, EIT
Harley Ellis Devereaux

Stu Kogge, PWS
JF New

Michael J. Labadie, PE
Fleis & VandenBrink Engineering

Thomas Larder, PE
Process Results, Inc.

John LeFevre, PE
MSU Physical Plant

Peter Margules, PE
NTH Consultants

George McKenzie, PE
Consumers Energy

Todd Sneathen, PE
Director of Public Works

Michael J. Thelen, PE
Soil & Materials Engineers, Inc.

Anthony Thomas, PE
Soil & Materials Engineers, Inc.

Phillip Vogelsang, PE
URS Corporation

Jeremie Wilson, PE
PE Michigan Department of Transportation

Civil & Environmental Engineering Civil Design Award

The Civil & Environmental Engineering Senior Design Award ($700 and plaques) is presented to the best team as judged by the faculty and a panel of practicing engineers.

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.

These companies currently make this award possible. FTC&H is a professional civil engineering, environmental consulting, architectural/engineering, and construction management firm with clients in Michigan and throughout the nation. Barr Engineering is a professional engineering company providing engineering, environmental, and information technology services to clients across the nation and around the world.

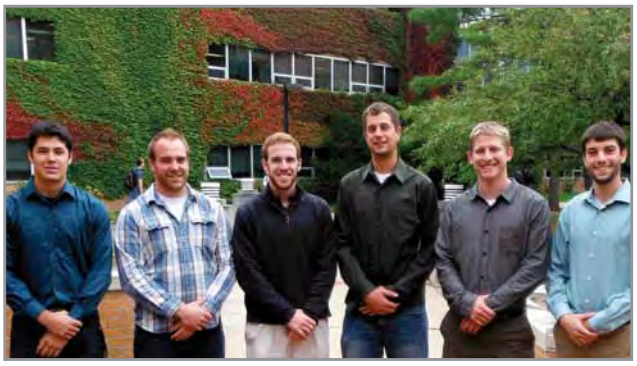
Award Sponsors

BARR

ftc&h

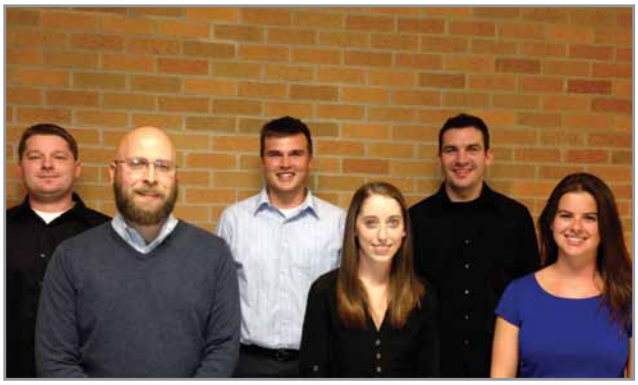
Michigan State University
Student Apartment Complex Designs

Student-teams developed preliminary designs for elements of a 160-unit student apartment complex located east of campus near the Red Cedar River. Two configurations were considered: the existing development employs three buildings, each with a paved, uncovered, interior courtyard that is used for parking; building height is limited to three stories above ground in order that wood frame construction can be employed. The second alternative would provide the same number of housing units in a more compact configuration that placed some parking within each building's footprint; these buildings required at least four stories above ground which necessitates steel and/or concrete structures. Teams provided a design for key structural elements of the buildings and their foundations; for road and intersection geometry, as well as; the pavement design; for an enhanced pedestrian and bike pathway connecting the development with Grand River and the MSU campus; for a constructed wetland to treat storm water; and for improvements to the existing mitigation-wetland.



Team 1 – Elite Engineering:
l-r: Eric Paul (Transportation), Steven Brenneman (Pavements), Sean Wheeler (Hydrology), Alex Miedema (Structures), Luke Prudhomme (Project Manager), Keith Laurenz (Environmental)

Team 2 – Highland Consulting:
l-r: Ross Simons (Project Manager), Erin McNamara (Environmental), Michael Seling (Structures), Christopher Bauer (Transportation), Thomas Anderson (Pavements), Kevin Reseigh (Hydrology), Jack Potterack (Geotechnical)



Team 3 – Grand River Consulting:
l-r: Brandon Betz (Pavements), Christopher Gembel (Geotechnical), Taylor Sting (Hydrology), Kelsey Gragg (Project Manager), Joshua Czolgosz (Transportation), Elizabeth Donaldson (Environmental)

Computer Science and Engineering

Capstone Course Sponsors

We thank the following companies for their generous support of the computer science capstone course.

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

General Motors
Detroit, Michigan

IBM Corporation
Armonk, New York

Meijer
Grand Rapids, Michigan

Mozilla Corporation
Mountain View, California

MSU Federal Credit Union
East Lansing, Michigan

Quicken Loans
Detroit, Michigan

Spectrum Health System
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Whirlpool Corporation
Benton Harbor, Michigan

The Capstone Projects

Dr. Wayne Dyksen
Professor of Computer Science and Engineering

Presentation Schedule – Engineering Building, Room 3405

Time	Team	Project
7:30 a.m.	Auto-Owners	Catastrophe Insurance Adjuster App
7:50 a.m.	Boeing	Aircraft Assembly Line Simulator
8:10 a.m.	GM	Augmented Reality Auto Mobile Guide App
8:30 a.m.	IBM	Information Technology Assessment Toolkit
8:50 a.m.	Meijer	Chief Information Officer Dashboard
9:10 a.m.	Mozilla	Australis-Styled Widgets for Mozilla Firefox
9:30 a.m.	Break	
9:45 a.m.	MSUFCU	Smart Start Savers
10:05 a.m.	Quicken Loans	Survey and Voting Web Apps
10:25 a.m.	Spectrum Health	Talent Connections Careers Mobile Site
10:45 a.m.	TechSmith	Learning Activity Capture
11:05 a.m.	Urban Science	Dealership Consultant Mobile App
11:25 a.m.	Whirlpool	Connected Appliance SmartZones App

CSE 498 Collaborative Design

CSE 498, Collaborative Design, provides the educational capstone experience for all students majoring in computer science. The course objectives include the following:

- Designing, developing, and delivering a comprehensive software system to a client;
- Learning to work effectively in a team environment;
- Developing written and oral communication skills;
- Becoming proficient with software development tools and environments;
- Learning about system building and system administration; and
- Considering issues of professionalism and ethics.

Project sponsors are local, regional, and national, and have included Auto-Owners Insurance, Boeing, Chrysler, Dow, Electronic Arts, Ford, GE Aviation, General Motors, Google, IBM, Meijer, Microsoft, Motorola Mobility, Mozilla, MSU Federal Credit Union, Quicken Loans, Spectrum Health System, TechSmith, Toro, Union Pacific Railroad, Urban Science and Whirlpool.

Auto-Owners Insurance
Catastrophe Insurance Adjuster App

Auto-Owners Insurance is a Fortune 500 company that is known for exceptional financial strength and stability with written premiums of over $5 billion. For over 95 years, Auto-Owners has been dedicated to the independent agency system.

Catastrophes such as hurricanes, tornados and earthquakes often cause widespread damage affecting many Auto-Owners policyholders. As a result, an unusually large number of claims are filed by its customers simultaneously.

When a catastrophe occurs, our Catastrophe Insurance Adjuster App enables Auto-Owners to manage large teams of insurance claim adjusters to respond to its customers' needs as quickly and as efficiently as possible.

Using our app, catastrophe coordinators at Auto-Owners assign a list of customer claims to adjusters. As adjusters select claims to process, our app provides navigation directions from location to location. Adjusters receive continual updates from the catastrophe coordinators.

As adjusters process claims, they change the status of a claim from "Assigned" to "In Progress" to "Completed." After a claim is marked as completed, the adjuster's app updates with navigation to the next claim location.

Our Catastrophe Insurance Adjuster App supports desktop computers, laptops and a wide range of mobile devices such as mobile phones and tablets.

Our app is written in PHP, HTML, CSS3, and utilizes the Google Maps API. The data is hosted in a MySQL database.

Auto-Owners Insurance
Life Home Car Business
The No Problem People®

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The Boeing Company
Aircraft Assembly Line Simulator

The Boeing Company is the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft.

Aircraft assembly lines are very large and very complex systems, which represent significant investments for Boeing. With the average assembly time of one month per aircraft, it is important to minimize the time and cost of building an aircraft, while maximizing safety.

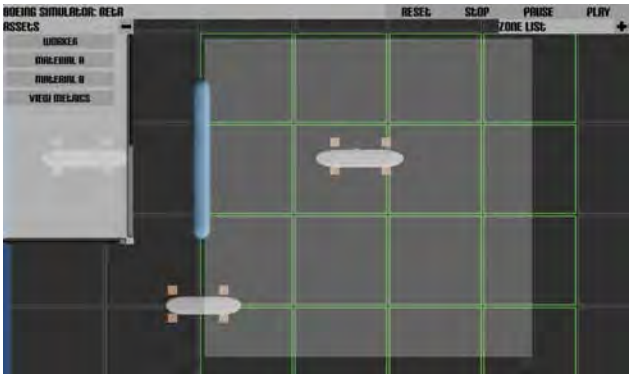
Developed in collaboration with Boeing, our Aircraft Assembly Line Simulator is used to design new assembly lines, and to optimize existing ones.

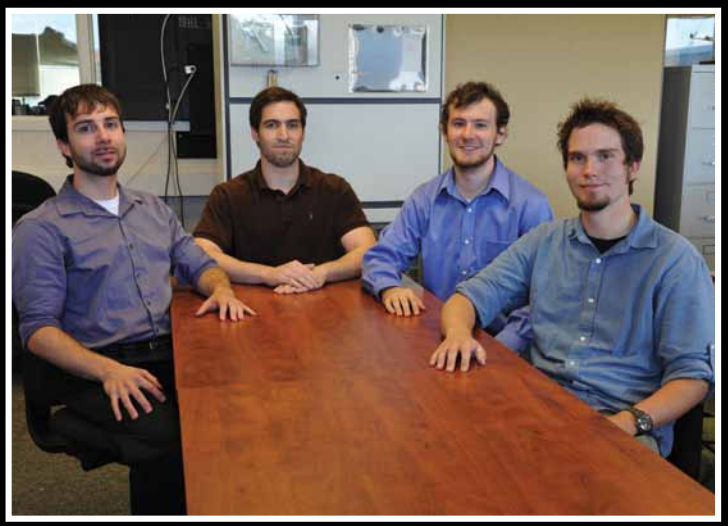
After launching our simulator, users are able to create an assembly line by placing various assets on a factory floor. After completing the factory layout, the simulation begins during which users can navigate throughout the assembly line and observe various assembly processes while they occur.

When the simulation completes or is stopped, users are presented with statistical data that measures the performance of the assembly line. This performance data is then analyzed by a specialist who determines the overall efficiency and safety of the user-created assembly line.

After analyzing a factory layout for cost and safety improvements, users can modify their factory, rerun their simulation, and collect new performance data.

Our Aircraft Assembly Line Simulator runs natively on Windows 7 and Mac OSX. It uses the Unity Game Engine and is scripted in C#.





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General Motors
Augmented Reality Auto Mobile Guide App

Headquartered in Detroit, Michigan, General Motors is a global Fortune 100 automobile company with over 212,000 employees on six continents. For over 100 years, General Motors has developed innovative technologies and shaped the future of the automotive industry.

Our Augmented Reality Auto Mobile Guide App provides iPhone users with instant information about GM automobiles simply by pointing their phones at a car.

After identifying the make, model and year of the car, our app uses augmented reality to display information about the car over its image on the iPhone screen.

A tap of the screen shows all of the car's special features and specifications along with promotional photos.

The example at the right shows our app identifying a model of a 2005 Corvette along with the screen resulting from tapping "Tap for More Info."

Users can save favorites and review cars looked at previously. Pictures and information about the car can be shared on Facebook and Twitter with a simple press of a button.

Our Augmented Reality Mobile Guide App furthers GM's reputation as one of the automobile industry's leaders in technological innovation.

Our app is written in Objective-C using Xcode for iOS 7. Our application identifies cars using the Metaio image recognition software.

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IBM Corporation
Information Technology Assessment Toolkit

IBM Corporation strives to create technology that makes the world smarter, faster, and better. They have been developing hardware and software solutions for over a century.

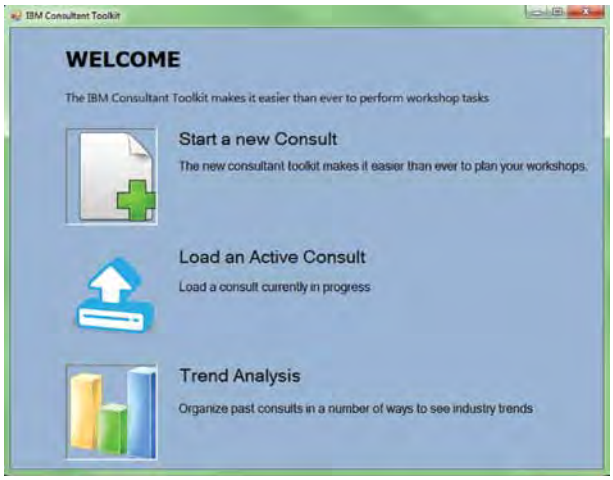
Information technology (IT) consulting is one of the primary services of IBM. Our Information Technology Assessment Toolkit is designed to improve the performance of IBM's consultants thereby increasing the benefit their clients receive from their services.

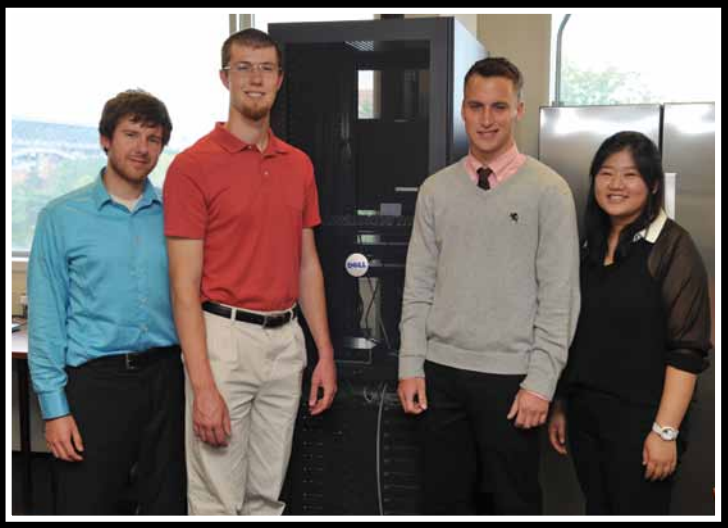
Our Information Technology Assessment Toolkit enables IBM consultants to organize and synthesize data, expedite the assessment processes, and provide feedback that is beneficial to their clients. Consultants can store data collected from their clients onto a database, quickly generate and send surveys to their clients, and produce interactive charts and graphs from the survey results.

Consultants do three main assessments for each client: one for the business group, one for IT group, and one for both. Assessments can be done remotely by emailing surveys in the form of Microsoft Word documents or in person at a consulting seminar called a workshop.

Our toolkit performs cross-client comparisons so that consultants can see trends across all their clients, providing insights on the most common areas requiring improvement.

Our Information Technology Assessment Toolkit is a native Microsoft Windows application developed in Microsoft Visual Studio using the .NET Framework. The Entity Framework is used to communicate with an IBM DB2 Express-C database.





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Meijer
Chief Information Officer Dashboard

Meijer is a regional supercenter providing quality food and merchandise in five states throughout the Midwest. Headquartered in Grand Rapids, Michigan, Meijer has nearly 200 stores and over 60,000 employees.

In order to provide the best service possible for its customers, Meijer makes significant use of a wide variety of information technologies that are managed by a large group of information technology (IT) professionals who are led by the Chief Information Officer (CIO).

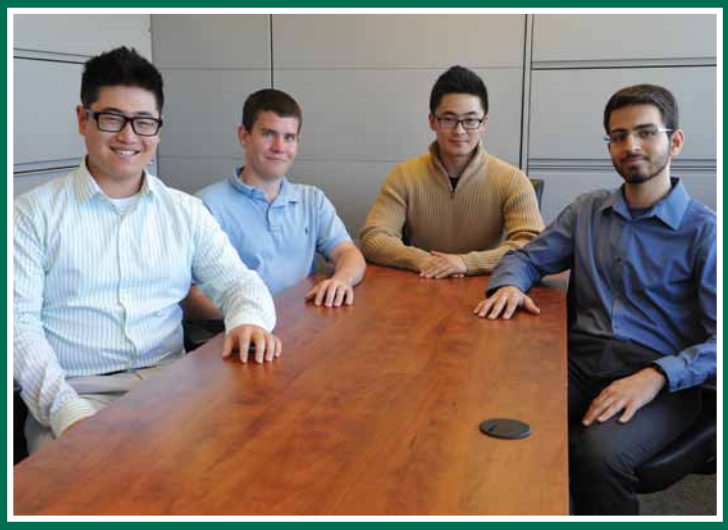
Our Chief Information Officer Dashboard provides the CIO with an at-a-glance status of all of the major IT functions throughout Meijer.

Our CIO dashboard summarizes large amounts of complex data on a single display using eight subsections of color-coded charts and graphs. Green, yellow and red are used to indicate performance with red zones requiring attention.

Many of the eight subsections support so-called drill-down views. Clicking on a chart or graph reveals more detailed views that display more detailed information, which can be used to determine the cause of a problem.

The main CIO dashboard view combined with drill-down views provides the Chief Information Officer with a single easy-to-use source of information of all of Meijer's IT systems.

The CIO Dashboard uses Microsoft's SQL Server Reporting Services and is hosted by Microsoft's Report Server.



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Mozilla Corporation
Australis-Styled Widgets for Mozilla Firefox

Mozilla Firefox is one of the world's most popular web browsers. Millions of people each day use Firefox to surf the Internet. Part of Firefox's success is due to its extensions, which are applications that add to the browser's functionality.

Mozilla is changing the way Firefox looks with a new visual style called Australis. In addition to visual changes, Australis changes the way some of Firefox's extensions look and work.

Our Australis-Styled Widgets for Mozilla Firefox show users the new face of Firefox extensions. Our four widgets make use of Mozilla's latest technology including Australis' new visual style as well as a number of new tools in Firefox.

The weather extension displays weather information such as current temperature, humidity and cloud coverage. Users get weather for their city and can add up to four more cities.

The music player extension plays back virtually any music file on a user's computer. It keeps track of their music collection and automatically downloads cover art.

The MSU sports extension tells users all about their favorite Spartan team. Schedules and scores are available for many popular MSU sports.

The Bugzilla extension lets users track their tickets on Bugzilla from one easy window. The extension sorts tickets into categories and quickly shows each ticket's important information.

Our four Firefox extensions are written in JavaScript, HTML, CSS, and Mozilla's XML User-Interface Language (XUL).

mozilla Firefox

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MSU Federal Credit Union
Smart Start Savers

Michigan State University Federal Credit Union (MSUFCU) was founded in 1937 in East Lansing, Michigan. MSUFCU is an important member of the Michigan State University community and is currently the largest university-based credit union in the world, serving more than 175,000 members.

MSUFCU recognizes the importance of teaching our youth the value of being financially responsible. Our Smart Start Savers app is an iPad application that provides local elementary and middle school students with the ability to do banking at MSUFCU micro-branches during the school day.

Once a school is enrolled in the Smart Start Savers program, parent volunteers are able to use our iPad app to set up MSUFCU micro-branches within the school to accept and review student deposits.

Students bring the cash they wish to deposit to the parent volunteer who then uses our app to locate the student's account and record their deposit. Our app sends a receipt to each student's parent or guardian.

When the in-school banking hours are over, our app creates a daily summary so that the parent volunteer can reconcile the day's deposits. The parent volunteer takes the money to a local MSUFCU branch to be processed by MSUFCU associates.

This Smart Start Savers program is designed for initial use by MSUFCU's Oakland University Credit Union brand.

Our app runs on an iPad 2 or newer running at least iOS 6. It is written in Objective-C and interfaces with a PHP API to access the MySQL database.

MICHIGAN STATE UNIVERSITY
FEDERAL CREDIT UNION
Building Dreams Together

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Quicken Loans
Survey and Voting Web Apps

Quicken Loans is the nation's largest online mortgage lender and is headquartered in Detroit, Michigan. The company has closed nearly two million home loans since being founded in 1985.

Quicken Loans uses electronic survey and voting tools to collect feedback from their team members. Feedback may be gathered over the course of days with a survey or instantly by voting at meetings.

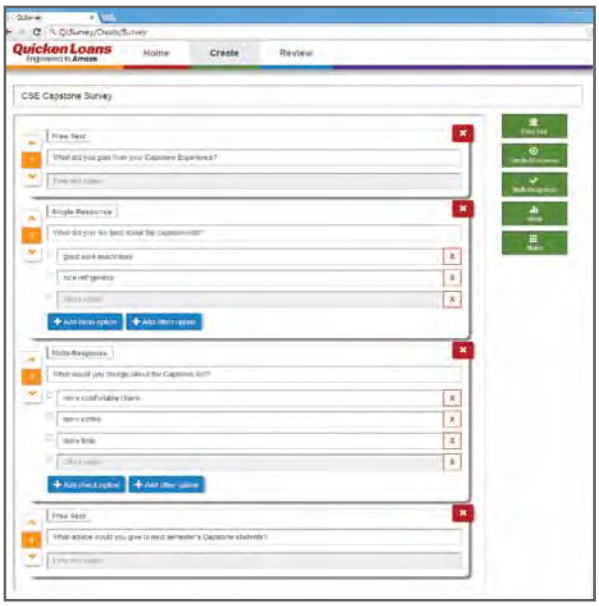
Currently, Quicken Loans uses third-party survey and voting tools. Use of these third-party tools is cumbersome and results often fail to meet the needs of Quicken Loans.

Designed in collaboration with our clients from Quicken Loans, our Survey and Voting Web Apps provide survey and voting tools that are completely internal to Quicken Loans.

Using our web apps, team members create surveys and voting ballots, take surveys and vote, and review survey and voting results. Surveying and voting can be done anonymously and restricted using Geo-Fencing. Results can be exported to Excel spreadsheets.

Our Survey and Vote Web Apps supports all modern desktop web browsers as well as many mobile devices.

Our application uses a Model-View-Controller architecture with the Microsoft Entity Framework along with jQuery and JavaScript. Microsoft SQL Server is used to store surveys, voting ballots and results.



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Spectrum Health System
Talent Connections Careers Mobile Site

Spectrum Health System, headquartered in Grand Rapids, Michigan, provides high quality, high value healthcare in West Michigan through its nine hospitals, which are staffed by over 20,000 employees.

In order to maintain and grow its workforce, Spectrum Health hosts online job search and application systems.

Our Talent Connections Careers Mobile Site is a new easy-to-use mobile job application system that provides a way for on-the-go users to apply quickly and easily for jobs at Spectrum Health. Our system supports both smart phones and tablets.

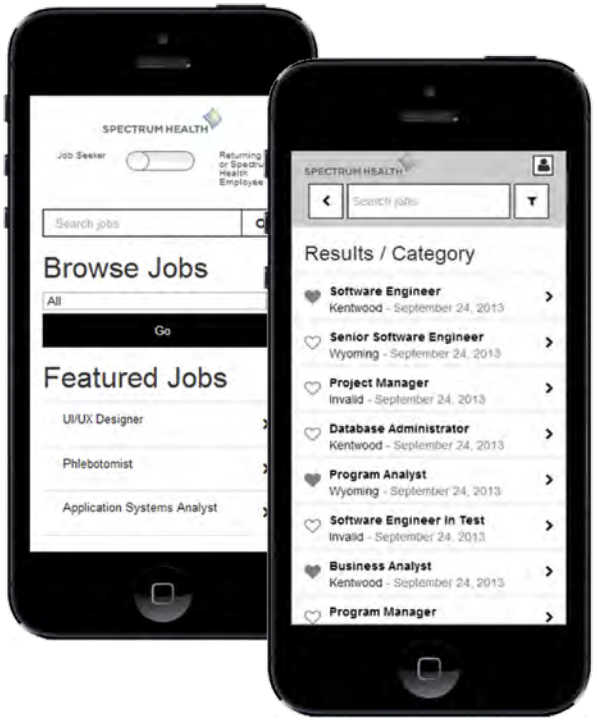
When a user expresses interest in applying for a position, they are directed to the search page shown at the right. Available jobs can be filtered by numerous criteria or sorted either alphabetically or by the date they were posted.

Search results include basic information about each job, including a position title and location. Tapping on a job search result gives more details along with an option to apply.

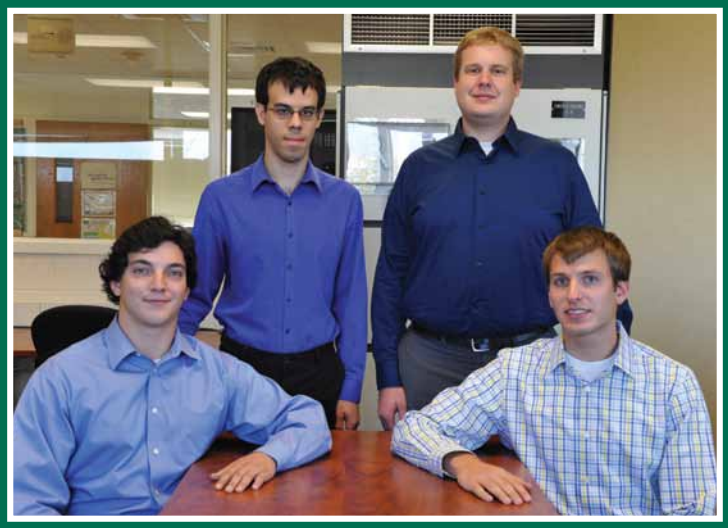
Our mobile web site uses a responsive layout, which enables it to accommodate the great variety of differing mobile device screen sizes automatically and dynamically.

Since many mobile phones and tablets do not allow users to store documents on them, our Talent Connections Careers Mobile Site is integrated with DropBox so users can submit their résumés by logging into their DropBox account.

Our single-page web app employs state-of-the-art technologies including HTML5, CSS3, AngularJS and Bootstrap.



SPECTRUM HEALTH



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TechSmith
Learning Activity Capture

Based in Okemos, Michigan, TechSmith provides over 180 countries around the world with screen capture and recording software, which is widely used in educational settings for computer-based learning activities.

Our Learning Activity Capture software captures users' computer-based learning activities by tracking and organizing these activities, and making them available to users online.

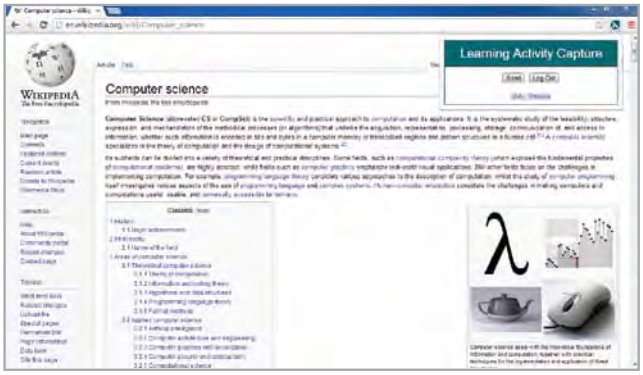
Our software is comprised of three distinct parts: a Google Chrome extension, a Microsoft Windows application and the TechSmith Smart Player. All three create and record statements that describe a user's learning experience. Users can view an organized summary of their learning activities on their individualized "Record Store" web page.

The Chrome extension is a browser button that, when pressed, sends statements about visited websites as a learning activity. Typical statements are "Ben read a Wikipedia article" or "Brett watched a YouTube video."

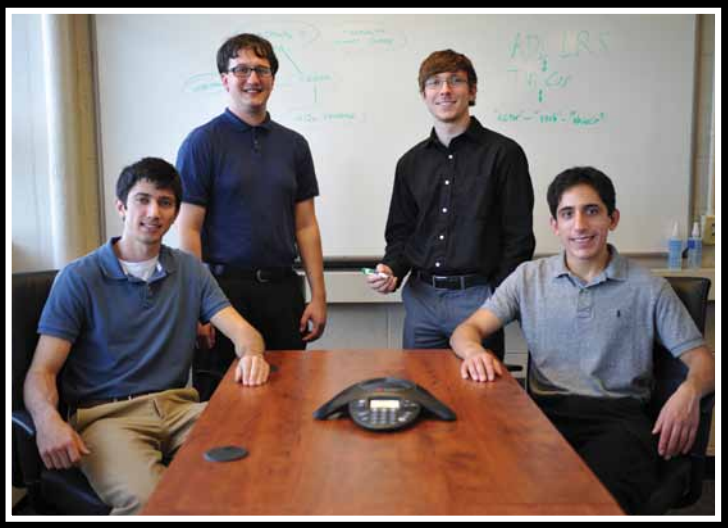
Unlike the Chrome extension, the Windows application sends statements automatically by monitoring when certain programs or files are opened and determining the appropriate time to record these events as learning activities.

The TechSmith Smart Player is a web application that presents interactive video quizzes and sends these quiz results as learning activity statements.

The user applications are written in JavaScript and C#, the web pages are served through Django, and the back-end is supported by a PostgreSQL database.



TechSmith®



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Urban Science
Dealership Consultant Mobile App

Urban Science is a business-solutions company focused on supporting the sales and marketing needs of the automotive industry. They leverage a scientific methodology to help their client partners sell more vehicles, improve profitability, and increase customer loyalty.

Urban Science consultants work with individual dealerships to improve their performance. Consultants collect and analyze dealership specific data along with regional data. Using this information, consultants travel to dealerships and meet with their clients to review performance data and make recommendations for improvements.

Working with Urban Science, we have developed a mobile app for use by consultants before, during and after meetings with dealerships called Dealership Assistant.

Our app provides consultants with instant and easy access to all of the dealership performance data during their client meetings. Graphs and charts provide helpful visualizations of the data to identify areas needing improvement.

Consultants then use our app to record the results of the meeting along with agreed upon action items for the dealership, which are then uploaded to a central database for further analysis by Urban Science.

Our Dealership Consultant Mobile App supports both iPads and Android tablets.

Our software is written in XCode and Java. SQL is used for the back-end database.

URBAN SCIENCE

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Whirlpool Corporation
Connected Appliance SmartZones App

Whirlpool Corporation is a leader of the global home appliance industry. With appliances in every major category, Whirlpool offers products to serve all kinds of household needs with innovative features and cutting edge technology.

Whirlpool's latest generation of "Connected Appliances" offers increased energy savings and convenience on-the-go through specialized smartphone apps.

Our Connected Appliance SmartZones App enables Whirlpool customers to create and manage so-called "SmartZones," which provide customers with important information about their appliances and automate appliance features. There are four types of SmartZones.

The VacationZone controls home appliances while customers are away from home. The ComfortZone is perfect for "set it and forget it" temperature management. Both of these zones reduce energy costs and automate appliance operations.

In addition, the AlertMeZone and RemindMeZone send Whirlpool Connected Appliance customers information about maintenance and regular replacement parts such as water filters.

Our Connected Appliance SmartZones App uses a diverse range of technologies including location services and the Whirlpool Connected Appliance API. Our app is written in Objective-C for iPhones and Java for Android phones.

Whirlpool CORPORATION

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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. The winners are selected on Design Day by a panel of distinguished judges.

Auto-Owners Exposition Award

Auto-Owners Insurance
Life Home Car Business
The "No Problem" People®

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 GM
My Conference Room

Tom Smale, Matt Tarnowsky, Jeff Girbach, Daniel Bachelis
Presented by Sue Snodgrass, Erin McLaughlin, Bob Buchanan, and Scott Lake

Chrysler Praxis Award

CHRYSLER

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 Chrysler Praxis Award, which is sponsored by Chrysler LLC of Auburn Hills, Michigan.

Team Mozilla
Multi-Touch Gestures for Firefox

Bill de Araujo, Ray Heldt, Brandon Waterloo
Presented by Karen Wrobel

Spring 2013

Design Day Judges

April Clobes
MSU Credit Union

Louise Hemond-Wilson
IBM

Marty Strickler
Rose Packing Company

Greg Davidson
Urban Science

Vandy Johnson
XRS Corporation

Karen Wrobel
Chrysler

Mike Drazan
Toro

David Mysona
Blackstone Technology Group

Rich Enbody
Michigan State University

Kevin Ohl
Michigan State University

TechSmith Screencast Award

TechSmith

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 Okemos, Michigan.

Team Whirlpool
Guided Cooking and Recipe App

Zach Jones, Nick Kecskes, Duncan Finney, Josh Marti
Presented by Dean Craven

Urban Science Sigma Award

URBAN SCIENCE

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 Urban Science Sigma Award, which is sponsored by Urban Science of Detroit, Michigan.

Team TechSmith
American Sign Language Learning App

Malcolm Doering, Michelle Truong, Adam Crane
Presented by Greg Davidson

ArcelorMittal

At ArcelorMittal, steelmaking today is safer, cleaner and relies on cutting-edge technologies and a highly skilled workforce to produce an essential material for the modern world. We are looking for the best and brightest minds to lead our company into the future – from engineering and business professionals to skilled technicians and operators.

Because steel touches every part of our daily life, working at ArcelorMittal provides our employees with a sense of pride and contribution for playing a direct role in transforming tomorrow. A future with the leader in steel starts now. Visit *www.workforarcelormittal.com* today.

www.arcelormittal.com

ArcelorMittalUS

transforming tomorrow

USAA is currently seeking talented IT summer interns and full-time college hires for the showcase campus in San Antonio, TX. Meet a representative on campus and learn more about our IT workforce.

See what we have to offer. Apply Today.

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Insurance Banking Investments Retirement Advice

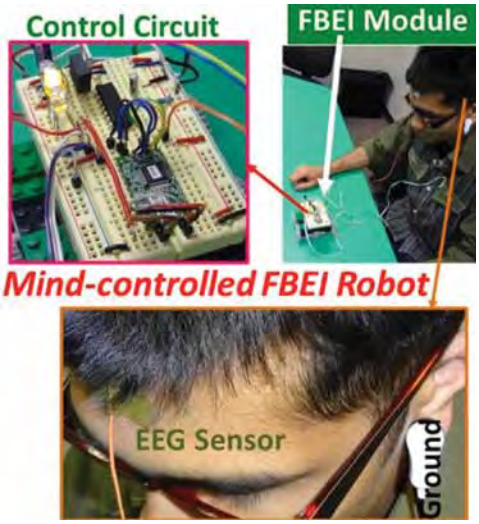
USAA®

Introduction to Electrical and Computer Engineering

Dr. Dean M. Aslam
Professor of Electrical and Computer Engineering

Thrills for Freshman Students: Mechanisms that fascinate, captivate, stimulate and entice

ECE 101 is an elective course introducing freshman students to Electrical and Computer Engineering through a series of innovative hands-on laboratory experiments linked to new research and teaching areas. These experiments include (a) maple-seed robotic fliers (MRF) with on-board electronics, (b) brainwaves and mind-controlled games and robots using EEG sensors, (c) C programming of robots based on MSP430 microcontrollers and NXT LEGO controllers, (d) computer switches, (e) pH measurement using NXT sensors, (f) location of bio-molecules using RFID, (g) renewable energy resources using windmill and solar cells, (h) nanotechnology study using a LEGO gear-train.



Team Members	Project Title
Daniel Jarratt Alex Kohler Daniel Kortemeyer	Self-Balancing Robot Using C
Scott McCarter Khoa Tran Michael Young	Robotic Mapping
Jason Martin Rachel Moses Jonathon Parnell Yaoting Xu	Checkout Scanner

The Capstone Projects

Dr. Timothy Grotjohn
Chairperson and
Professor of Electrical and
Computer Engineering

Dr. Lalita Udpa
Professor of
Electrical and
Computer Engineering

Presentation Schedule – 2250 Engineering Building

Time	Team Sponsor	Project Title
8:00 a.m.	MSU Technologies	Portable Micro-sensor Reader
8:25 a.m.	U.S. Air Force Research Laboratory	Wireless Sensor Network Health Diagnostic
8:50 a.m.	Robert Bosch LLC	Infotainment and Navigation System Monitor
9:15 a.m.	ArcelorMittal	Hot Strip Mill Centerline Tracking
9:40 a.m.	Chrysler Group, LLC	Advanced Testing Breakout Board
10:05 a.m.	Break	
10:20 a.m.	Resource Center for Persons with Disabilities	Expandable Computer Power Storage System
10:45 a.m.	Texas Instruments	Electronic Parachute Deployment System
11:10 a.m.	Texas Instruments	RC Car Drone
11:35 a.m.	Michigan State Solar Car Team	Motor Controller for Sensored BLDC Motor

To view these presentations live please visit the Design Day website: http://designday.egr.msu.edu and click the *Watch Live* tab in left side menu bar.

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, legal, intellectual property, accommodation issues and entrepreneurship.
- Polishing their communication skills – individual and team – on proposals, reports, resumes, evaluations, posters, web pages, and oral presentations.
- Requiring each student to complete four individual hardware/software laboratory assignments.

Team sponsors are local and national, including, Air Force Research Laboratory, ArcelorMittal, Chrysler Group LCC, Michigan State Solar Car Team, MSU Technologies, Resource Center for Persons with Disabilities, Robert Bosch LLC, and Texas Instruments. Thank you to each of these team sponsors.

ECE 480 Room 2250 | 2nd Floor **8:00 a.m.**

MSU Technologies/National Science Foundation
Portable Micro-sensor Reader

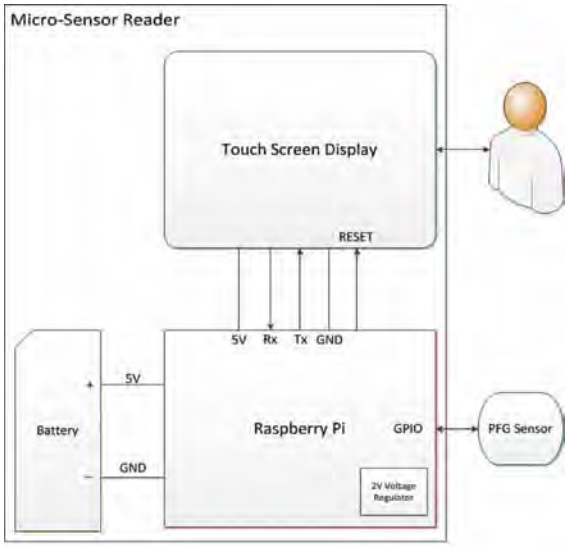
Sensors are useful devices for collecting data about the world around us. Over the course of seven years, the Michigan State Adaptive Integrated Microsystems Laboratory (AIMLab) has developed a self-powered sensor that can measure strain forces in the environment. These sensors will be implanted into athletic equipment, so that researchers can better understand the causes and effects of head injuries.

This sensor module stores the data that it collects via on-board flash memory. Over time, the information accumulates on the sensor and is ready to be retrieved. A device needs to be designed that could connect to the custom input/output pins on the sensor module and pull the data off the memory. The reader needs to be portable and self-powered.

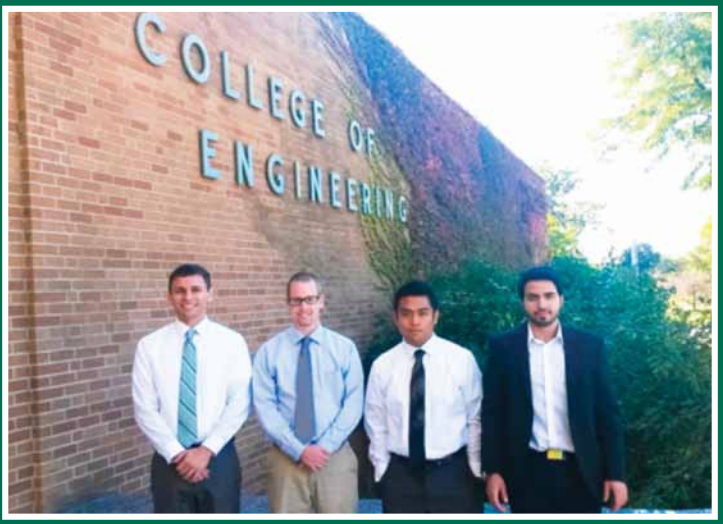
The Raspberry Pi minicomputer provides a cost- effective solution to solve the problem. It has all the components of a typical computer. The Raspberry Pi, coupled with a touchscreen LCD display, allows a user to input various commands which are labeled on the sensor module schematic.

The product is powered by a battery, creating a portable device that can fit in your pocket. All of the reader's internals are housed in a custom enclosure that protects the reader from damage caused by accidents or the environment.

An important thing to remember when powering electronics is to consider the proper voltage requirements. This solution utilizes voltage regulators to provide a constant DC voltage to each individual component within the reader.



MSU Technologies



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Saudi Arabia

Yuval Levental (Not Pictured)
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MSU Technologies/ National Science Foundation
Project Sponsor

Shantanu Chakrabartty
East Lansing, Michigan

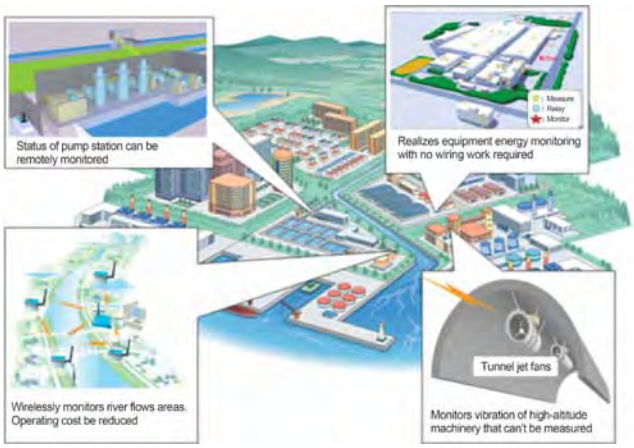
U.S. Air Force Research Laboratory
Wireless Sensor Network Health Diagnostic

The United States Air Force relies on wireless sensor networks for protecting its equipment and U.S. military personnel around the world. Thus, it is paramount that these sensor networks are working properly. In order to ensure the integrity of a sensor network it must be monitored for potential failures. This project revolves around creating a health diagnostic for detecting sensor node failures across the network in real time.

Our project consists of a wireless sensor network which measures environmental metrics including temperature, light, and humidity. The network is organized in a star topology with every sensor node solely communicating to a central cluster head. Every sensor node continually collects environmental information and then periodically transmits it to the cluster head. From there the cluster head forwards the information onto a computer where it undergoes analysis and is intuitively displayed.

In order to design a robust health diagnostic, more metrics must be monitored. Every sensor node also keeps track of internal metrics such as battery level and current draw. These internal metrics, in combination with environmental metrics, allow for a comprehensive network health analysis.

Ultimately, our project could be deployed in a variety of places; for example, in a pump station in order to ensure the pumps are properly functioning. A pump room operator must simply periodically check the computer to see the status of each pump and sensor to determine if maintenance is needed.



AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

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U.S. AFRL
Project Sponsor

Joseph Natarian
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ECE 480 Room 2250 | 2nd Floor **8:50 a.m.**

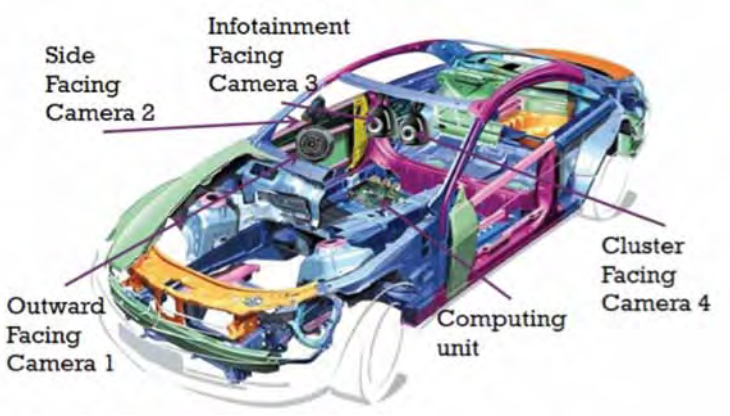
Robert Bosch, LLC
Infotainment and Navigation System Monitor

As Bosch strives to build quality systems, the monitoring of possible issues through on-road testing is necessary. The Infotainment system features also include the driver's and passenger's interface to the vehicle's entertainment system. This is a central unit for communication and has a number of hands-free operational features, all of which require testing. Testing hours can range between a short ride to the gas station, or crossing a number of states.

Testing of the Infotainment system only includes the entertainment functions and GPS system. This testing is on-road and includes the monitoring of the GPS turn-by-turn directions and the display screen, both monitored to ensure that the information being given to the driver is accurate and consistent with available routes on the road. Errors can result from the GPS system software or can be associated with possible user input.

Therefore, in order to detect possible issues with these features, a method of monitoring the driver and the system while on the road is needed. This information is collected with the purpose of re-creating, debugging, and ultimately fixing any issues found in the road or as a result of user input.

The team has developed a system consisting of 4 cameras and a computing unit. These modules will work together to record multiple views and will have post-processing features such as time and GPS stamping.



BOSCH
Invented for life

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Robert Bosch, LLC
Project Sponsor

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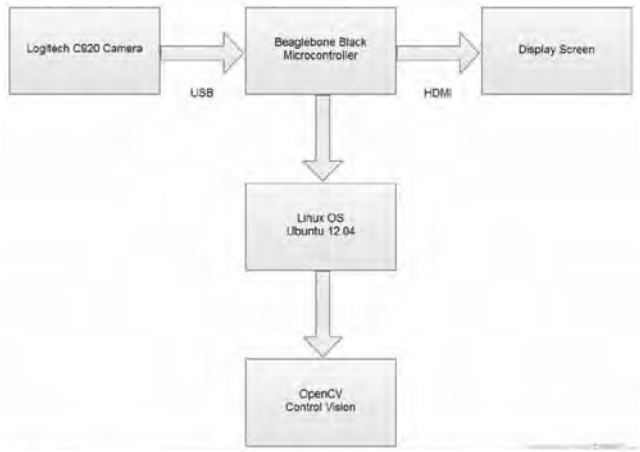
ArcelorMittal
Hot Strip Mill Centerline Tracking

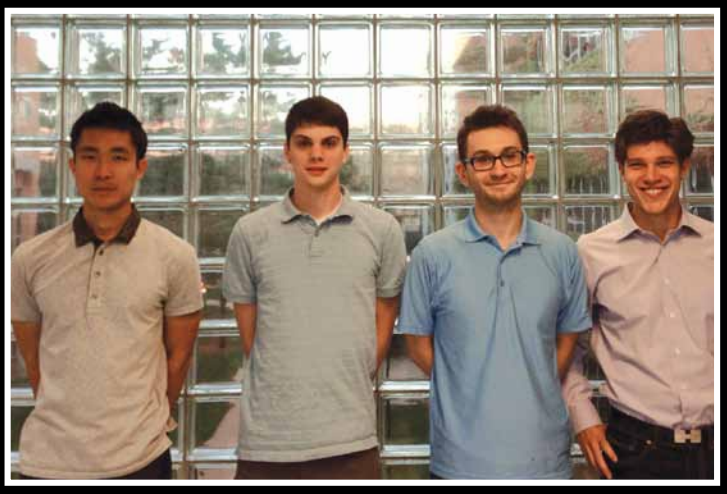
The finishing section of ArcelorMittal's steel hot strip mill passes strips of hot steel through seven high pressure rolling stands to decrease the thickness of the strips. Inconsistencies in the strip's temperature and the pressures applied by the seven rolling stands can cause the steel strip to bend from side to side. When this happens, the steel strip has the potential to bend and curve off of its intended path. The implemented design will provide a cost-efficient solution to numerically represent the curvature and reduce the occurrence of mill wrecks caused by curved steel.

In order to detect the problem quickly and efficiently, our design employs a high-definition webcam and powerful microcontroller, the BeagleBone Black. Using image processing templates supplied by OpenCV, a database of open source computer vision software, our microcontroller will be able to process the image matrix. The BeagleBone will then be able to detect the edges of the steel strip. After the edges are detected, the centerline of the strip can be calculated and stored in ROM. When the centerline varies outside of a tolerated level (defined by the American Institute of Steel Construction), a visual queue will appear on a display screen.

By allowing the hot strip mill operators to detect the curvature of the steel strip, they can more accurately adjust roller pressures to minimize the curvature in the next strip. The ability to quantize this data is imperative to minimizing costly downtime in the hot strip mill.



ArcelorMittal



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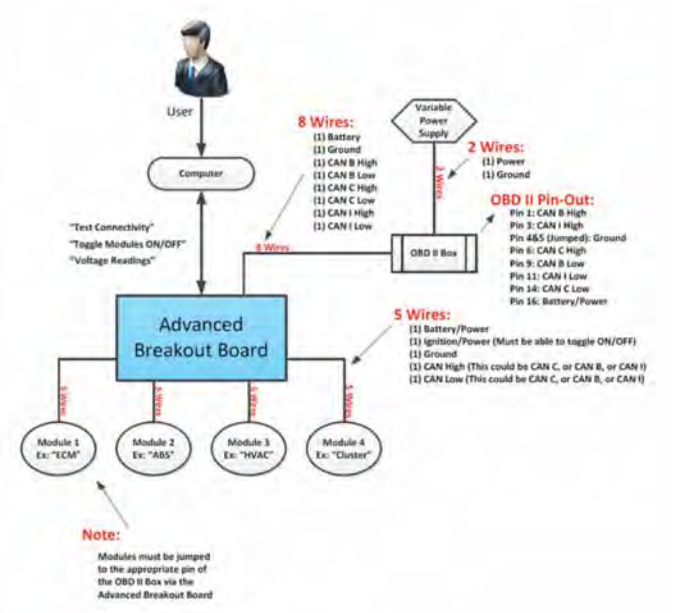
ECE 480 Room 2250 | 2nd Floor **9:40 a.m.**

Chrysler Group, LLC
Advanced Testing Breakout Board

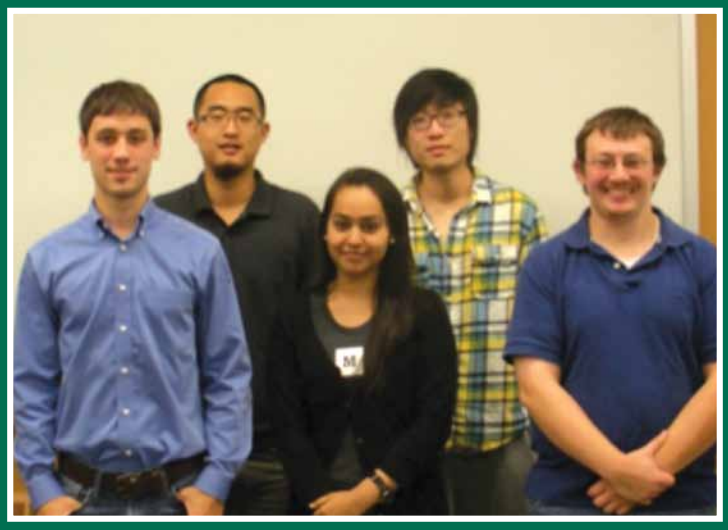
During the development of a new vehicle, a number of prototypes must first be designed and built. In order to accomplish this task in a timely manner, a carrier vehicle is chosen to serve as a base in which new technology is tested. The carrier vehicle's wiring and general electrical architecture serves as a starting point for engineers to retrofit new and current technology. However, due to the expedited nature of prototype development, bench top studies are essential when testing and debugging communication schemes. As the number of modules on any given vehicle grows, a bench top test area can become cluttered and confusing to work with. Thus, there is a growing need for an advanced communications breakout board that will be used to test up to as many as ten modules at a time.

This advance communications breakout board needs to handle the modules by successfully supplying sufficient power and communication buses for any individual unit. The communication buses should not interfere with each other or pick up any outside noise from surrounding circuitry. All of these controls, along with voltage readings taken from the communications bus, need to be displayed on a graphical user interface that allows the engineer working with the modules to view any of these readings.

After designing, implementing and testing the final proposed solution, the team's design is capable of handling the required number of modules and displays the correct readings and voltages within + 1% accuracy.



CHRYSLER



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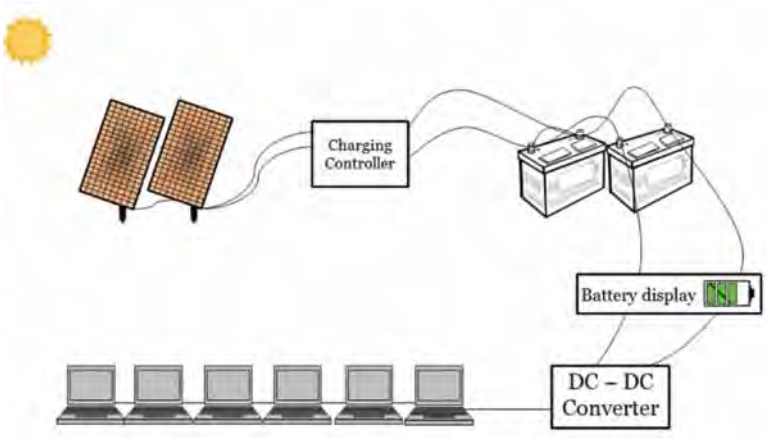
Resource Center for Persons with Disabilities
Expandable Computer Power Storage System

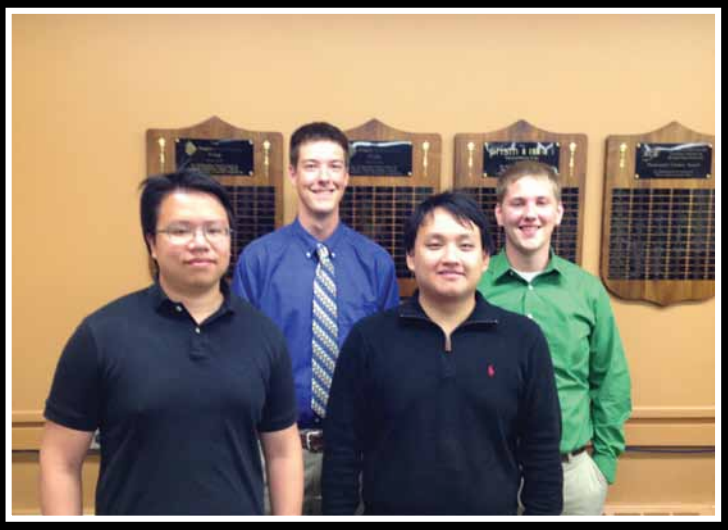
The Resource Center for Persons with Disabilities (RCPD) manages a program that scans textbooks to aid blind students. After the textbooks are converted into a computer readable format, they then use voice-recording software to create audio files. The RCPD wants to implement this program in a school in India, but the power grid is very unreliable, causing frequent power outages that last for a few hours at a time. To avoid this problem, there needs to be a way to power the computers independently of the power grid.

India's power grid is archaic, and poorly maintained. Power outages due to high energy demand and broken power lines are common occurrences in India. Since the existing power grid is unreliable, at best, there needs to be an external energy supply in order to make the system completely independent from the power grid. Due to the sunny climate near the school, solar power is a good choice for an alternate energy source.

Steven Blosser from the RCPD has proposed the challenge to design an expandable power supply for a laptop computer lab that will use solar power to keep a battery bank charged in order to supply power to as many as 30 laptops. After designing the system, the team's solution is able to power two laptops for eight hours and is able to charge the deep cycle batteries using solar power.



Resource Center for Persons with Disabilities



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Project Sponsor

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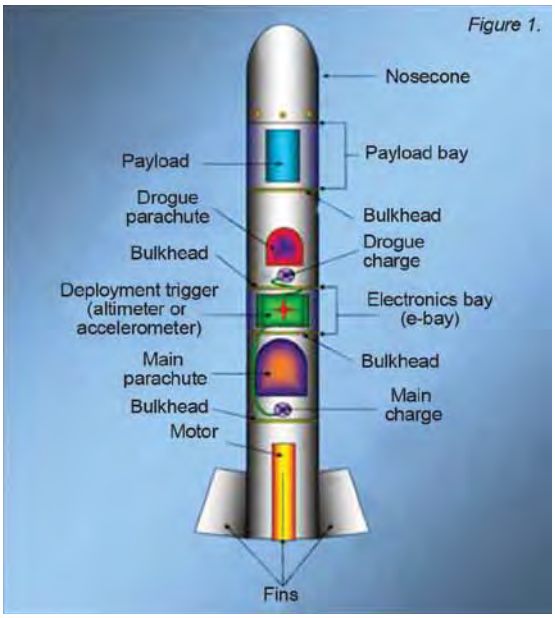
ECE 480 Room 2250 | 2nd Floor **10:45 a.m.**

Texas Instruments
Electronic Parachute Deployment System

Model rocketry is a popular hobby for many, ranging from a fun educational activity for children to a highly technical recreation for adult enthusiasts. The basics of model rocket flight include liftoff by force of propellant, and a parachute system to retrieve it after descent. After a rocket has successfully lifted off from the launch site, the next concern is its descent- a rocket without a functioning parachute system will go "ballistic," falling nose-first in a missile-like fashion. These falling rockets pose safety concerns for all onlookers in its path below. Too often, a failed rocket parachute system results in a broken rocket, and broken spirits for those who spent so much time and money designing it.

Texas Instruments lends sponsorship of this design team to provide an electronic solution to a model rocket's parachute deployment. This electronic parachute deployment system (EPDS) will replace the basic timed-charge system commonly used in many model rockets today. It will employ the use of a fabricated printed circuit board (PCB) consisting of accelerometer and altimeter sensors to sense the g-forces and air pressure (respectively) acting upon the rocket, as well as an LCD to capture data obtained during the flight. These components will communicate with an MSP430 LaunchPad and microcontroller to deploy two parachutes during the rocket's flight. The use of this EPDS will ensure model rockets have safe descents and a longer lifespan.



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Ryan Lupinski
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Peter Semig
Dallas, Texas

Texas Instruments
RC Car Drone

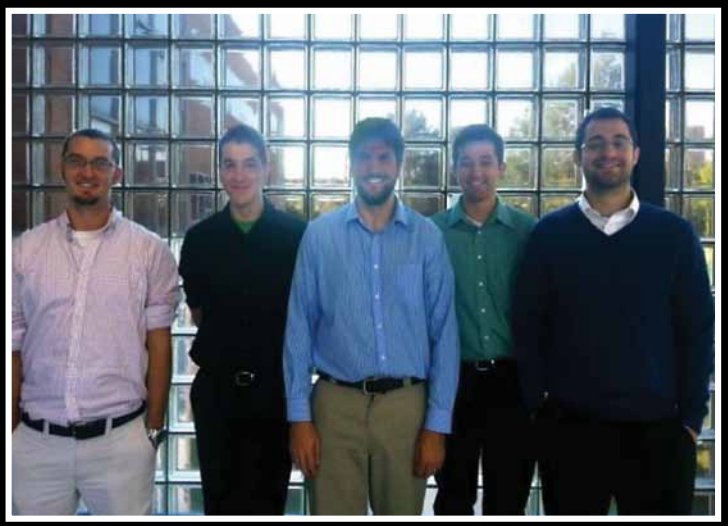
Texas Instruments is a renowned company specializing in semiconductors and consumer electronics. They have proposed a project involving the design, prototyping and testing of an RC car drone. The final product will perform as a functional drone that can be utilized by the Texas Instruments' motor lab located in Dallas, Texas.

The RC drone will be controlled over the internet via a website, and locally using a Bluetooth interface. The purpose of the project is to create a user-friendly application of Texas Instruments' DRV8301 microcontroller kit in order to demonstrate the capabilities of the control algorithms. The coding and communication scheme of the RC drone will serve as a predecessor for a flying drone in future development.

The brushless DC motor driving the drone requires a sophisticated control algorithm to function properly. The DRV8301 is designed specifically for brushless DC motors. The control board contains the MOSFET gate drivers and outputs for the 3 phases needed for the motor. The microcontroller sends the inputs to the gate drivers that it receives from the phone via a Bluetooth connection.

The core component to making this project a success is the ability to send commands from the website to the onboard Android phone in order to control the RC drone. The design allows the drone to be controlled by a user from a website while receiving the drone's GPS coordinates as well as visual feedback through the phone's camera.

TEXAS INSTRUMENTS



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Zachary Buckley
Dallas, Texas

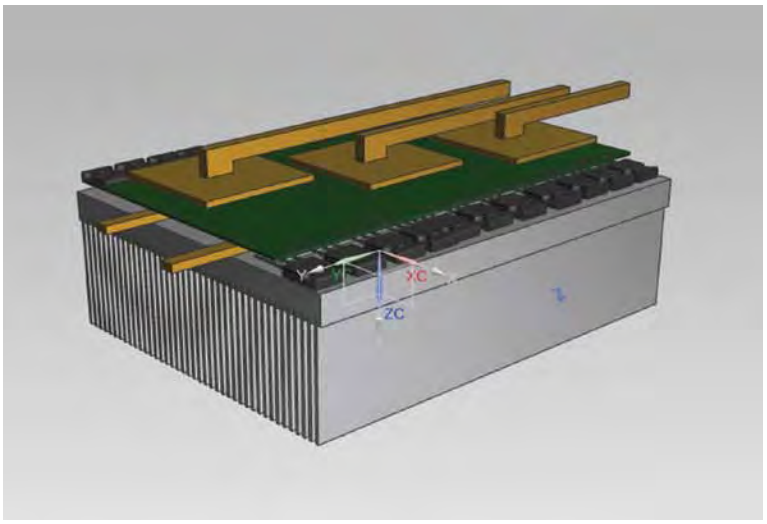
ECE 480 Room 2250 | 2nd Floor **11:35 a.m.**

Michigan State Solar Car Team
Motor Controller for Sensored BLDC Motor

Our design team is tasked to build a motor controller for a brushless DC motor. This motor controller will be used to power the motor on the Michigan State University Solar Car. The Solar Car Team is one of the latest racing teams to be organized at Michigan State University. Since 2010 the team has participated in two races and has been unable to complete the race due to unreliable components. The Michigan State Solar Car Racing Team competed in the American Solar Challenge for the first time in 2012.

Ten miles into the race the NGM motor controller being used on the car failed and stopped working. During the attempt to fix the motor controller, it was found that the NGM controller lacked robustness to hold up to the demands of the car. The area of weakness in the controller was in the high voltage distribution section, particularly the MOSFETS which could not handle the current demand of the motor. With a new design the motor controller can be built to be more reliable and easier to repair. This will prevent the future car from being unable to race in its next event

A motor controller is an electronic component of a drive system that converts DC voltage into a three-phase AC signal that can drive an AC motor. The motor controller converts the DC to AC using a 6-step inverter which is implemented with high power MOSFETS and a Microcontroller. The H-bridge of our motor controller can be seen modeled in CAD on the right.



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Chris Sommer
Mason, Michigan

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MSU Solar Car Team
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Colin Monroe
Schoolcraft, Michigan

Design Day Awards Spring 2013

Electrical & Computer Engineering Prism VentureWorks Prize & Winners, Spring 2013

The Prism VentureWorks Prizes ($1,500, $1,000, and $500, respectively) are awarded each semester to the most outstanding teams in the Electrical and Computer Engineering Senior Capstone Design Course, as judged by a panel of engineers from industry. A team with members from both ECE and another engineering major (mechanical engineering, for example) is also eligible, if the team's project is administered through ECE 480. The prizes are sponsored by Prism VentureWorks, a Boston-based venture capital firm, and Mr. William Seifert, an ECE alumnus, who is a partner in that firm. The faculty and students of Electrical and Computer Engineering are very grateful for this generous support.

Prism VentureWorks First Prize: Fason Controls & Engineering: Parts Measurements System

Left to right
Jarad Jones, Eric Martz, Justin Walz, Nolan Boyda, and Mark Holzhauer

Prism VentureWorks Second Prize: Texas Instruments: Electrocardiogram (ECG) Demonstration Board

Left to right
Mike Mock, Chaoli Ang, Justin Bohr, Xie He, Nate Kesto, and Yuan Mei

Prism VentureWorks Third Prize: US Agency for International Development: Low Cost Wireless Agricultural Sensors

Left to right
Anthony Bird, Paul Solomon, Jennifer Byford, Andrew Warner and Scott Oliver

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MSU Michigan State University FEDERAL CREDIT UNION
Building Dreams Together

Mechanical Engineering Room 1240 | First Floor 9:00 a.m. - Noon

ME 371 Mechanical Design I

Dr. Farhang Pourboghrat
Professor of Mechanical Engineering

Dr. Brian Thompson
Professor of Mechanical Engineering

Thrills for Pre-collegiates: Mechanisms that Fascinate, Captivate, Stimulate and Entice

Teams of students were required to design and manufacture mechanisms that would thrill an audience of pre-collegiate students. The constraints imposed upon this assignment were that each mechanism must incorporate at least one linkage, one gear set and one cam-follower combination. These engineering marvels will be demonstrated, and displayed with a complementary poster explaining the subtleties of each mechanism. The ME 371 teams will also be interviewed and rated by the pre-collegiate students. The most highly-rated team will be awarded the Sparty Plaque, which was designed and fabricated by students at Holt Junior High School over a decade ago.

Teams and members

Section 1

Team 1	Team 2	Team 3	Team 4	Team5	Team 6
Ryan Jacobs	Jinbo Chen	Ryan DuTour	Trevor Laskowski	Alexander Bonnen	Danielle Durocher
Jacob Kramer	Yuhao Chen	Tina Isaac	Bjarne Laursen	John Hardy	Ravin Kelser
Adam Polack	Kyle Corey	Sapan Patel	David Miller	Bansari Patel	Evan Nordquist
Andrew Poteracki	Arric McLauchlan	Saurabh Sinha	Hunter St. Pierre	Samantha Pohlen	Dane Spillman

Team 7	Team 8	Team 9	Team 10	Team 11	Team 12
Stephanie Black	Jill Furness	Gabrielle Colby	Tianyi Fu	Evan Bryant	Joshua Haneline
Austin Daugherty	Camden Harp	Joshua Cresswell	Travis Reinhart	Lauren Grigg	Shadi Jammoul
Stephen Marshall	Jeremiah Manning	Megan Simpson	Pengjie Zhuang	Kevin Licata	Yousib Kammo
Paul Miller		Austin Trethewey		David Thomas	David Zilinskas

Section 2

Team 1	Team 2	Team 3	Team 4	Team5	Team 6	Team 7
Brett Close	John Alocilja	Juntai He	Jason Avedesian	Darius Barrett	Bara Aldasouqi	Justin Fauntleroy
Anthony Kazenko	Trent Johnson	Xue Jiang	Kevin Betts	Sean Hand	Samuel Bekkers	Geoffrey Giese
David Torres	Kyle Sherman	David Richard	Carl Kaspari	Lauren Marino	Martha Rehm	Travis Packer
Alexander Williams	Thomas Stevenson	Kuan-Ying Tao	Alexander Schuen		Seium Teshome	Ryan Volkman

Team 8	Team 9	Team 10	Team 11	Team 12	Team 13	Team 14
Joseph Kim	Paul Petrous	Stephen Jurewicz	Eric Bambach	Reema Aldhaneem	Matthew Heimonen	Evan Flynn
John Multer	Michael Pinger	Benjamin	Nicholas Chase	Joshua Gann	Aidan Hunter	William Freed
Arthur Paquier	Manmit Singh	Rittinger	Brandon Keener	Danielle LaPointe	Tyler Jezowski	Taylor Gilliland
Marian Truttling	Charles Whiteside	Jason Seely	Mitchell Williams	Grant Ridley	Scott Oldham	
		Barrett Winrick				

ME 412
Heat Transfer Laboratory

Dr. André Bénard
Associate Professor of Mechanical Engineering

The Fantastic Vortex Tube

Each project team is to design, model, build, and test a compressed-air-powered Ranque-Hilsch vortex tube---a mechanical device with no power input that separates a single inflow of compressed air into two outflows: one hot and one cold. The goal is to minimize the temperature of the cold outflow while maximizing the temperature of the hot outflow. The vortex tube must be manufactured by the project team. To test each vortex tube, an air compressor will be used to provide the air inflow. There are no restrictions on the dimensions of the tube but the compressor will operate at a fixed setting. Temperatures of the hot and cold outflows will be measured. Each team will have 20 minutes to set up their vortex tube, the operation of which they must demonstrate for at least 10 minutes. Each team is required to prepare a YouTube video to be presented to the audience during the competition, which explains the device's operation and the principles involved.

Competition Schedule

Time	Team Name	Team members		
8:00	J.N.J.	John Casuccio	Nicholas Hansen	Jeffrey McCague
	PV = nR-Team	Kathleen Fitzsimons	James Miller	
8:20	C.C.G.	Benjamin Cooper	Harrison Cummings	Gustavo Gomes
	Team Tubular	Ruibo Gong	Stefan Hebert	Angela Marinich
8:40	You're Hot 'n Cold	Scott Bachor	Riley Chapdelaine	Rochelle Kirzhner
	Under Pressure	Renee Chabon	Sarah Kurtz	Jared Lee
9:00	Prestige World Wide	Andrew Kaye	Suzanne Normand	Kevin Pruess
	Mister Twister!	John Jess	Zakary McLennan	Spencer Turner
9:20	The Air Splits	Amanda Boyd	Benjamin Dewys	Craig Miller
	A.J.	Yelder Abitayev	Abdulrahman Bafaraj	
9:40	Tornado	Andrew Bloch	Daphne Cai	
	Air Extremes	Adam Leenheer	Yanfeng Wu	Ge Zhu
10:00	Team Oz	Eric Darin	Scott McCarter	
	Nerf Inc.	William Hanley	William Lindstrom	Bryan Mittelstaedt
10:20	Dorothy Mantooth	Ann Barrett	Peter Engstrom	Tyler Haley
	The Pragmatists	Daniel Kenny	Nathaniel Sunderlin	
10:40	Team	Christopher Baldwin	Peter Dolce	
	Team Science	David Crouse	Rami Janoudi	
11:00	Icy Hot	Aerin Klump	Mariah Krebs	Katie Renaud
	The Hurricanes	Barrett McManaman	Trevor Nill	Austin Tokarski
11:20	Leopard-Tiger	Jacob Davenport	Daniel Dokter	

ME 471
Mechanical Design II

Dr. Ron Averill
Associate Professor of Mechanical Engineering

Build and Test a Refrigerator Door

Students in ME 471 were challenged to design, build and test a refrigerator door with a non-circular hinge system that steers the door around a fixed obstacle when it is opened. This design helps meet the trends of modern kitchen design. In addition, the hinge and door system must be as light as possible and safely support a 50 pound load at multiple opening positions without significant door sag.

Competition Schedule

Team	Time	Design Team
1	8:00	Louis Dionise, Justin Sagorski, Ryan Thompson, Peter Woodbridge
2	8:12	Abdulrahman Bafaraj, Craig Cline, Brianna Hogan, Kyle Wright
3	8:24	Zhiheng Cen, Deonte Childress, Joshua Hubert, Tae Lee
4	8:36	Jin Chen, Trenton Hicks, Adam Kluz, Ryan O'Sullivan
5	8:48	Robert Hyatt, Haoqi Liu, Brittany Watton, Kyle Watts
6	9:00	Steven Cooper, Hermilo Guerracantu, Daniel Howarth, Yongkang Zhou
7	9:12	William Asherman, Caitlyn Cubba, Nicholas Palazzolo, Daniel Schwartz
8	9:24	Croix Jastrow, Cody Little, John Potts, Jamie Steinberger
9	9:36	Steen Hilliard, Connor Koester, James Miller, Timothy Najar
10	9:48	Jin Ahn, Joseph Aljajawi, Megan Blaszak, Alexander Morita
11	10:00	Garrett Baughman, Joshua Boerger, Alexander Primeau, Qichen Xiao
12	10:12	Brandon Cameron, Kyle Griffiths, Katherine Jansen, Yaojing Yang
13	10:24	Oroje Agari, Thomas Parshall, Eric Schendel, Alan Seery
14	10:36	Hassan Alyousef, Daniel-Dean Delorme, Thomas Hotari, Theodore Linabury
15	10:48	Jessica Doody, Emma Drenth, Michael Uggeri, Ge Zhu
16	11:00	Luke Ferguson, Matthew Pingel, Todd Sabotta, Stephen Tatangelo
17	11:12	Scott Belonge, Christopher Brady, Man Foo, Miles Turrell

This ME471 design project was generously sponsored by Whirlpool Corporation

Whirlpool CORPORATION


Chassis
Brakes


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The Capstone Projects

Dr. Giles Brereton
Associate Professor of Mechanical Engineering

Presentation Schedule – Room 1208 Engineering Building

Time	Team Sponsor	Project Title
8:30 a.m.	Marathon Petroleum	Portable Oil Pipeline Inspection Gage
9:00 a.m.	Ingersoll Rand	Improved Packaging for HVAC Units
9:30 a.m.	GM	Design of a Carbon-fiber Vehicle Hood
10:00 a.m.	Denso	Pre-chamber Igniter for Lean Combustion
10:30 a.m.	Consumers Energy	Heating System for a Pressure Regulator
11:00 a.m.	Chrysler	Waste Heat Recovery with Thermoelectrics
11:30 a.m.	ArcelorMittal	Improved Dust Removal from Arc Furnaces

Presentation Schedule – Room 1220 Engineering Building

Time	Team Sponsor	Project Title
8:30 a.m.	Meritor	Optimized Transfer-case-housing Design
9:00 a.m.	Bosch	Installation/Removal Tool for Accelerometers
9:30 a.m.	Union Pacific	Efficient Use of Carboline Paint Containers
10:00 a.m.	U.S. Steel	Redesigned Scraper for Steel Galvanizing
10:30 a.m.	Whirlpool	Washing Machine Brake Mechanism
11:00 a.m.	Whirlpool	Food-processor Extruder
11:30 a.m.	ZF	Torque Calibrator for Ball Joints

To view these presentations live, please visit the Design Day website: http://designday.egr.msu.edu and click the Watch Live tab in the left-side menu bar.

ME 481 Mechanical Engineering Design Projects

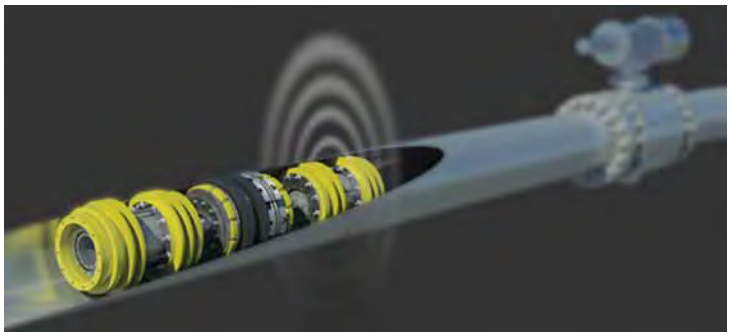
Mechanical engineers make the world move and provide the energy for it to do so. One goal of the MSU Mechanical Engineering Program is to educate engineers who are prepared to Lead, Create, and Innovate as their professional or graduate careers evolve. The Mechanical Engineering Design Program is the 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 faculty advisers for these projects are: Seungik Baek, Giles Brereton, Patrick Kwon, Dahsin Liu, Alfred Loos, Farhang Pourboghrat, Rodney Tabaczynski, Elisa Toulson, Indrek Wichman, Neil Wright and George Zhu.

Marathon Petroleum Corporation
Portable Oil Pipeline Inspection Gage

Marathon Petroleum is a major oil company that operates rigs, refineries, and supply pipelines in the Gulf of Mexico and throughout the US. The efficient operation of a pipeline network requires that it undergoes periodic inspection and maintenance, and one such inspection tool is the Pipeline Inspection Gauge or PIG. PIGs are remotely operated, and are inserted into and removed from pipelines at 'traps,' upstream and downstream of which are 'trap valves.' After insertion into a pipeline, PIGs perform routine cleaning, check for protrusions from pipe walls and are often used in conjunction with other in-line inspection tools to perform rigorous inspections of the pipe-wall structure such as detecting cracks and measuring wall thicknesses. When operating PIGs, it is essential to know where the PIG is with respect to the trap valves, so that these valves can be safely opened or closed at the right time, without damaging the PIG, so a device that signals the location of each PIG is desirable.

Marathon Petroleum Corporation has assigned the ME481 design team the task of designing and manufacturing a portable and reliable PIG Signaler that can be adapted to pipelines of different diameters. Existing Signalers are unreliable, can be difficult to install, and can be damaged if bounced/flushed from a trap to a pipeline, which in turn can damage expensive PIGs. A successful PIG Signaler design will facilitate PIG insertions, provide pipeline technicians with accurate data on PIG locations relative to trap valves, and provide the same benefits if installed in other in-line inspection tools.



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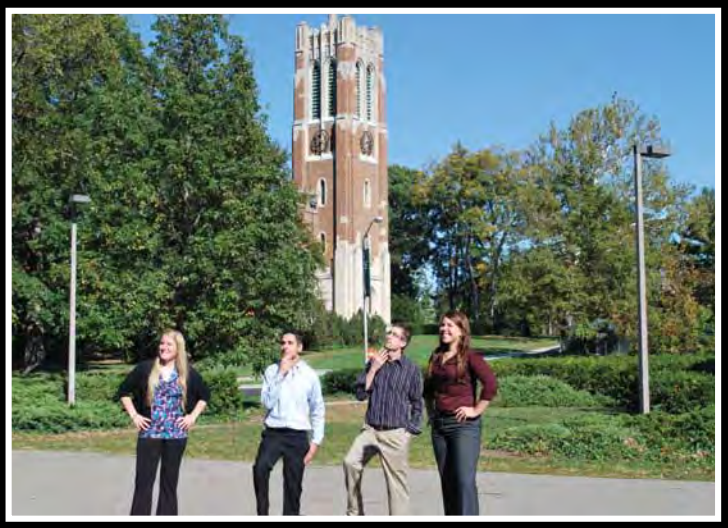
Ingersoll Rand
Improved Packaging for HVAC Units

Ingersoll Rand, a global industrial company, has been enhancing and designing heating and air conditioning systems for domestic and commercial use for over 140 years. One focus of this company is to provide products and services that offer high customer satisfaction. A recent addition to the Ingersoll Rand product line is a wide range of HVAC (heating ventilation and air conditioning) systems. The current packaging and delivery process for these products appears to need troubleshooting and improvement, as approximately 10% of some system components show signs of damage upon installation.

The goal of this project is to reduce the incidence of damaged HVAC systems to 5% or less under specified cost constraints. To do so, the MSU team will attempt to identify the most likely points and modes of damage to these HVAC components during the current packaging, loading, delivery, unloading, and storage processes, design an improved system for shipping these components, and perform tests to evaluate whether improvement is achieved in one or more of these specified areas. When an optimal solution has been identified, further testing will be carried out at Ingersoll Rand.



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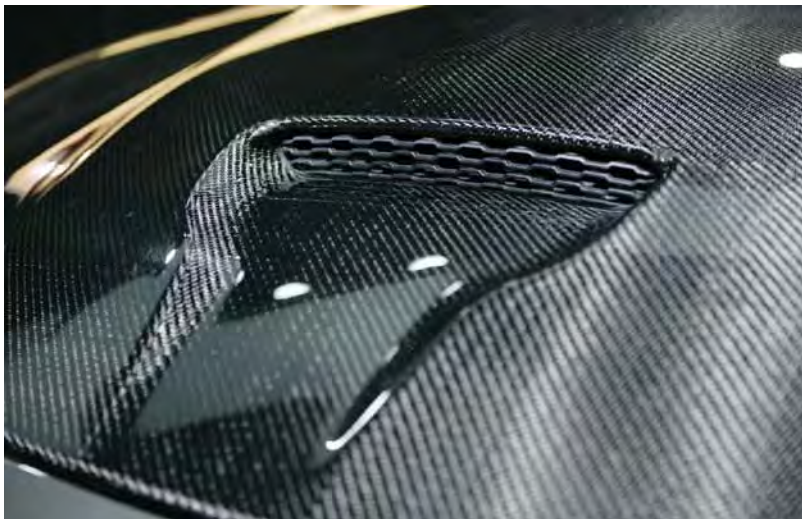
ME 481 Room 1208 | First Floor **9:30 a.m.**

General Motors Foundation
Design of a Carbon-fiber Vehicle Hood

General Motors is one of the Big Three automakers and produces millions of vehicles each year for the domestic and global auto markets. Their production fleet comprises a wide variety of vehicles that includes various passenger vehicles, electric cars, sports cars, SUV's and pickup trucks. GM is interested in the potential use of composite materials like carbon fiber for vehicle body panels, and their strength, weight, and cost relative to steel ones. This ME 481 team has been assigned the task of exploring the feasibility of manufacturing carbon fiber hoods for these vehicles and analyzing whether or not such hoods can be designed and manufactured in a cost effective manner.

The ME 481 team plans to carry out a series of finite element analyses on representative hood geometries to explore the potential benefits of carbon fiber relative to steel. These computational analyses will be used to determine the feasibility of this lightweight material for future GM products.



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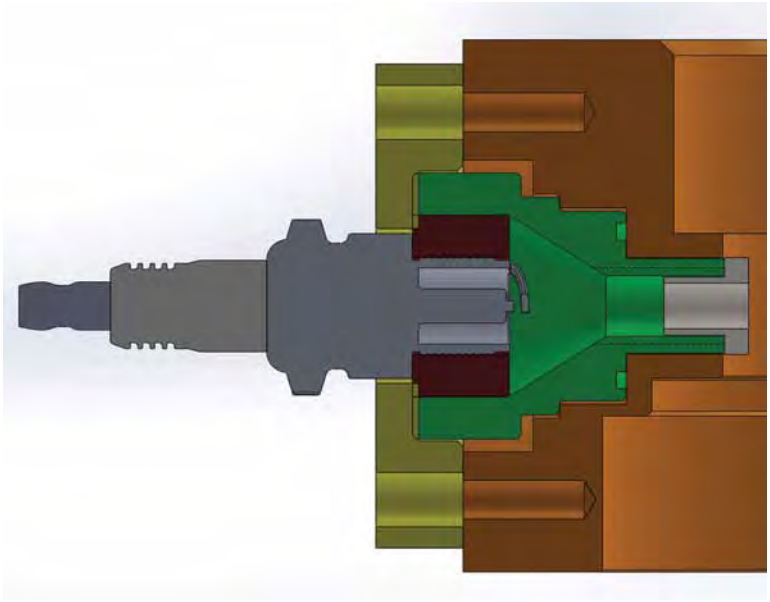
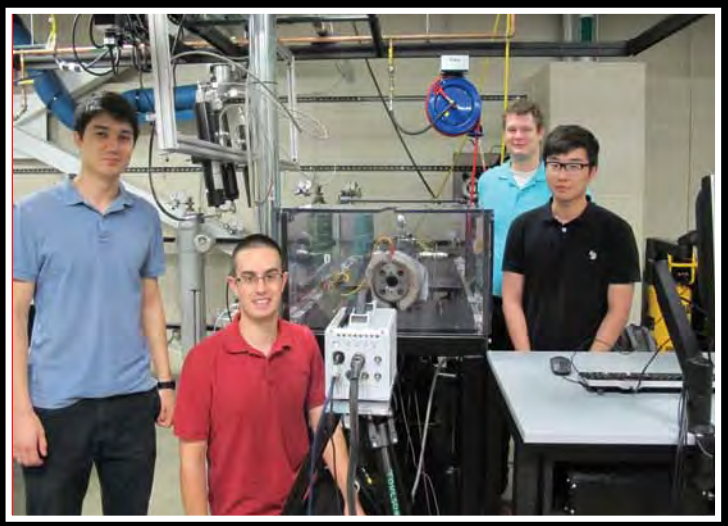
DENSO North American Foundation
Pre-chamber Igniter for Lean Combustion

DENSO is a leading supplier of advanced automotive technology, systems and components to all the world's major automobile manufacturers. DENSO produces many different advanced factory-installed components for vehicle powertrains including fuel injection, exhaust gas treatment, and ignition systems. This corporation is currently interested in developing ignition systems for engines of the future, which can provide greater thermal efficiency and reduced NOx emissions by operating at air-fuel mixtures that are much leaner than those of today's engines.

The goal of this senior design team is to use the findings of current advanced ignition research to design a complete pre-chamber ignition system, with a unique geometry and a high-energy sparkplug ignition system. The long-term goals of this project are to refine the ignition system so that it produces optimal lean flammability limits, burn rates and pressure-rise rates during the combustion in an internal combustion engine.



DENSO



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DENSO
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Consumers Energy
Heating System for a Pressure Regulator

Consumers Energy is one of the largest energy suppliers in the State of Michigan and provides electricity and natural gas to over 6 million customers. As a natural gas supplier, Consumers Energy provides methane fuel to a wide range of customers in the southeast and middle parts of the state. Natural gas enters Michigan through transmission pipelines at a high pressure which must be reduced before delivery to cities and neighborhoods. As the pressure is decreased through city gate and regulator stations, the gas expands and cools. This cooling effect, known as the Joule-Thompson effect, can cause the gas temperature to decrease below freezing, which can potentially cause damage to pipes and other equipment. Consumers Energy is interested in design concepts that allow for the safe heating of the natural gas to avoid sub-freezing gas temperatures.

The goal of this project is to design and evaluate a set of heat exchangers for installation at regulator station sites that satisfies Consumers' constraints. An optimal design will be selected and then modified to meet a range of local site characteristics. A model of the selected design will then be created and delivered to Consumers Energy for further evaluation.

Consumers Energy
Count on Us

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Chrysler Group, LLC
Waste Heat Recovery with Thermoelectrics

Chrysler Group, LLC, is one of the leading manufacturers of automobiles, selling 2.2 million vehicles a year. Along with its global strategic-alliance partner Fiat, Chrysler embraces next-generation technology. Driven by consumer demands, government mandates, and environmental responsibility, Chrysler would like to maintain a competitive edge in the fuel economy of its vehicles, and one particular opportunity for doing so lies in using thermoelectric materials to recover otherwise wasted heat energy in, for example, the exhaust system, and convert it into electricity for use in the vehicle. In current automotive engines, approximately two-thirds of the chemical energy released during gasoline combustion is lost in the form of heat in the radiator and the exhaust. With ever increasing fuel economy demands, the ability to harness this waste heat in internal combustion engines could help automobiles improve their efficiency.

Thermoelectric materials, or TEMs, are a developing material-science technology that uses a temperature difference to produce an electrical voltage. The objective of the project is to study an automotive system to determine the feasibility of using TEMs and to determine the optimal location for their placement in a vehicle. The team will analyze how this additional power output could be utilized to reduce vehicle weight and improve fuel economy. The results will be quantified with both a computational model and a physical prototype.

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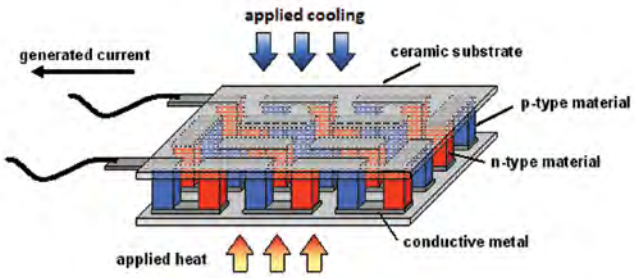

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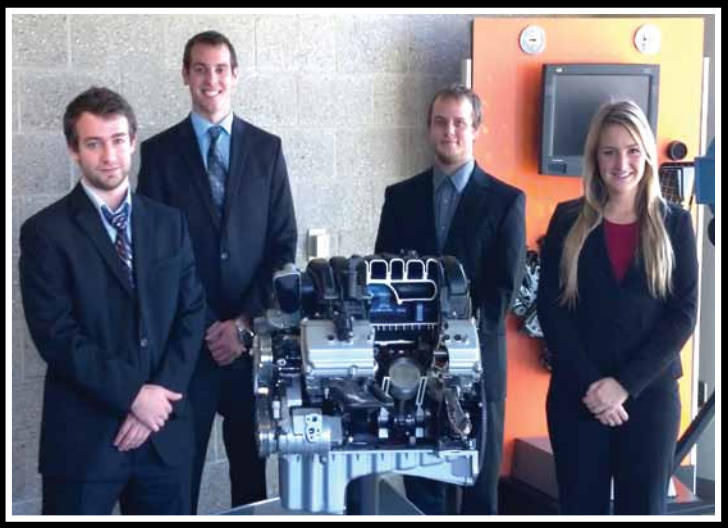

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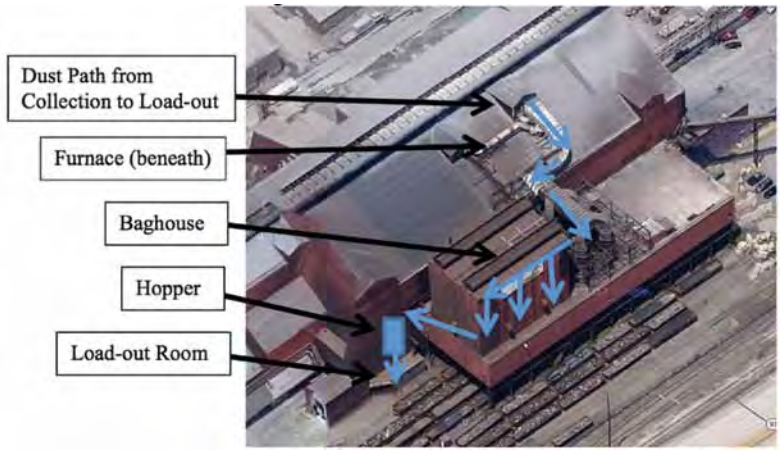
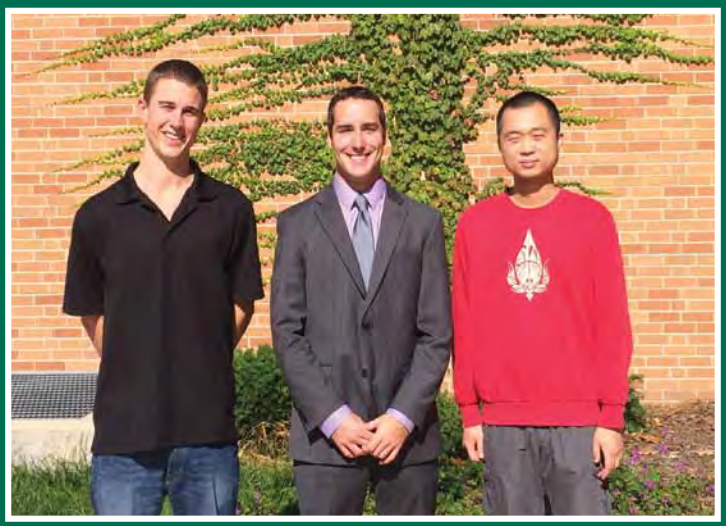
ArcelorMittal
Improved Dust Removal from Arc Furnaces

ArcelorMittal is a world leader in mining and the production of quality steel products. A common machine used in the modern day steel industry is the electric arc furnace (EAF), which uses a high-powered electric arc to heat and melt steel. An EAF is ideal for recycling scrap steel. Unfortunately, it also results in large amounts of dust being created during the melting process. Since this dust is a hazardous waste, laws require that it be collected in a way that minimizes its escape. After filtration, EAF dust is collected for recycling and disposal by loading onto truck beds. ArcelorMittal is interested in design recommendations to update their existing system to better prevent the release of fugitive dust, and to recapture the dust that escapes in the loading dock.

The MSU engineering team has been tasked with finding and recommending solutions that eliminate the fugitive dust during the EAF dust load-out. An optimum design will require little or no routine cleanup, little maintenance, and be easy to use. A successful solution will be a design that minimizes dust leakage, and provides a method to re-capture any dust that does escape. The solution will be demonstrated with a scale model.



ArcelorMittal



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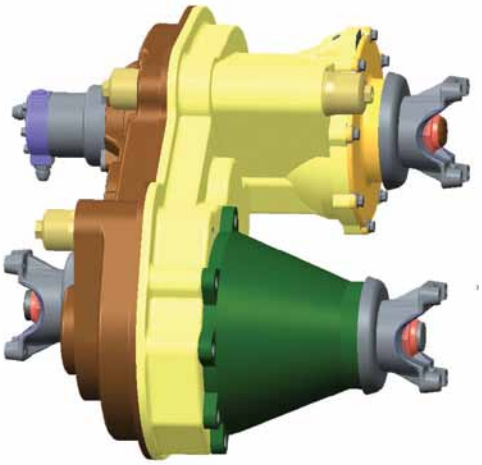
Meritor
Optimized Transfer-case-housing Design

Meritor is a leading global supplier of axle, brake, and suspension solutions to original equipment manufacturers and to the aftermarket for the transportation and industrial sectors. One of the driveline products that Meritor provides to the commercial truck and industrial sector is its line of transfer cases, which take power from an engine's transmission and distribute it to one or more (i.e., front and back) axles, in a wide range of customized assembly configurations. Meritor is interested in adding another transfer case to its product line to meet the needs of the 33 k-lb. gross vehicle weight segment of the commercial four-wheel drive truck market, and has asked the MSU team to evaluate a design for this transfer-case housing.

The main objective of this project is to design a transfer-case housing that is optimized for weight and cost. The optimized housing must meet specific requirements for deflection, stress, and fatigue life. It must be of a bolted-joint design with internal lubrication channels and must also provide satisfactory heat dissipation. The team's optimized design will be evaluated by Meritor.



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Robert Bosch, LLC
Installation/Removal Tool for Accelerometers

Robert Bosch, LLC is a leading global supplier of technology and services in the areas of automotive technology, consumer goods, industrial technology, and energy and building technology. The Diesel Fuel Systems group tests all diesel components manufactured in North America, from fuel injectors to particulate filters and oxidation catalysts. One important aspect of testing is the susceptibility of components to vibration during vehicle operation, which is tested by mounting accelerometers to locations of interest on the component and comparing the observed levels to pre-determined vibrational limits found from shaker-table testing. Many of the locations of the accelerometers within the engine bay, including the fuel pump, are difficult to reach by hand and require an engine teardown. Due to the time-consuming manner of setting up these tests, a faster method is needed to attach accelerometers to the engine components.

The MSU design team will assess different possible tool concepts before deciding on possible designs, which will then be manufactured as one or more prototypes. The prototypes will be evaluated for functionality and an optimal tool will be created. This tool will then be delivered to Bosch for further vibration tests and should improve the ease of accelerometer application and removal, while decreasing the overall duration of its vibration tests.

Flexible, Rigid Hose Body for Tool Prototype

Sample position of of accelerometer on Bosch pump

BOSCH
Invented for life

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Robert Bosch, LLC
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Union Pacific Railroad
Efficient Use of Carboline Paint Containers

Union Pacific operates the country's largest railroad network, providing transportation services for over 32,000 miles of track in 23 states. The railcars in the fleet suffer wear from continuous use and exposure to the elements and are sent to the repair facility in Desoto, MO for operational refurbishing. One of the major reconditioning programs there involves repainting the inside of the food-grade covered hopper railcars to protect their contents from contamination during travel. The paint used is a two-part epoxy that arrives in industry-standard totes that cannot be fully emptied because of the tote's design. Because of its chemical properties, the unused paint is considered hazardous waste and must be disposed of at a significant cost to the company. Union Pacific is interested in a new method to remove all the paint from the totes that will make them a nonhazardous commodity and allow the company to recycle them or dispose of them as regular waste.

The MSU team will assess multiple design options that satisfy Union Pacific's and the tote's constraints. An optimal design will be selected and tested based on performance, ease of installation into the refurbishing process, and cost reduction of the current tote disposal system. The team will travel to the Desoto facility to present the final prototype and test its effectiveness.

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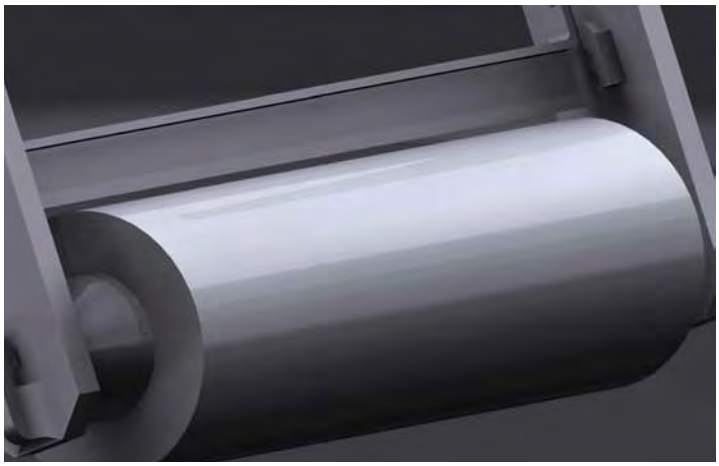
United States Steel Corporation
Redesigned Scraper for Steel Galvanizing

United States Steel Corporation is one of the leading manufacturers of galvanized sheet steel in the United States for the domestic automotive industry. The process of steel galvanizing takes place in a pot rig comprising three rolls that guide a strip of steel into a bath containing a metallic mixture of zinc, iron, and aluminum. The iron in the steel strip that moves through the zinc pot reacts with the metallic mixture to form a compound known as dross. When dross collects on the rolls and makes contact with the steel strip, the quality of the galvanized finish may be compromised. Currently, an automatic scraper removes dross from the main roll, but the life span of the scraper is limited. Manual removal of the dross is still necessary for all three rolls, which is dangerous. In addition, it is necessary to replace rolls that build up excessive amounts of dross, which is costly. US Steel is interested in exploring and implementing design concepts for a new scraper system with a longer operating life that reduces the amount of manual scraping of the main roll. In addition, US Steel would like to incorporate automatic scraping of one of the secondary rolls.

The MSU team will evaluate several new scraper designs that satisfy US Steel's objectives and meet their constraints. An optimal design solution will be proposed based upon mathematical and 3D modeling as well as cost. A functioning proof-of-concept prototype will then be built and evaluated as a possible prototype for a full-scale model, which would be tested for functionality and reliability.



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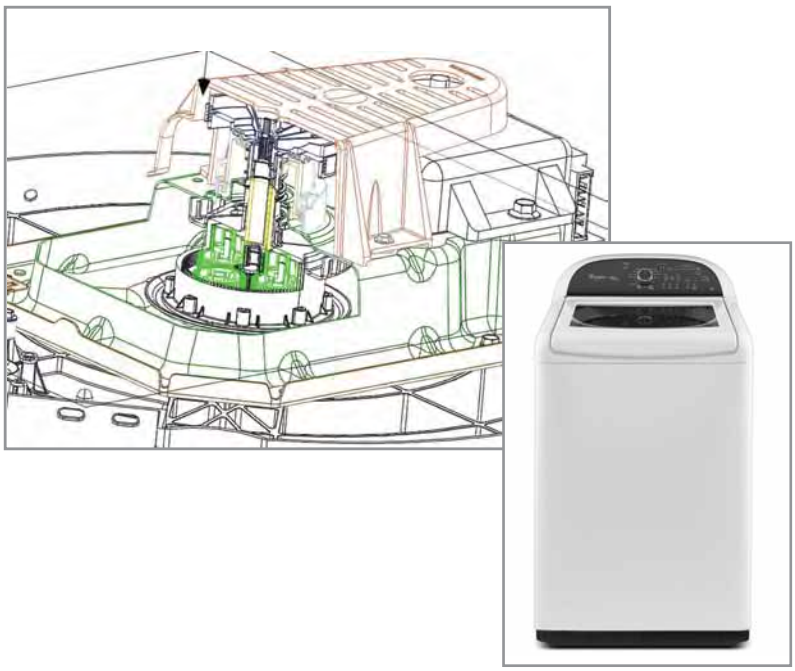
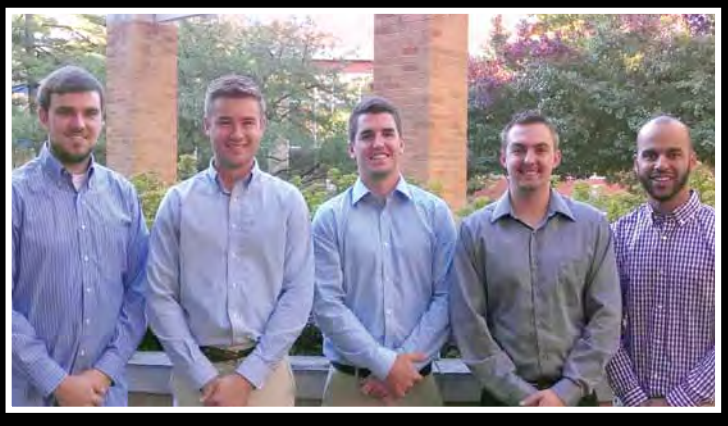
Whirlpool Corporation
Washing-machine Brake Mechanism

Whirlpool Corporation is one of the largest appliance-manufacturing companies in the United States and sells its products throughout the world. One product line in which Whirlpool has identified an opportunity for redesign is its washing machines, of which it manufactures many different models. According to Whirlpool's safety standards, a washing machine cannot be opened until the rotating tub/basket has come to a complete stop. For safety reasons, a door lock prevents the lid from being opened until the machine reaches a complete stop. In some cases, it can take up to three minutes for the tub to come to rest after the completion of the washing cycle, after which the customer can open the door to the washer.

Whirlpool would like to add a braking system to these washers to stop the rotating tub in less than 7 seconds. The braking system must be cost-effective and quiet, and must not degrade either the function or safety of the washing machine. The MSU design team is considering several conceptual braking-system designs and will build and test a prototype of the optimal design for Whirlpool to evaluate.



Whirlpool CORPORATION



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Whirlpool Corporation
Project Sponsor

Brad Morrow
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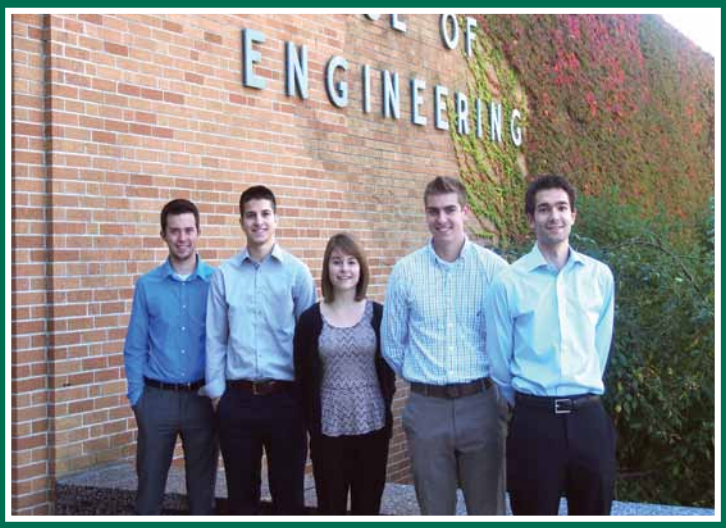
ME 481 Room 1220 | First Floor **11:00 a.m.**

Whirlpool Corporation
Food-processor Extruder

KitchenAid, a division of Whirlpool, was founded in 1919 when its first product was the stand mixer. Today, KitchenAid produces and sells worldwide a diverse selection of appliances to meet almost all food preparation needs. Today's large food processors are typically capable of a wide variety of functions while smaller, less expensive processors tend to have limited but specialized uses. However, consumer surveys have shown that customers want to quickly and easily process single-batch ingredients in small processors, while still maintaining the ability to process a wide variety of foods such as whole fruits, vegetables, meats, and cheeses. They wish to do so without having to use the larger, more expensive food processing machines. Consumers have also expressed the desire for a small processor that can extrude processed food in a 'hands-free' manner to achieve gourmet-like results.

The aim of this project is to create a food processor/extruder design that offers the functionality of a large food processor with the footprint of a small, specialized processor. The ME481 team will design, build, and test a prototype to meet these criteria, for evaluation by KitchenAid.

Whirlpool CORPORATION



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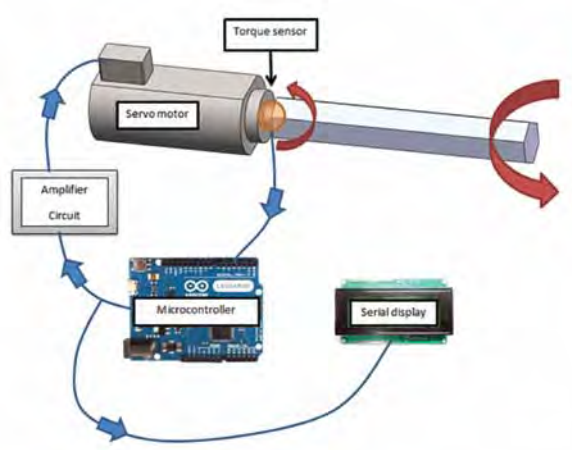
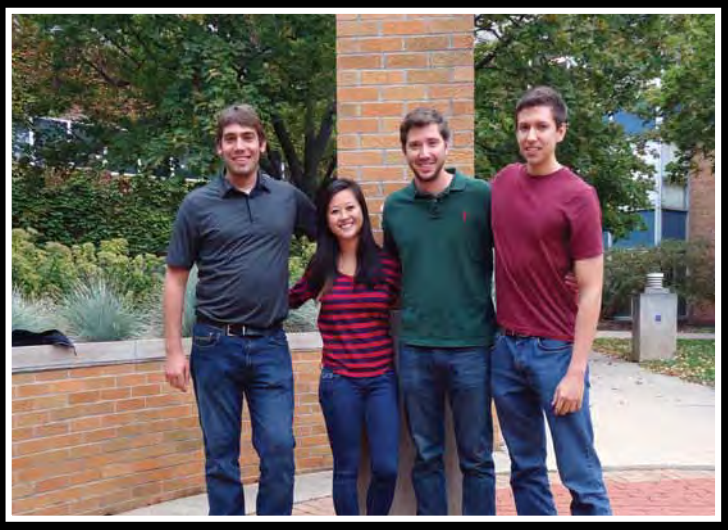
ZF Chassis Components
Torque Calibrator for Ball Joints

The ZF Group is one of the world's largest automotive suppliers, and develops and produces transmissions, steering systems, axles and chassis components. ZF Lemforder is the subsidiary of this group that specializes in steering and suspension technology and, in particular, ball-joint and suspension-linkage testing systems. Ball joints are utilized in several parts of a vehicle's suspension, where multi-axis rotation is needed, and undergo extensive testing for their friction, torque, elasticity, wear and fatigue characteristics. ZF is interested in improving the accuracy with which the frictional force can be measured in a ball joint undergoing rotation, as friction levels within a certain range can correlate with ball joint service life.

The objective of this project is to design a torque calibration device that can be used with ZF's existing torque-application machines to measure friction in ball joints. The torque calibration device will simulate a "perfect" ball joint, giving a torque reading of a constant, known value with a specified degree of precision. The design team plans to do so by using a feedback loop to monitor and adjust the torque provided by a servo motor as a surrogate for a ball joint undergoing rotation. The MSU team will design, build, and test a prototype which will be used to evaluate this measurement concept.





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ZF Chassis Components
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Design Day Awards

ME 481 Thomas Alva Edison Undergraduate Design Award

The Edison Undergraduate Design Award is given to the ME 481 Design Team that is judged to have produced the most outstanding technical design project. Last semester's winning Edison Scholars were Todd Graham, Dan Holmes, Elizabeth Kurcz and Sylvia Reiser. They carried out a project sponsored by Dow Chemical Company of Edina, MN in which they designed, built, and tested a compressed-air-driven machine to automatically wrap, tension, and secure a plastic film to a reverse-osmosis filter. The project was supervised by Adam Alderman and Tom Lanz at Dow Chemical, and Dr. Abraham Engeda at MSU. The funding for this award is provided by the Shell Oil Company.

ME 481 Edison (Dow Chemical Company
Fabrication of a Reverse Osmosis Filter)

Left to right:
Professor Giles Brereton
Todd Graham
Elizabeth Kurcz
Sylvia Reiser
Dan Holmes

ME 481 Project Presentation Award

The ME 481 Project Presentation Award is given to the ME 481 Design Team that is judged to have given the best technical project presentation. Last semester's winning team comprised: Jun Li, Jiao Luo, Andrew Putz, and Yue Xu. The team presented and demonstrated a detailed engineering structural analysis and design of an extender for a hospital bed, in a project sponsored by Stryker Corporation. The project was supervised by Chris Sweeney at Stryker Corporation, and by Dr. Tom Pence of MSU.

Left to right:
Professor Giles Brereton
Jun Li
Jiao Luo
Yue Xu
Not shown: Andrew Putz

Spring 2013

ME 471 Machine Design Award: The Leonardo da Vinci Award

The Leonardo da Vinci Award is given to the winning team in the ME 471 machine design competition on Design Day. Last semester's winners, Benjaman Bennetts, Ronald Dewberry and Peter Engstrom, designed, built and demonstrated the best robot to stack cylindrical objects on pallets.

Left to Right:
Professor Ronald Averill
Ronald Dewberry
Peter Engstrom
Benjaman Bennetts
Todd Graham
Not shown: Lukasz Kurczab

ME 412 Heat Transfer Design Award

The student team members winning the ME 412 competition at Design Day are given the Heat Transfer Design Award. The award winners, Dan Holmes, Landon Riker and Cory Snowdin, demonstrated the most effective candle-powered water desalinator.

Left to right:
Landon Riker,
Dan Holmes.
Not shown: Cory Snowdin

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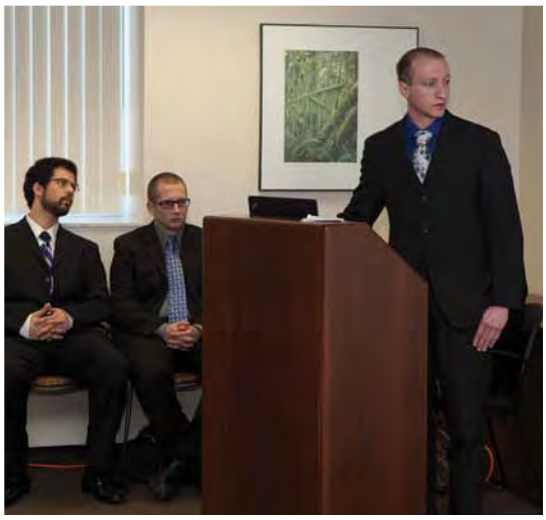

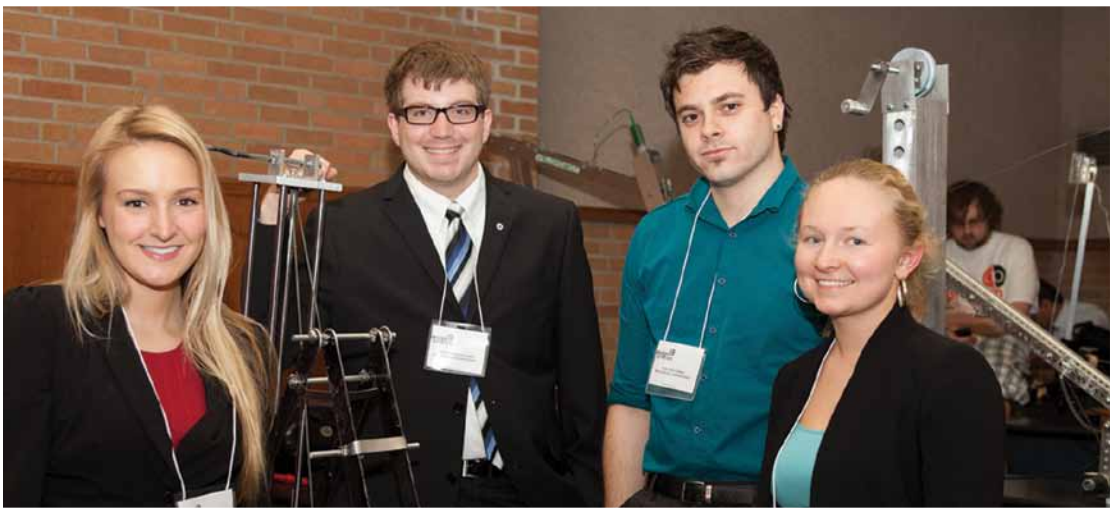


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