MICHIGAN STATE UNIVERSITY

MICHIGAN STATE UNIVERSITY
DesignDay
COLLEGE OF ENGINEERING

Fall 2011

AUTO-OWNERS INSURANCE COMPANY
AUTO-OWNERS LIFE INSURANCE COMPANY
HOME-OWNERS INSURANCE COMPANY
OWNERS INSURANCE COMPANY
PROPERTY-OWNERS INSURANCE COMPANY
SOUTHERN-OWNERS INSURANCE COMPANY

Auto-Owners Insurance

Life Home Car Business

The "No Problem" People®

~ Serving Our Policyholders and Agents for More Than 90 Years ~

December 9, 2011

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

On behalf of Auto-Owners Insurance Company, and in partnership with Michigan State University, it gives us great pleasure to welcome you to the beautiful MSU campus and specifically to the MSU College of Engineering Design Day. We are pleased and honored to partner with Michigan State University in this program, which showcases the talents and abilities of many gifted students.

It has been said the future belongs to the youth. If this is the case, (which we believe to be true) by the creativity, imagination, and initiative displayed by the participating students in this year's Design Day Program, you have to admit the future looks very bright indeed. A tremendous array of skills and abilities will be displayed this year, which further substantiates our continued support of this program. We congratulate each participant along with those who have provided support, guidance and instruction to them.

As a recruiter of talent for the ongoing needs of our Company, we could not be more pleased with programs like Design Day, or the constant exposure to creative thinking that is provided through the daily course work at Michigan State University. We hire many graduates from numerous disciplines at MSU, and find them to be dedicated, hard working individuals who quickly become solid members of our team. We could not be more proud. Auto-Owners Insurance has called Michigan home since our beginning in 1916. We consider ourselves, along with Michigan State University, one of the great success stories in this state. This year we were ranked "Highest in Customer Satisfaction with the Auto Insurance Claims Experience, Four Years in a Row" by J.D. Power and Associates. One of the reasons we are able to receive such a great recognition and continue to grow is because of our outstanding associates and our partnership with great local agencies.

We wish you a truly pleasant, exciting and stimulating day here on the MSU campus. May you be thrilled by the talent of the participants as well as the deep heritage of this campus. We at Auto-Owners Insurance join in congratulating all the participants, proud parents, and sponsors who took the initiative to support this program. Our best wishes to all for a wonderful day!

Jeffrey F. Harrold, CPCU, CLU, ChFC
Chairman & CEO

"Highest in Customer Satisfaction with the Auto Insurance Claims Experience"

- - J.D. Power and Associates

Program Page/Course Number
Index Listing: December 9, 2011

Design Day Events Schedule:
Friday, December 9, 2011

EVENTS	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon	1 p.m.
Audio Enthusiasts and Engineers	2nd Floor Concourse 8:00 a.m. – 1:00 p.m					
Engineering Student Organizations		2nd Floor Concourse 9:00 a.m. – 1:00 p.m.				
EGR 100 Presentations		2nd Floor Parlor A 9:00 a.m. – noon				
ME 371 Demonstrations		2nd Floor Gold Rooms A & B 9:00 a.m. - noon				
ME 412 Competition		2nd Floor Ballroom 9:00 a.m. - 11:30 a.m.				
ME 456 Competition	Lake Superior Room 8:00 a.m. - 9:40 a.m.					
ME 471 Competition		2nd Floor Ballroom 8:30 a.m. - 11:30 a.m.				
CAPSTONE COURSES						
All Capstone Posters	1st Floor Lounge 8:00 a.m. - noon					
CE 495 Project Presentations	Lake Michigan Room 8:00 - noon					
CE 495 Project Presentations	MSU Room 8:00 - noon					
CSE 498 Project Presentations	Lake Ontario Room 8:00 a.m. - 11:35 a.m.					
ECE 480 Project Presentations	Lake Huron Room 8:00 a.m. - 11:45 p.m.					
ME 481 Project Presentations			Lake Superior Room 9:55 a.m. - 11:30 p.m.			
ME 481 Project Presentations	Tower Room 8:00 a.m. - 11:30 p.m.					
LUNCH AND AWARDS						
High School Awards			Parlor C Noon - 12:10 p.m.			
MSU Lunch			2nd Floor Concourse 12:15 p.m. - 1:00 p.m.			
MSU Awards				Ballroom 1:15 p.m.- 2:00p.m.		

KEY:
- 🟥 CE event
- 🟫 CSE event
- 🟥 ECE event
- 🟧 EGR event
- ⬛ ME event
- 🟩 School event

FLOOR PLANS:

1st Floor

Food Court | Service | MSU Federal Credit Union | Union Central | Post Office | Concourse | Main Lounge | Spartan Spirit | Women's Lounge | MSU Dairy Store

2nd Floor

Ballroom | Sun Porch | Kitchen | Administrative Offices | Coat Room | Concourse | Parlor A | Parlor B | Parlor C | Gold Room A | Gold Room B | Green Room

N W E S

3rd Floor

Lake Michigan Room | Lake Erie Room | Student Activities Office | Concourse | MSU Room | Lake Huron Room | MSU Admissions Office Welcome Room | Lake Ontario Room | Women's Resource Center | Student Alumni Foundation | Lake Superior Room

4th Floor

Storage Room | Tower Room | 1925 Room

STAFF ACKNOWLEDGEMENTS:

Roy Bailiff   Jill Bielawski   Linda Clifford   Kelly Climer   Cathy Davison   Craig Gunn

Phil Hill   Matt Jennings   Debbie Kruch   Jamie Lynn Marks   Garth Motschenbacher   Mary Mroz

Gregg Mulder   Stephen Paslaski   Roxanne Peacock   Adam Pitcher   Jeanette Robertson   Meredith Schmidt

Norma Teague   Teresa VanderSloot   Brian Wright

MACHINE SHOP AND DESIGN LAB STAFF:

Ken Barlage, Russ Tindall, Colin Perrault

A note from the Design Day Director

The College of Engineering welcomes you to Design Day! We wish you a very memorable event as you experience our students and their amazing talents through presentations, competitions, and posters.

We are proud to recognize Auto-Owners Insurance as the Fall 2011 Design Day Executive Partner. A Lansing based Fortune 500 company; Auto-Owners Insurance has a rich history of engagement with Michigan State University and the College of Engineering.

As you visit our various exhibits throughout the MSU Union, please take time to learn about the projects. Our students are an incredible group of people who love to share their enthusiasm for engineering.

An exciting part of Design Day is the approximately 200 high school students participating in the Dart Foundation Day of Engineering Innovation and Creativity for 7th-12th Grade Students. These future engineers will explore design principles with hands-on projects requiring the application of their creativity and ingenuity.

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

Design Day would not be possible without the continued support of our project sponsors who provide both funding and a professional experience for our capstone design teams.

Along with our Executive Partner, Auto-Owners Insurance, we thank our Supporting Partners Dow Chemical Corporation, GE, Michigan State University Federal Credit Union, and Norfolk Southern.

Please join us for the Design Day Awards ceremony in the Ballroom at 1:15 pm when we will honor all of our talented Spartans, the best of the best.

Sincerely,

Maureen E. Blazer-Adams
Director, Design Day
MSU College of Engineering

Dart Day of Innovation and Creativity
for 7th-12th Grade Students
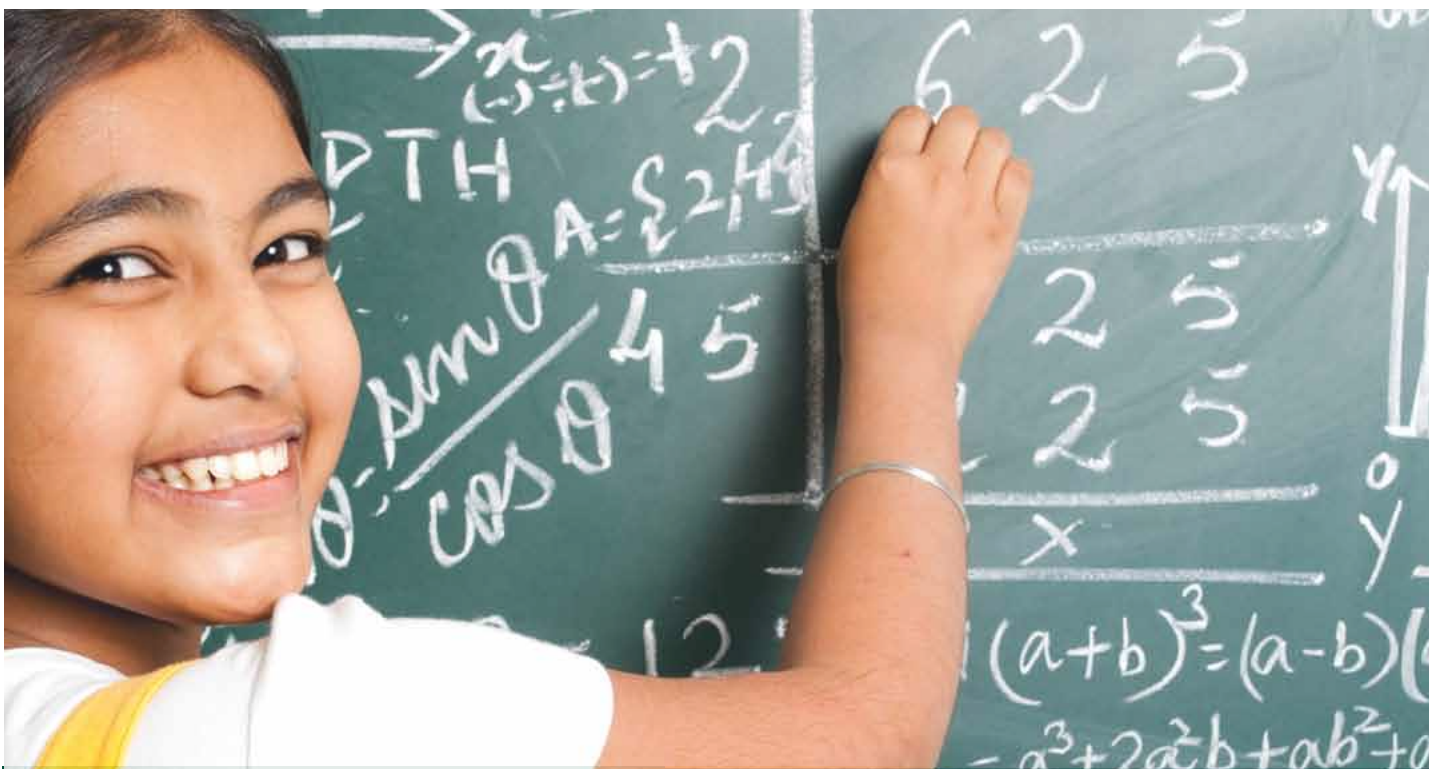
Our Future Lies in Some Very Precious Hands...

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**

Middle & High School Innovation & Creativity Day

December 9, 2011

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.

NSF funded Research Experiences for Teachers (RET) Site Workshop 9 a.m. - Noon	
9:00–9:55	Welcome and Summer Institute Teacher Curriculum presentations
10:00–10:55	VEX Robotics and Interdisciplinary Engineering Builds
11:00-11:55	Engineering Student Project Viewing and Voting
12:00–12:10	Award ceremony in Parlor C

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.
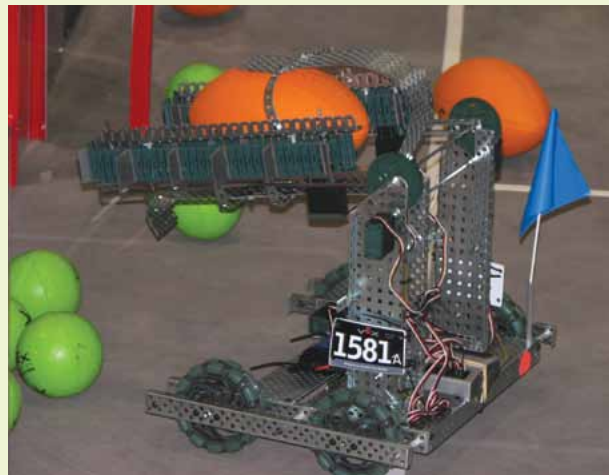
INTERDISCIPLINARY ENGINEERING BUILD

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

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

Jamie Lynn Marks
MSU Engineering
Recruitment and
K-12 Outreach

Russ Pline
Okemos High School
and MSU Design Day
Coordinator

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

Luis Donado
Assistant Director
for Recruitment
and K-12 Outreach
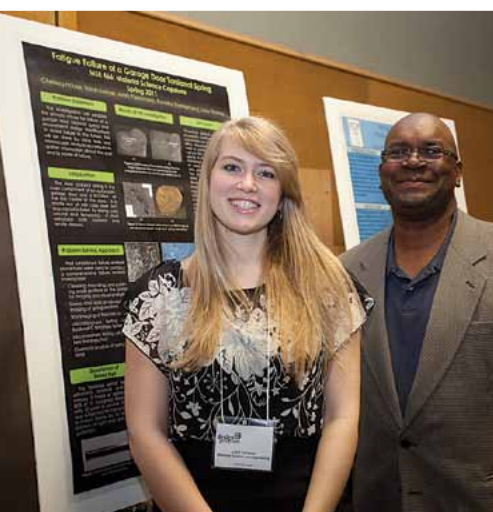
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GE employs nearly 600 MSU alumni and is a proud sponsor of Design Day

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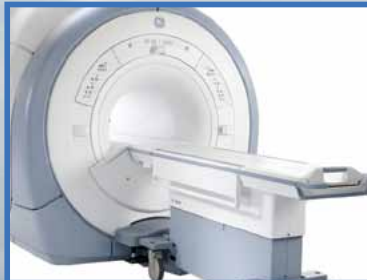
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EGR 100 Introduction to Engineering Design

Mr. Hinds

INTRODUCTION TO ENGINEERING DESIGN

INSTRUCTOR: Mr. Timothy Hinds

TA STAFF: Alexander Baumann, Wouter Brink, Lauren Fedak, Ian Jarvis, Ross Loynes, Eric McElmurry, Brad Rutledge, Marc Santa, Anthony Steward, George Wimbrow

MENTOR STAFF: Christina Barry, Ryan DeBono, Michael Douglass, Mike Fetter, Carrie Fox, John Gaiser, Nur Azan Joned, Jennifer Jury, Mariah Krebs, Franklin Luchini, Kyle Melzer, Ian Neerken, Trent Pasini, Landon Riker, Cori Roth, Sarah Steudle, Chaoran Sun, Kyle Sweet, Shane Ung, Matthew Wiggans, Kenneth Young

RCPD ADVISOR: Stephen Blosser

PROBLEM STATEMENT

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 Cornerstone Engineering and Engineering Residential Experience programs. The course introduces students to the engineering profession and the engineering design process through team-based, interdisciplinary design projects and assignments. Over 700 students are enrolled in EGR 100 this semester.

For the final course project, the student teams selected from three project types: (i) thermal insulator design, (ii) Lego® Mindstorms® competition and (iii) MSU Resource Center for Persons with Disabilities (RCPD) design. For the first choice, the student teams were to design, build and test a thermal insulator that would minimize the temperature increase of a given volume of water exposed to a heat source. The prototypes were to fit within a specified test fixture. The second choice required the students to build and program an autonomous robot that competes simultaneously against other robots to gather high-scoring, colored balls. Points were awarded to teams based upon the values of the balls in the team's goal area at the end of the competition. The third project type had student teams work with RCPD clients to design and build working prototypes to assist the clients in daily activities. Teams from each of the three project types will display their prototypes at Design Day along with a poster detailing their design concepts. Pre-college students will recognize the most outstanding projects with awards.

Spring 2011 Winners:
Hoyoung Jung
Collin Myers
Gerald Saumier
Alex Sims
Raymond Yee

RCPD ADVISOR:
Stephen Blosser
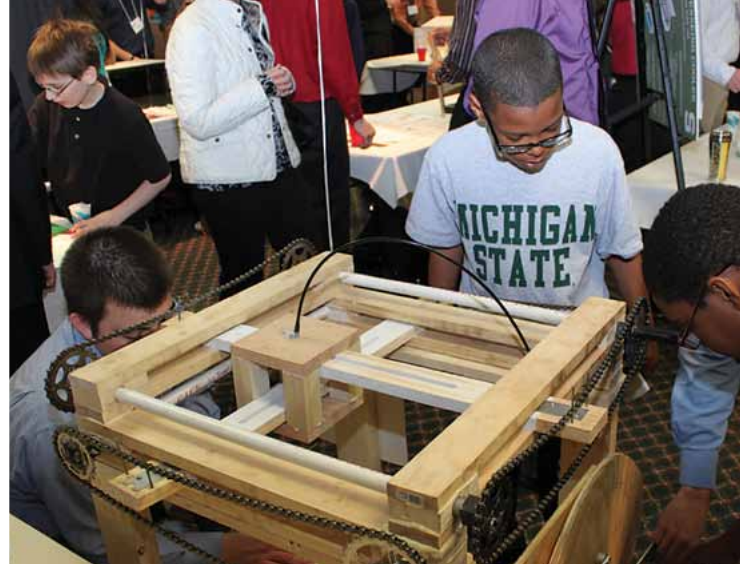
CE 495 SENIOR DESIGN IN CIVIL ENGINEERING

FACULTY ADVISORS: Professors Baladi, Kodur, Maleck, Masten, and Wallace

Baladi   Kodur   Maleck   Masten   Wallace

Student-teams developed preliminary designs for elements of MSU's Facility for Rare Isotope Beams (F-RIB) – the $550 million cutting-edge research facility to advance understanding of rare nuclear isotopes and the evolution of the cosmos. In this semester's exercise, teams developed preliminary plans for the following: elements of the proposed south highbay extension, an alternate configuration of the linac tunnels, managing stormwater runoff and sediment during construction, maintaining transportation services during and after construction, as well as an improved potable water supply for the University.

PROFESSIONAL EVALUATORS

Engineers and scientists associated with the following firms, municipalities, and companies donated time to provide students with a practicing professional's perspective: Bergmann Associates; Consumers Energy; East Lansing Department of Public Works; Fishbeck, Thompson, Carr & Huber; HNTB; MSU Physical Plant; NTH Consultants; Soil & Materials Engineers; Tetra Tech MPS; and URS Corporation. We gratefully acknowledge their generous contributions.

Leonard Becker, PE
HNTB
Detroit, MI

Rick Chelotti, PE
Bergmann Associates
Lansing, MI

Daniel Christian, PE
Tetra Tech MPS
Lansing, MI

David Conklin, PE
FTCH
Grand Rapids, MI

Matt Junak, PE
HNTB
E. Lansing, MI

Thomas Larder, PE
Process Results, Inc.
Saline, MI

John LeFevre, PE
MSU Physical Plant
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Peter Margules, PE
NTH Consultants
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George McKenzie, PE
NTH consultants
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Navid Merham, PE
URS Corporation
Southfield, MI

Stephanie O'Donnell. EIT
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Todd Sneathen, PE
Director of Public Works
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Michael J. Thelen, PE
Soil & Materials Engineers, Inc.
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Consumers Energy (retired)
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Anthony Thomas, PE
Soil & Materials Engineers
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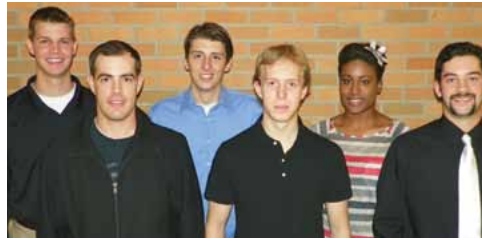
Award Sponsors

BARR

ftc&h

CE 495 SENIOR DESIGN IN CIVIL ENGINEERING

Team 1: l-r: Ryan DeBono, Brian O'Rourke, Yonas Aberra, Kevin Maro, Nicholas Janicke, Matthew McCloskey

Team 2: Back, l-r: Christopher Dean, Michael Scavo, Morgan Johnson. Front: Ryan Hohler, Benjamin Dueweke, Ted Hirsch. Absent: Dan Pinkerton

Team 3: Back, l-r: Jon Stratz, Ryan Bernard, Tim Little. Front: Jay Cuda, Austin Sash, Valentine Nsofor, Tyler Ruel.

Team 4: Back, l-r: Joshua Tolbert, Michael Chandler, Joe Haberl. Front: Drew Cronk, Matthew Snell, Jalal Amir, Katie Nash.

Team 5: Back, l-r: Adam Walsh, Erik Brinkman, Alex Russeau, Jason Saghy, Corey Hackworth. Front: Kelly McElroy.

Team 1	Team 3	Team 5
8:00 a.m.	*9:20 a.m.*	*10:40 a.m.*
MSU Room	*MSU Room*	*MSU Room*
Team 2	**Team 4**	
8:00 a.m.	*9:20 a.m.*	
Lake Michigan Room	*Lake Michigan Room*	

CIVIL ENGINEERING SENIOR DESIGN AWARD

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

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.

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 from 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.

CE 495 Senior Design in Civil Engineering

Undergraduates in civil 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 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.

Engineers and scientists associated with the following employers donated time to provide students with a practicing professional's perspective: Bergmann Associates; Consumers Energy; East Lansing Dept of Public Works; Fishbeck, Thompson, Carr & Huber; HNTB; NTH Consultants; MSU; Soil & Materials Engineers; Tetra Tech MPS; and URS Corporation. We gratefully acknowledge their generous contributions.

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

Ford Motor Company
Dearborn, Michigan

GE Aviation
Grand Rapids, Michigan

Meijer
Grand Rapids, Michigan

Motorola Mobility
Libertyville, Illinois

Sparrow Health System
Lansing, Michigan

Spectrum Health Systems
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Computer Science and Engineering Capstone Course Projects

Presentation Schedule – Lake Ontario Room
Dr. Wayne Dyksen
Professor of Computer Science and Engineering

Time	Team	Project Title
8:00 a.m.	Auto-Owners	24-Hour Road Service Mobile Apps
8:20 a.m.	Boeing	BAPS 2: Battle Aircraft Position Share 2
8:40 a.m.	Ford	Ford Quikboard
9:00 a.m.	GE Aviation	NextGen Aircraft Taxi Assistance
9:20 a.m.	Meijer	Tablet-Based Point-of-Sale System
9:40 a.m.	Motorola Mobility	Synchronized Program Content Delivery
10:00 a.m.	Break	
10:15 a.m.	Sparrow	iSupport Device Management System
10:35 a.m.	Spectrum Health	Log Monitoring Compliance
10:55 a.m.	TechSmith	Mobile Web Reporter
11:15 a.m.	Urban Science	Visual Hierarchy Selection

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, Ford, GE Aviation, General Motors, IBM, Meijer, Microsoft, Motorola Mobility, Raytheon, Sircon, Sparrow Health System, Spectrum Health Systems, TechSmith, Terex, Toro, Two Men and a Truck, the Union Pacific Railroad, and Urban Science.

CSE 498 Computer Science & Engineering Projects

Auto-Owners Insurance
24-Hour Road Service Mobile Apps

When going on a vacation or simply driving home from work, flat tires or other car problems can ruin one's day. Auto-Owners Insurance provides 24-hour road service to their customers, aiding in the acquisition of help.

Unfortunately, when problems occur, customers often do not know their account information or their exact location.

With this in mind, we have developed iPhone and Android mobile apps that store a customer's Auto-Owners account information and have the ability to determine a customer's exact location using the phone's GPS in the event of trouble.

When in need of roadside assistance, a customer sends a help request to Auto-Owners with a few button presses, after which our app places a phone call on the customer's phone to verify that a tow truck is indeed on the way.

In addition to being able to view their own account information, Auto-Owners customers can search for maps to nearby restaurants, hotels, and service centers.

As a companion to our mobile apps, we have developed a website for use by Auto-Owners Insurance associates to monitor and track the utilization of our mobile apps. Auto-Owners associates can view app usage by service coverage limit, state, and a variety of other parameters.

The applications are developed with Objective-C and Java. The website is built with C# using MVC3. Both use a restful web service to communicate with MySQL databases.

Michigan State University
Team Members (left to right)

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Howell, Michigan

Paul Fritschen
Novi, Michigan

Lingyong Wang
Jinan, Shan Dong, China

Auto-Owners
Corporate Sponsors

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Corey Burns
Lansing, Michigan

Tony Dean
Lansing, Michigan

Priscilla Facundo
Lansing, Michigan

Scott Lake
Lansing, Michigan

Jim Schumacher
Lansing, Michigan

The Boeing Company
BAPS 2: Battle Aircraft Position Share 2

B attle Aircraft Position Share 2, or BAPS 2, is a game in which two players compete in a 3D arena to destroy their enemy's targets, which include technology centers and planes. Players must protect their own targets by intercepting enemy communications and reacting accordingly. The game occurs in real time, with each player working to command their entire fleet through both offensive and evasive maneuvers.

Continuous and strategic command of technology centers is essential to mounting a strong defense. In addition, each player selects a cyber-defense plan, which offers certain advantages and disadvantages, depending on whether or not the player is playing offensively or defensively.

Players must deal with information overload and respond to feedback resulting from game events. Players who react both quickly and effectively will have an advantage in the game.

Since BAPS 2 is a web app, it can be played on many devices from different locations. The web app connects to a central game server, which keeps the game synchronized across all devices. This server also ensures that network latency does not have significant influence on the game. Communication between the web app and the game server is encrypted.

BAPS 2 is compatible with Windows XP/Vista/7, Mac OS X, Linux, Android, and iOS. The visuals are rendered in WebGL. Network connections between the game web app and the game server are made through WebSockets.
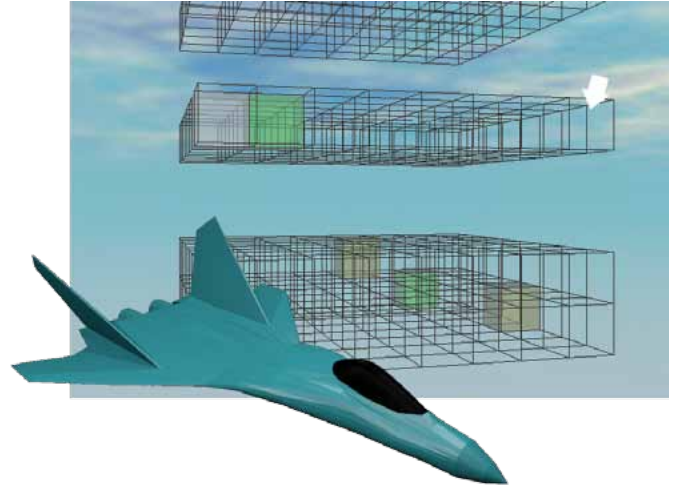
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Boeing
Corporate Sponsors

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Matt Daniels
Saint Louis, Missouri

Bob Feldmann
Seattle, Washington

Jayson T. Vincent
Saint Louis, Missouri

Steve Yallaly
Saint Louis, Missouri

The Ford Motor Company
Ford Qwikboard

Ford is a global company that has many geographically dispersed teams. In order for these teams to be able to communicate more effectively and efficiently we have designed and written Ford Qwikboard.

Ford Qwikboard is a "sticky note" web application that allows teams to share key ideas through text, audio, video and various office attachments. For easy organization a Qwikboard is able to be broken into different sections called panels.

When a user logs in they see their current Qwikboards, can create a new Qwikboard, and they can add users with whom they will be able to collaborate. The Qwikboard is one big open space to share thoughts and ideas freely with peers.

The Qwikboard is updated in real time, which allows for instant communication and feedback. This eliminates confined conference rooms and cluttered whiteboards.

The Ford Qwikboard is a very user friendly web application that captures the natural look and feel of using 'sticky notes' on a whiteboard. Everything is ideally located with large buttons. Our application replaces cluttered war room processes and whiteboard brain storming with a clean and efficient virtual one accessible at any time.

Ford Qwikboard is written in HTML5 with Java, JavaScript, jQuery and multiple open source frameworks. It runs on any modern web browser or mobile device.
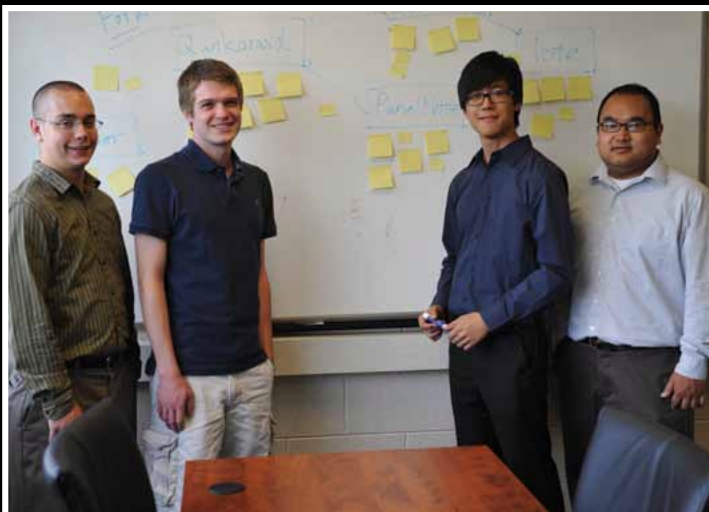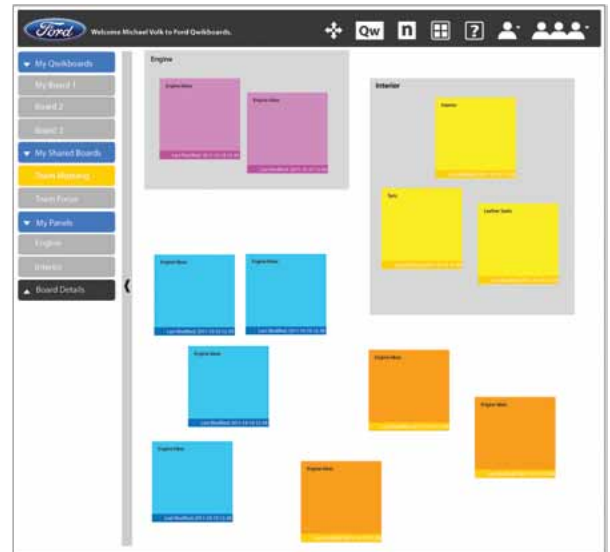
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Jin Hou
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Danh Tran
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Michael Seneski
Dearborn, Michigan

Laura Terbrack
Dearborn, Michigan

Michael Volk
Dearborn, Michigan

GE Aviation
NextGen Aircraft Taxi Assistance

R unway and taxiway collisions account for the majority of commercial airliner accidents. In fact, the deadliest accident in aviation history occurred when two Boeing 747 jumbo jets collided in dense fog on a runway in the Canary Islands.

While on the ground, pilots are often challenged by a variety of competing factors including bad weather, tight schedules, and high-traffic volume. Breakdowns in communication along with limited visibility due to fog can lead to dangerous situations resulting in disastrous collisions.

Our NextGen Aircraft Taxi Assistance provides pilots with an intuitive user interface that enables them to plan their ground routes, to easily navigate complicated airports, and to avoid other aircraft while taxiing to their destination. With our system, runway and taxiway collisions will be greatly reduced and possibly eliminated completely.

NextGen Aircraft Taxi Assistance is the latest addition to the MSU Next Generation Flight Deck, which is the culmination of five Capstone team projects. While nothing can replace the skills and ingenuity of an experienced flight crew, our next generation flight deck design equips pilots to operate aircraft safely and reliably better than ever even in the direst of situations.

Built with C++ and OpenGL, NextGen Aircraft Taxi Assistance is integrated with the X-Plane flight simulator to simulate aircraft taxiing and to test the use of our system.
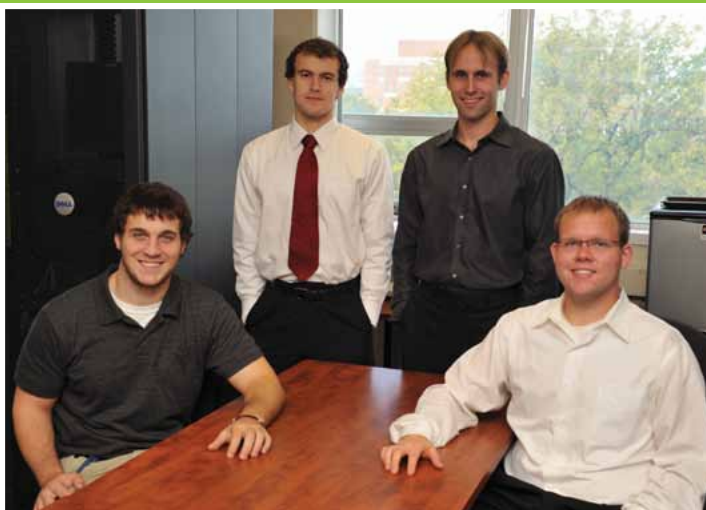
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Fowler, Michigan

Jacob Walker
Lake in the Hills, Illinois

Jason Cepela
Canton, Michigan

Johnathan Richter
Dewitt, Michigan

GE Aviation
Corporate Sponsors

Serge Badiane
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Grand Rapids, Michigan

Brian Loyal
Grand Rapids, Michigan

Dashiell Kolbe
Grand Rapids, Michigan

Meijer
Tablet-Based Point-of-Sale System

With over 200 stores, Meijer continues to grow steadily because they truly value their customers. To better enhance the shopping experience, Meijer is experimenting with innovative ways to use mobile devices in the checkout process.

Our Tablet-Based Point-of-Sale System is a creative new interface, which provides Meijer customers with a "next generation" checkout experience.

Our tablet-based system uses barcode scanners to identify each item to be purchased. It then sends a unique product identifier to Meijer's Point-of-Sale system, which responds with the specific information about the item.

Shoppers interact with two tablets at the checkout station. The tablets display information about the scanned items such as their name, description, and price. Our system handles a variety of exceptions such as price or age verification.

The goal of our tablet-based system is to replace the bulky touchscreen devices that are currently in use. One important advantage is that the tablet itself is small, self-contained, and relatively inexpensive. In the event that a tablet breaks, thereby shutting down a self-checkout station, the broken tablet can easily be replaced with a working one.

Our application runs in web browsers on the two tablets. The software is written in C# with ASP.Net MVC. Data is stored in Microsoft SQL Server 2008. The UI for our system is written in HTML 5, CSS, and JavaScript.

Michigan State University
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Motorola Mobility
Synchronized Program Content Delivery

Increasingly today, consumers are improving and enhancing their lives in a variety of ways through the use of mobile devices like Android phones and tablets, iPhones, and iPads.

While many things have changed significantly, the television viewing experience has changed relatively little in comparison.

To this end, the Synchronized Program Content Delivery framework provides viewers with a highly interactive, highly immersive television experience. While a viewer is watching their favorite show, an app can display auxiliary information related to the show on the viewer's mobile devices, in sync with the show.

Advertisers can utilize our system to market their products to a targeted audience. For example, if Hugh Laurie walks in wearing your favorite athlete's jersey, an icon would appear with a link to the website where the jersey may be purchased.

Viewers are able to sync their mobile devices via their cable box, or if they're away from their cable box, the app can record an audio snippet of the show, identify the program, and sync accordingly. If capturing an audio snippet is not a feasible option, then the user can manually select the show on the app.

Our Synchronized Program Content Delivery service is based on a RESTful web framework using Restlet, Java, MyBatis and PostgreSQL. Our intuitive mobile apps are written using jQuery and jQuery Mobile optimized for the Motorola Xoom, and are deployed via a Glassfish server.

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Sparrow Health System
iSupport Device Management System

Sparrow is mid-Michigan's largest health provider, with a diverse range of services and facilities. Sparrow has two Lansing campuses, Sparrow Clinton Hospital, Sparrow Ionia Hospital, Sparrow Specialty Hospital, Michigan Athletic Club, Medical Supply, Pharmacies, Medical Groups, and dozens of other satellite locations. Each of these facilities house dozens of high tech devices, which are critical to the care of their patients. In a hospital setting, keeping these devices working is a matter of life or death.

Our iSupport Device Management System shows Sparrow IT helpdesk staff the status of hardware devices such as printers, fax machines, copiers and computers. When a device fails, our systems helps Sparrow IT staff to assist hospital staff to quickly find an alternate working device, as well as getting devices serviced more quickly.

Floor maps in the various campus buildings are displayed. A helpdesk associate can select a floor, see all the devices on that floor, and see which devices are working and not working.

A helpdesk associate adds new devices to the map and moves existing ones with a graphical drag-and-drop user interface. Devices can be identified and located on a floor map by simply searching for them using their unique device ID. New floor maps with new devices are easily added to the system.

Our iSupport Device Management System works with any web browser. It is written using ASP.NET/C#, JavaScript and jQuery. Data is managed with Microsoft SQL Server 2008.
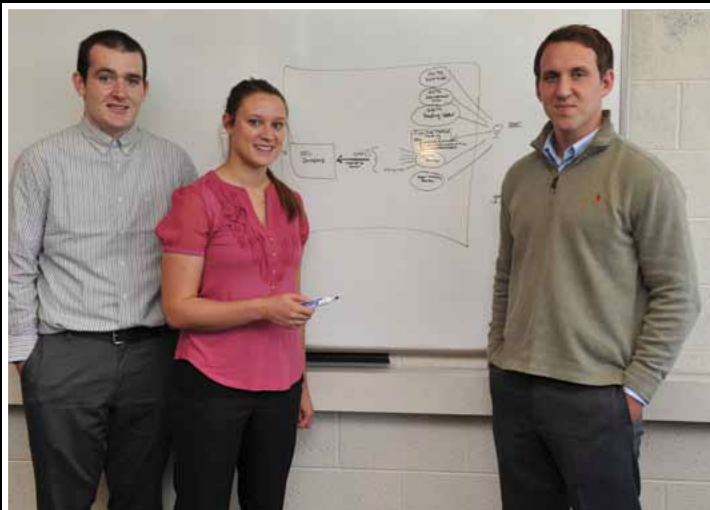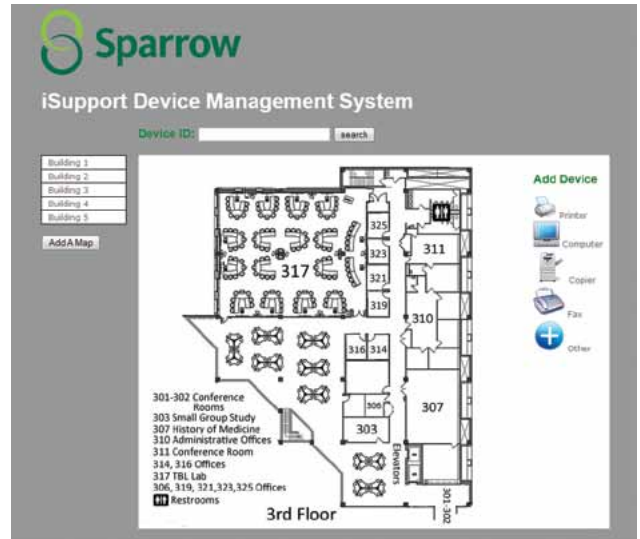
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Spectrum Health Systems
Log Monitoring Compliance

S pectrum Health Systems is a not-for-profit healthcare system in Western Michigan. Healthcare systems manage large quantities of extremely sensitive data. Monitoring access to this information is extremely important since it keeps medical information safe and helps Spectrum Health Systems stay in compliance with federal regulations.

Working with Spectrum Health Technology Information Solutions, we developed Log Monitoring Compliance, a system that monitors and reviews information and configuration accesses.

After an employee accesses sensitive information, that information access is logged. Our system stores this log record centrally and marks if it requires manual review. Designated reviewers can access records requiring manual review with our user application.

Within the application, a user can keep up-to-date information about each review they are overseeing. Managers can see the compliance of their employees and track progress.

The Log Monitoring Compliance system also provides high-level summary reports of the total compliance of Spectrum Health Systems' Technology and Information Solutions division, which allows executives to quickly see and assess the company's adherence to audit objectives.

Our application runs in standard web browsers. The application is written in C# with the MVC Razor Engine framework and the underlying database is SQL.
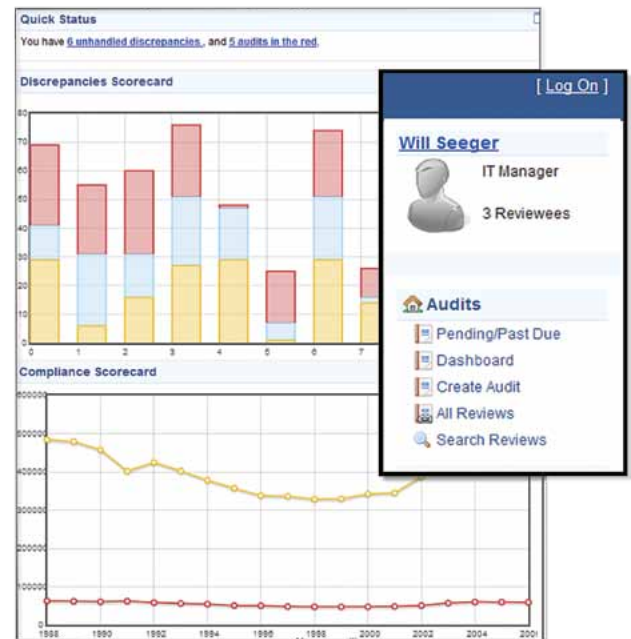
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TechSmith
Mobile Web Reporter

The Mobile Web Reporter enables users to make journalist style videos from their mobile devices. The app has a web browser embedded so that the user can search for relevant information in the background as well as record their audio commentary and video of their environment.

For example, let's say that you go out to eat at a restaurant with your family and, in the middle of dinner, your friends at home ask you what you think of the place. Instead of trying to explain it to them, with the Mobile Web Reporter you are simply able to take your phone, pull up online ratings, and make a video of your experience all in real time.

Once you are satisfied with your report you can save the video to your phone and continue eating, or you can upload the video to the web right away. You have the option of uploading your video to social networking websites like Facebook. In a matter of seconds your friends at home are able to see and hear what you are experiencing.

The major design challenges for the Mobile Web Reporter are recording a video that captures both the screen and camera, creating an easy to use workflow, and achieving good performance on mobile devices.

The Mobile Web Reporter is a mobile app designed for iPhone and iPad (iOS), using Objective C, and for Android, using java and C/C++. For the iPhone and iPad, videos are created in MPEG-4 format using the AV Foundation. In the Android app videos are created in WebM format using a native encoder.

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Urban Science
Visual Hierarchy Selection

U rban Science is an automotive consulting company, helping manufacturers better evaluate, structure, and manage their dealer networks and marketing programs through a combination of scientific analysis and software solutions.

In order to manage marketing and research data efficiently, Urban Science utilizes multiple hierarchical organization systems. This data is currently presented in a traditional text based manner. The goal of Visual Hierarchy Selection is to allow users to navigate through this same data in a more intuitive, modern, and visual fashion.

Visual Hierarchy Selection provides a natural user experience across keyboard, mouse, and touch-based interfaces. A search feature is implemented to allow for quicker selection, both through the entire hierarchy and on each level during navigation.

Due to the variety of data managed, Visual Hierarchy Selection implements multiple display styles, allowing data to be visually represented in an appropriate manner for the content.

The hierarchical data is retrieved before it is requested by the user and stored, so that Visual Hierarchy Selection provides not only a visually appealing interface but one that is also responsive and easy to use.

Visual Hierarchy Selection is built to run in any modern browser, using Javascript and HTML. The data is stored in an SQL database on a server running Microsoft SQL Server 2008, and retrieved using ASP.NET.

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Christian Hessler
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Mark Colosimo
Detroit, Michigan

Greg Davidson
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Ryan Hespenheide
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Shannon Muldowney
Detroit, Michigan

Computer Science and Engineering

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

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 to Design Day attendees. Each team plays their project videos and answer 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 Raytheon
Dynamic Spectrum Access for Network Radios

Matt Bowser, James R. Voss, William Bonner, Srinivasa Settaluri
Presented by Scott Lake and Bob Buchanan of Auto-Owners Insurance

Chrysler Praxis Award

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

The CSE capstone team that engineers the software system that is the most technically challenging is recognized with the Chrysler Praxis Award, which is sponsored by Chrysler LLC of Auburn Hills, Michigan.

Team Boeing
BAPS: Battle Aircraft Position Share

Andrew Kos, Eric Muller, Steven Garske, Adam Cook
Presented by Karen Wrobel of Chrysler

Design Day Judges

Mike Drazan
The Toro Company

Bob Feldmann
The Boeing Company

Louise Hemond-Wilson
IBM

Brian Loomis
Microsoft

Marty Strickler
Rose Packing Company

Rich Enbody
Michigan State University

Adam Haas
Ford Motor Company

Keith Landau
GENBAND

Kevin Ohl
Michigan State University

Karen Wrobel
Chrysler

TechSmith Screencast Award

Each CSE 498 capstone team produces a video that describes and demonstrates their software product. Starting with a storyboard and a script, teams use Camtasia Studio 5 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 Medtronic
Cloud-Based Athletics Operations Center

Michael Holp, Evan Francis, Christopher Paterson, Caitlin Russ
Presented by Dean Craven of TechSmith

Urban Science Sigma Award

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

The capstone team that delivers the best overall capstone experience is recognized with the Urban Science Sigma Award, which is sponsored by Urban Science of Detroit, Michigan.

Team Sparrow
iSupport Center

Ryan Hewitt, Dianna Kay, Brett McMillen, Maurice B. Wong
Presented by Mark Colosimo and Randy Berlin of Urban Science

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HUMAN
7E+09
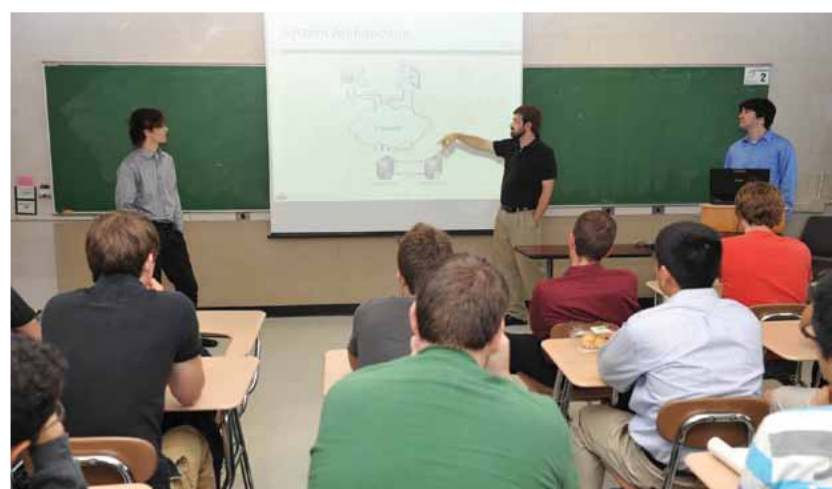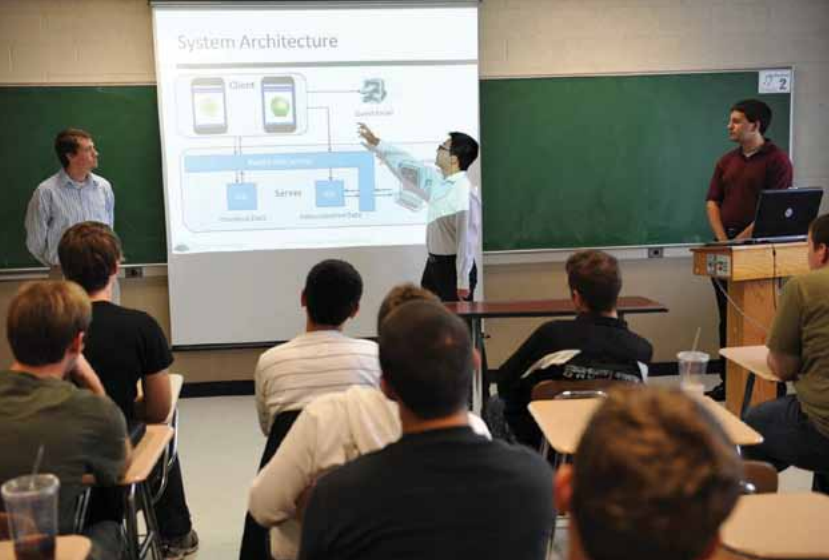
To see chemistry through the eyes of humanity is to see the promise of a better future. That's the power of the Human **Dow** Element. The Dow Chemical Company proudly supports MSU College of Engineering's Design Day and the hope for the future it represents.

Prof. Shanblatt

ELECTRICAL AND COMPUTER ENGINEERING PROJECTS

PRESENTATION SCHEDULE — Lake Huron Room

Course Coordinator: Professor Michael Shanblatt

Faculty Advisors: Professors Deller, Li, McGough, Mitra, Rothwell, Salem and Strangas

Time	Project Sponsor(s)	Sponsor Representative(s)	Faculty Facilitator(s)	Project Title
8:00 ECE 480	**Cypress Semiconductor**	**P. Kane**	**R. McGough**	**Arduino Friendly PSoC Shield**
8:30 ECE 480	**Marathon Oil Corp and MSU Resource Center for Persons with Disabilities**	**S. Blosser**	**J. Deller**	**Indoor Digital Orientation Communication and Enabling Navigation Technology**
9:00 ECE 480	**ArcelorMittal and MSU Resource Center for Persons with Disabilities**	**S. Blosser**	**F. Salem**	**iNODES for Wi-Fi Network Enhancement**
9:30 ECE 480	**Battelle Laboratories**	**C. Ball**	**T. Li**	**Smartphone Control of Advanced Sensor Systems**
10:00 Break				
10:15 ECE 480	**Texas Instruments**	**P. Semig**	**E. Strangas**	**Wireless Sensing System for Intelligent Concrete Curing**
10:45 ECE 480	**MIT Lincoln Laboratory**	**B. Perry**	**E. Rothwell**	**Remotely Operated Intrusion Alarm**
11:15 ECE 480	**MIT Lincoln Laboratory**	**G. Charvat**	**J. Mitra**	**Portable Range Doppler Radar System Detecting Objects With Coffee Cans**

ECE 480 Senior Capstone 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 MSU Resource Center for Persons with Disabilities, Texas Instruments, Cypress Semiconductor, ArcelorMittal, Battelle Laboratories, MIT Lincoln Laboratories

Cypress Semiconductor:
Arduino Friendly PSoC Shield

The Programmable System on Chip (PSoC), made by Cypress Semiconductor, is a configurable hardware component containing a CPU and programmable elements. It is used by numerous companies to build embedded systems. The purpose of this project is to provide a means to connect the PSoC to Arduino shields, in order for Cypress to expand its market base. Until recently Arduino was a hardware platform for hobbyists and students, but has recently been endorsed by Google as an Android Development Platform. Arduino includes a CPU and can be connected to one or more daughterboards, known as shields.

This project consists of interfacing the PSoC with the Arduino Ethernet Shield by physically connecting the pins. The PSoC general purpose IO pins are configured and routed using the PSoC Creator application. The firmware for the PSoC to interface with the Ethernet Shield was written by modifying parts of the existing Arduino libraries to integrate with the Cypress software libraries.

Several internet applications were developed to demonstrate the capabilities of the project. These demos include writing to an SD card on the Ethernet Shield as well as interfacing with other hardware to prove Ethernet capabilities. The team has also developed a custom printed circuit board as the final prototype which could be used with other Arduino shields.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group01

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C. Acosta
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Mr. Kane

Dr. McGough

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Matt Durak
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Cecilia Acosta
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Brett Donlon
Lab Coordinator

RCPD: iDOCENT Phase II:
Indoor Digital Orientation Communication and Enabling Navigation Technology

The iDOCENT Phase II is a continuation of an indoor navigational smartphone application system for the Michigan State University Resource Center for Persons with Disabilities. The main purpose of iDocent is to guide the visually impaired, visitors, and emergency personnel inside campus buildings. iDOCENT Phase I made use of existing Wi-Fi access points to triangulate location of an individual. Phase II system utilizes microphone modules to receive a sound signal from a smartphone speaker. Microphone units are connected to the server via existing Ethernet network. Ethernet provides fast communication between modules and the server and supplies power to each microphone unit.

The system command prompts are voice or touch activated, depending on user preferences and abilities. Once the user opens the application, the correct map structure is automatically downloaded. The application will then establish communication with the server. The server registers each user based on their phone number. After confirmation, a high frequency audio signal will be sent through the smartphone speaker. Microphone modules will receive the signal and pass it to the server. This signal will be received by the three closest microphones in the area. The microphones will individually encode a time stamp when the signal is received and forward to the server. Based on collected data, the server will triangulate the current location of the user. The application will also enable users to select points of interest, such as emergency exits, and efficiently navigate the user to that location.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group02

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V. Kim *Electrical Eng.*
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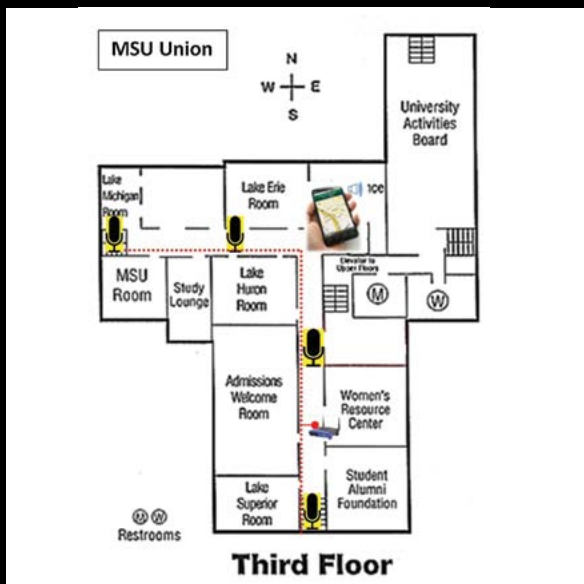
Project Sponsors
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RCPD: iDOCENT
iNODES for Wi-Fi Network Enhancement

In the past, navigation typically consisted of an individual looking at a map on printed paper. As technology advances, individuals in today's society are shifting to an electronic lifestyle. Today, people rely on GPS as a means of navigation in outdoor environments, but are still reliant on diagrams or maps while indoors. This is because GPS signals typically will not penetrate the physical structures that humans encounter on a daily basis.

Indoor Digital Orientation Communication and Enabling Navigational Technology (iDOCENT) is a cell phone application aimed to assist navigation throughout buildings on Michigan State University's campus. The software application can direct an individual along the best path to a specified location while vocally speaking turn by turn directions. iDOCENT uses existing Wi-Fi access points supplemented with the iNODE to receive the device's signal strength for localization purposes. The iNODE is designed to increase system accuracy of a building outfitted with an existing Wi-Fi network, as well as making a building without Wi-Fi capable for iDOCENT navigation. The ultimate iDOCENT system will enhance the ability for any individual to navigate through an iDOCENT mapped building efficiently. This application is designed primarily for visually impaired individuals, but could also be useful for anyone unfamiliar with the Michigan State campus.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group03/index.html

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Resource Center for Persons with Disabilities

ArcelorMittal

Mr. Blosser

Prof. Salem
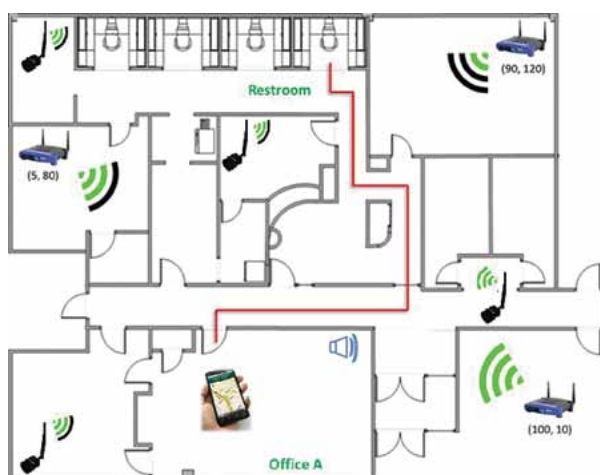
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Battelle Laboratories: Smartphone Control of Advanced Sensor Systems

T eam four is sponsored by Battelle, a non-profit research and development organization that addresses the needs of government and industry. The goal of our project is to control an advanced sensor system through the use of a common android smartphone. This sensor system was designed to analyze the amount of harmful chemicals in the air and trigger an alarm if they exceed a safe level. Due to the dangers associated with occupying the area around the sensor, it is desired to communicate to it wirelessly from a remote location. The aim of our team is to provide Battelle with a graphical user interface (GUI) that enables the user to control and monitor the sensors from an Android smartphone. In addition the team has documented a study of viable communication options such as radio frequency, WI-FI and Zigbee. The team then assembled a circuit that enabled wireless communication. The performance and operability of this design was demonstrated using a laptop to simulate one of the sensors.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group04/index.html

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Battelle
The Business of Innovation

Mr. Ball

Dr. Li

Proposed Design Solution

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Texas Instruments: Wireless Sensing System for Intelligent Concrete Curing

There is currently no reliable data driven method of tracking the completion of the concrete curing process. Applying pressure to concrete prematurely has the potential to cause severe damage. Ideally, the curing process could be monitored by embedding multiple sensors within the concrete interior. Through wireless transmission we can receive, interpret, and provide this data to the user.

Utilizing the MAVRK and uMAVRK platforms provided by Texas Instruments, along with multiple software elements, and signal conditioning circuitry, our team was able to prototype an effective design that extracts temperature and humidity readings from the curing concrete and display this data on to a centralized unit that is easily accessible by an end user. The decision to officially claim the concrete as cured will be left up to the end user.

The final system is comprised of a sensor module, uMAVRK and the MAVRK. The sensor module interfaces directly with the uMAVRK. This PCB module houses sensors for humidity and temperature data acquisition as well as signal conditioning circuitry. The uMAVRK converts the analog sensor information into a digital signal and transmits this information to the MAVRK via a RF UART. The MAVRK is programmed to accept data from the uMAVRK and display this data on a host computer.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group05/

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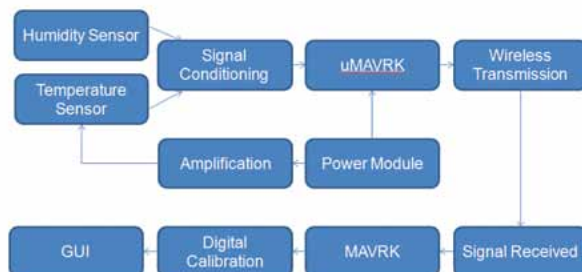
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MIT Lincoln Laboratory: Remotely Operated Intrusion Alarm

Our design team is working with MIT Lincoln Laboratory to create a Remotely Operated Intrusion Alarm. This project has been developed in a smaller version, which was previously designed by MIT Lincoln Laboratory as a classroom project. However, that system has many shortcomings such as slow processing speed, low accuracy and poor portability.

The goal of this project is to prototype a stand-alone radar system that overcomes these faults. The final system detects an intruder and sends a message with information pertaining to the intrusion to the user via text or email.

In the beginning of the operational flow the 2.4GHz radar scans the room and sends an audio signal through a filter and into the TI PCM1808 ADC. The ADC then converts the data and ports it to the TI Stellaris LM3S9D92. The Stellaris performs the necessary calculations to detect an intruder and measure its speed and distance. This data is sent to a PC via Ethernet connection, which subsequently attaches a timestamp. The PC can then send alert messages to via text message or email to relay the information of the intrusion.

This design is small, power efficient, and will allow maximum sampling rate in order to obtain real-time data, as well as system portability.

http://www.egr.msu.edu/classes/ece480/capstone/fall11/group06/index.html

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1951–2011
60 YEARS
LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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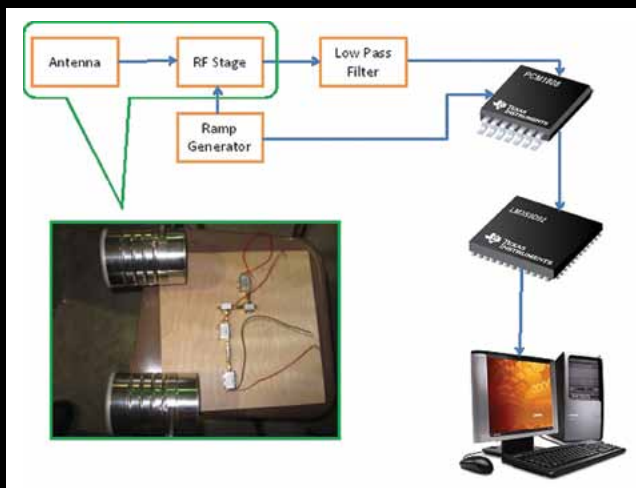
Dr. Rothwell

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Chris Leonard
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MIT Lincoln Laboratory: Portable Range Doppler Radar System Detecting Objects with Coffee Cans

Our group's task was to expand the functionality of an existing design MIT developed for a home-built short-range radar system. Our sponsor, MIT Lincoln Laboratory, provides a radar oriented course at MIT using this system. Our main goal was to expand functionality and accuracy of the system and in so doing provide a real-time GUI interface displaying what the radar system is illuminating. Both range and Doppler information are used to inform the user of targets that are in the illumination band, for example, if a car passes in front vs. a bike or pedestrian.

Since this system is intended to be mobile and used in the field, power limitations are very important. Thus, low-power components were chosen to interface between the system and the laptop. The previous implementation of the radar system used the laptop's line in port, where the associated software translated the audio signal to range and Doppler information. Our implementation uses a much higher sample rate in order to achieve more accurate data.

www.egr.msu.edu/classes/ece480/capstone/fall11/group07/file/Home.html

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LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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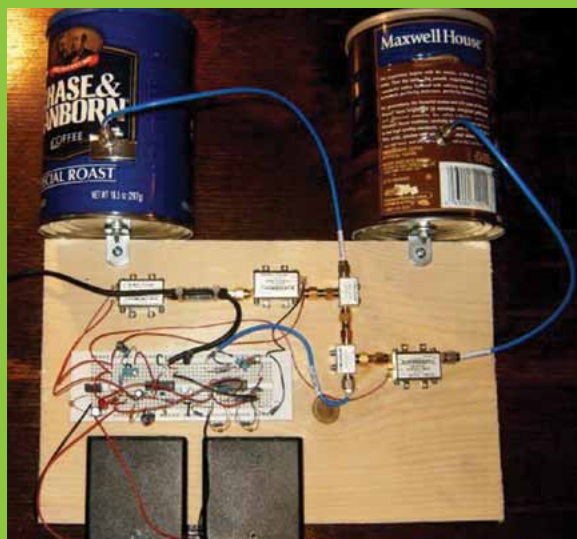
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Dr. Joydeep Mitra

Team Members & Non-Technical Roles

Shaun Eisenmenger
Manager

Enwei Gu
Webmaster

Adam Rogacki
Documentation Prep

Michael Zito Presentation Prep

Design Day Awards:

Electrical & Computer Engineering Prism VentureWorks Prize & Winners, Spring 2011

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: Department of Pharmacology & Toxicology: "Small Animal Barostat Instrument Design"

LEFT TO RIGHT:
Michael Shanblatt, Jacob Scott, Cody Knowles, Casey Davidson, Thomas Gordon

Prism VentureWorks Second Prize:
Texas Instruments: "Stepper Motor ControlCARDS"

LEFT TO RIGHT:
Michael Shanblatt, Leslie Thomas, Thomas Volinski, Patrick Thomas O'Hara, Kole Andrew Reece

Prism VentureWorks Third Prize:
Texas Instruments: "Over-Current Protection: Reference Design and Study"

LEFT TO RIGHT:
Michael Shanblatt, Joshua Myers, Stephen England, Kenji Aono, Ryan William Laderach

THANKS TO NORFOLK SOUTHERN

The Department of Electrical and Computer Engineering thanks Norfolk Southern for its generous financial support of Design Day. This support sponsored a design team, with their Triple Crown Services, and was used for production of this program and for other costs associated with Design Day, and for the infrastructure that allows our ECE Senior Capstone Design teams to work effectively on their industry problems.

Norfolk Southern Railway has a proud history, and today's NS includes not only the Norfolk and Western Railway and Southern Railway from which its name arose, but also all or large parts of many other historic railroads, such as the Pennsylvania Railroad, Nickel Plate Road, and Conrail. We are proud to have Norfolk Southern as a sponsor of Design Day! They recruit engineers (not locomotive engineers, but electrical engineers, computer engineers, etc.) at Michigan State University.

NS NORFOLK SOUTHERN ®

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aeemsu.com

AEE audio enthusiasts and engineers

Design Day:
December 9, 2011
8 a.m. until 1 p.m.

Second Floor Concourse:
Come hear and see all that we have done this semester.

OUR HISTORY:
Fall of 2006 a small group of engineers founding Audio Enthusiasts and Engineers, an organization open to all Michigan State University students. The first semester AEE designed and built their first masterpiece 'Revolution Audio', a stereo system engineered to produce true stereo sound regardless of which direction the listener is facing. AEE has become one of the most active student organizations in the College of Engineering. Its members are devoted to understanding audio concepts, as well as finding inventive ways to implement this knowledge. aeemsu@gmail.com

THEREMIN
Building a Theremin has shown how specialized oscillating circuits using the heterodyning principal can be used to create some very unique audio devices.

GUITAR PEDALS
Along with our Tube Amps a team built an assortment of Guitar Pedals. Members of this team learned research skills and how to use schematics and a soldering iron.

MOLDED EARBUDS
This team has been working to design and build in-ear headphones with mics on the outside to capture and listen to sound exactly as someone would live. Our members have learned valuable skills in research and development.

TUBE AMPS
This semester the Tube Amp Team built a variety of guitar amplifiers. Those involved in the Tube Amp Team quickly become knowledgeable about reading schematics, component layout, grounding and especially soldering.

Design Day Awards:

Mechanical Engineering: Thomas Alva Edison Undergraduate Design Award

The Edison Scholars are recognized as the ME 481 Design Team that has produced the most outstanding project. A jury of experts from industry and academia evaluate the final reports, the posters, and the final oral presentations in determining the award winners. Teams operating under ME 481 that include members from other departments and colleges are also eligible for this award. The funding for this award is provided by the Shell Oil Company.

SPRING 2011 ME 481 EDISON UNDERGRADUATE DESIGN AWARDS

First Place
David Kempf
Adam Nelligan
Amar Shah
Brian Smith
Joseph Wesorick

*l-r: Professor Clark Radcliffe, Adam Nelligan
Amar Shah, David Kempf, Joseph Wesorick and Brian Smith*

ME 481 Oral Presentation Award

The best ME 481 oral presentation as determined by the ME 481 students is recognized with this award.

SPRING 2011 ME 481 ORAL PRESENTATION AWARDS

First Place
Benjamin Cherwinski
Trevor DeLand
Jelena Paripovic
Jeremy Racine

*l-r: Trevor DeLand
Jelena Paripovic
Jeremy Racine
Benjamin Cherwinski
Professor Brian Feeny*

ME 481 Outstanding Poster Award

The ME 481 Outstanding Poster Award recognizes the best poster presented by an ME 481 design project team as judged by a team of individuals from industry and academia. Judging is based on both technical content and aesthetic layout.

SPRING 2011 ME 481 POSTER PRESENTATION AWARD

First Place
David Kempf
Adam Nelligan
Amar Shah
Brian Smith
Joseph Wesorick

*l-r: Professor
Clark Radcliffe
Adam Nelligan
Amar Shah
David Kempf
Joseph Wesorick
Brian Smith*

Design Day Awards:

ME 471 Machine Design Award

The student team members winning the ME 471 competition at Design Day are recognized with the Machine Design Award. The award winners are determined by the course instructors based on team scoring in the competition. The funding for this award is provided by the Shell Oil Company.

l-r:Professor Gaetano Restivo
Scott Coy
Mardan Kerimov
Theodore Belanger

First Place

Theodore Belanger
Scott Coy
Mardan Kerimov

ME 371 Mechanical Design I Kids' Choice Award

The precollege students participating in Design Day vote for the most outstanding ME 371 project. The winning team is designated as the Kids' Choice Award. This team is recognized with a plaque designed and manufactured by Mr. Jon Thon's 7th grade technology class at Holt Junior High School.

First Place

Stephen Campbell
Haley Orr
Russell Tindall
Michael Trotter

l-r: Professor Farhang Pourboghrat,
Russell Tindall
Haley Orr, Michael Trotter
and Stephen Campbell

ME 478 Mechanical Design II Award

The student team member winning the ME478 competitioin at Design Day were recognized based on scoring at a competition for Best Amphibious Vehicle.

First Place

Rachel Bogle
Ian Forney
Alexander Gage
Zachary Kadykowski
John Schiefer

l-r :Professor Patrick Kwon,
John Schiefer, Zachary Kadykowski
Ian Forney, Alexander Gage and
Rachel Bogle

ME 412 Heat Transfer Laboratory Heat Transfer Design Award

The student team members winning the ME 412 competition at Design Day are recognized by the Heat Transfer Design Award. The award winners are determined by the course instructor based on team scoring in the competition.

SPRING 2011 ME 412 HEAT TRANSFER DESIGN AWARD

First Overall

Theodore Belanger
Nicholas Righetti
Sarah Stoner

l-r : Dr. Laura Genik, Theodore Belanger
Nicholas Righetti, and Sarah Stoner

ME 371

**9:00 – Noon
Second Floor
Gold Rooms A & B**

THRILLS FOR PRE-COLLEGIATES: MECHANISMS THAT FASCINATE, CAPTIVATE, STIMULATE AND ENTICE

INSTRUCTORS: Professors Farhang Pourboghrat and Brian Thompson

PROBLEM STATEMENT

Teams of students were required to design and manufacture mechanisms that would thrill an audience of pre-collegiates. The only constraints imposed upon the assignment were that each mechanism must incorporate at least one linkage, one gear set and one cam-follower combination. These engineering marvels will be displayed along with a complementary poster explaining the subtleties of each mechanism, and each device will be demonstrated to the eager audience. Every ME 371 team will be interviewed by the pre-collegiate students who will assign points to each MSU team. Subsequently these points will be tallied and the winning team awarded the *Sparty Plaque* for creating the most thrilling mechanism. This inspiring plaque was designed and fabricated by students at Holt Junior High School more than a decade ago.

Teams and members

Section 1

Team 1	Team 2	Team 3	Team 4	Team 5
Zachary Albright	Peter Engstrom	Lukasz Kurczab	Jonathan Bancroft	Caitlin Bailey
Xiangyu Wang	William Lindstrom	Evan McCune	Kihun Kang	Benjamin Bosworth
Benjamin Zondiak	David Spears	Kevin Miller	Ross Otten	Olukemi Mejabi
		Zachary Timpf	Matthew Wiggans	Katie Renaud

Team 6	Team 7	Team 8	Team 9	Team 10
Jun Li	Shaun Bezinque	David Barrent	Jeffrey Hulbert	Christopher Griffith
Jiao Luo	Douglas Geiger	Kyle Biega	Daniel Kenny	Kyle Hyst
Kyle Sweet	John McCarthy	Nicholas Blancke	Elizabeth Kurcz	Kameron Kline
	Trevor Nill	Kyle Melzer	Lucas Sproul	Phat Nguyen

Section 2

Team 1	Team 2	Team 3	Team 4	Team 5
Frank Luchini	William Blancke	Karsten Harns	David Crouse	Sam Balasz
Brian McClure	Sean Crump	Zachary Hoyle	Zachary Graham	Brian Cheadle
Nicholas Putman	Stephen Owczarek	Paul Laymon	Yueyao Hu	Chenaimoyo Mushiri
Paul Snyder	Jonathan Tuse	Joel St. Cyr	Yan Wu	Isaac Platte

Team 6	Team 7	Team 8	Team 9	Team 10	Team 11
Ryan Aenis	Brian Farber	Corey Anderson	Alexander Dutch	Brendan Brown	Hasan Alali
Daniel Holmes	Todd Graham	Bradford Fillion	Tyler Haley	Ross Dudgeon	Amanda Boyd
Daniel Pylar	Landon Riker	Corey Silvis	Marcus Johnston	Charles Ferriera	David Gaunt
Sylvia Reiser	Cory Snowdin	Isaac Steinbrunner	Nicholas Lannes	Colin Perrault	Thomas Hallahan
					Jiantao Liao

THE MEAN GREEN ICE MELTING MACHINE

INSTRUCTOR: Dr. Laura J. Genik

TA Staff: Michael Farmer, Vasily Ivanov, Vahid Mirajili and Christopher Paul

You have seen them on television, the Miracle Thaw© or Super D frost Wonder© where hamburger patties are defrosted in less than ten minutes and an ice cube melts as though on a hot griddle, but these devices are cool to the touch. Is this some sham, or could it be real heat transfer at work? Only a Heat Transfer Lab student will know for sure.

PROBLEM STATEMENT

The project team is to design, analyze, build and test a heat transfer device to enhance the defrost process as realized by the energy transfer to melting ice. The device may have an active energy input, e.g. batteries or wall electricity, but the amount of active energy provided will be subtracted from the melting ice energy. To remain in context with the above described device, the ice may not be modified in any manner. The device must also begin at room temperature. The project team is to consist of no more than three students. The device will be judged on the basis of the energy rate of ice melting, the mass of the device, and its

TIME	DESIGN TEAM
9:00 am	John Chancey, Alexander Danaj, Alexander Tollis
9:00 am	Andrew Binell, Matthew Lempke, Zachariah Sprinkle
9:00 am	Brandon Gandy, Adithya Kosgi, David Marsh
9:15 am	Brendan Ayer, Fernando Vasquez, Seth Wald
9:15 am	Khalifa Al Mansouri, Dustin Colthorp, Robert Wooten
9:30 am	Justin Freeman, Jeffrey Klegon, Stephanie Vasi
9:30 am	Kelly Burke, Joshua De Walt, Hillary Gregory
9:30 am	Michael Olsztyn, Ryan Sanback, J.T. Whitman
10:00 am	Nichole Kramer, Gregory Tenbusch, Cory Waltz
10:00 am	Scott Coy, Gregory Thomas, Bryan Walega
10:15 am	Michelle Flachs, Mardan Kerimov, Steven Soave
10:30 am	Daniel Maniscalco, Ashley Swartz, Blake Wilmore
10:30 am	Erik Durfee, Joshua Talaga, Brian Tew
10:45 am	Taylor Darling, Samuel Goodsitt
10:45 am	Paul Jurcak, Michael Wong
11:00 am	Robert Conley, Scott Shaw, Mark Shuptar
11:00 am	Jason Lyman, Thomas Vacketta, Douglas Van Meter
11:15 am	Kevin Hanley, Brandon Miller, Peter Petersen
11:15 am	Sarah Chrustowski, Taryn Klinkner, Perrin Vander Veen
11:15 am	Andrew Grossman, Zachary Kadykowski, Joshua Ringbloom

ME 412 Heat Transfer Laboratory

PROTOTYPES OF COMMERCIAL PRODUCTS

INSTRUCTOR: Professor Clark Radcliffe
TA Staff: Abdul Motin

PROBLEM STATEMENT

The students in this course were challenged to develop, test, and demonstrate an innovative design for a commercial product design that synthesizes mechanical, electrical, electronic, thermal and/or fluid components with an imbedded microcontroller. Typical applications range from automotive engine controls and robotic manufacturing systems to toys and consumer appliances such as microwave ovens. Each group will make a 20-minute presentation and demonstration of a working prototype of their product.

Mechatronics Systems Design

TEAM	TIME	MEMBERS
1	8:00	Dustin Colthorp, Gerald Gentz, Daniel Maniscalco, Joseph Ray, Ryan Sanback
2	8:25	Joseph Bickham, Matthew Fisher, Peter Koenigsknecht, Brian Tew, Terrence Vinson
3	8:50	Kyle Crayne, Erik Durfee, Brian Gilkey, Brandon Miller, Andrew Nuttall
4	9:15	Ian Forney, Katherine Hilton, Nur Joned, Joshua Racalla

MOVING A 10 LB. WEIGHT

Instructor: Professor Ron Averill
TA Staff: Abhisek Jain

PROBLEM STATEMENT

Students in ME 471 were challenged to design and build a prototype device for moving a 10 lb. weight along a particular path. The device must be manually operated by one person, and should satisfy several competing goals.

An optimization study is required to achieve an optimum balance among the following goals:
• Minimize mass
• Minimize cost (per unit, assuming 10,000 units will be produced)
• Meet path constraints in the loaded and unloaded state (kinematics and stiffness)
• Meet failure constraints (static and fatigue)
• Meet marketing constraints (integrate the product logo into the design)

The total performance of each design is measured in terms of a weighted sum of these normalized objectives and constraints.

The total design performance determines 50% of the final grade, and the other 50% is determined by a final written report that details the concept development and selection process, kinematic analysis, finite element structural analysis, failure analysis, fatigue analysis, cost analysis, integration of marketing elements, and recommendations for future improvement of the design.

TEAM	STATION 1 TIME	STATION 2 TIME	DESIGN TEAM
1	8:30 am	8:42 am	Matthew Malek, Michael Mehall, Andrew Mozer, Benjamin Wilburn
2	8:42 am	8:54 am	Erika Crosby, Andrew Kristufek, Kyle Schubel, Megan Wallace
3	8:54 am	9:06 am	Kevin Andreassi, Austin Deneff, Matthew Gorman, Ashley Swartz
4	9:06 am	9:18 am	Jarrod Heck, Yirang Liu, Jeffrey Narkis, Jared Staubin
5	9:18 am	9:30 am	Jayson Blough, Joshua Hill, Jiawei Qin, Yingxu Wang
6	9:30 am	9:42 am	Benjamin Ambrose, Alex Bergquist, Khoa Nguyen, Michael Trotter
7	9:42 am	9:54 am	Werner Dahm, Andrew Grossman, Haley Orr, Nicholas Schooley
8	9:54 am	10:06 am	Michael Aurino, Jonathan Diclemente, Samantha Hilk, Brian White
9	10:06 am	10:18 am	Marcus Cannon, Rebecca Hannon, Scott Shaw, Russell Tindall
10	10:18 am	10:30 am	Peter Bentley, Jonathan Lusczakoski, Dane Marsack, Matthew Witmer
11	10:30 am	10:42 am	Robert Conley, Mark Hoyer, Kurt Northrop, Brandon Smith
12	10:42 am	10:54 am	Raid Alaswad, Mark Davison, Matthew Hoffdal, Christopher Matthes
13	10:54 am	11:06 am	Blaine Benson, Stephen Campbell, Ahra Ko, Justin Mrkva
14	11:06 am	11:18 am	Karl Krug, Adam Sajdak, Peter Schall, Yue Shi

Station 1: Weigh the device, mount it to the aluminum base plate, and prepare for the final test.
Station 2: While one team member delivers the one-minute pitch, the other team members set the device in place for the test.

ME 471 Mechanical Design II

ME 481

**9:55 – 11:30 Third Floor
Lake Superior Room**
and
**8:00 – 11:30 Fourth Floor
Tower Room**

Prof. Radcliffe

MECHANICAL ENGINEERING PROJECTS

PRESENTATION SCHEDULE — Lake Superior and Tower Rooms
Course Coordinator: Professor Clark Radcliffe
**Faculty Advisors: Professors Averill, Brereton, Loos,
Pourboghrat, Priezjev and Wichman**

Lake Superior Room

Time	Project Sponsor(s)	Professional Advisor(s)	Faculty Advisor (s)	Project Title
9:55	Union Pacific Railroad	T.W. Snyder L.J. Golden	A. Loos	Train Wheel Magnetization Metering System
10:20	Heartwood School and Shell Oil Company	K. Coviak	N. Priezjev	Instrument Mounts
10:45	Peckham, Inc. and Shell Oil Company	S. McGuire	F. Pourboghrat	Art at Work
11:10	Shell Oil Company	G. Ried	N. Priezjev	Two Special Boys; One Shared Dream of Riding a Bicycle

Tower Room

Time	Project Sponsor(s)	Professional Advisor(s)	Faculty Advisor (s)	Project Title
8:00	Chrysler LLC:	T. Drobot	A. Loos	Automotive Seating Product Design Project
8:25	Ford Motor Company	S. Bohr M. Bunge	G. Brereton	Boost Pump for Vehicle Evaporative Emission Systems
8:50	Ford Motor Company	R. Pearce	F. Pourboghrat	Carbon Canister Cooling System
9:15	General Motors Foundation	A. Herman	A. Loos	Pedestrian Safety Sounds/ Alerts for Electric Vehicles
9:40–9:55 Break				
9:55	Nexteer Automotive	P. McCarthy N. Roller	R. Averill	Controller Cover for Electric Power Steering
10:20	Whirlpool Corporation	L.Wohlgamuth	G. Brereton	Chilled Water Dispense Design
10:45	Whirlpool Corporation	G. Hortin	I. Wichman	Fast Flow Water Dispense
11:10	Whirlpool Corporation	A. Tenbarge	I. Wichman	Ice Maker Airflow Enhancement

ME 481 Mechanical Engineering Design Projects

ME481 is required for all mechanical engineering majors at MSU. The course provides students with a team-based capstone design experience:

• Using the technical expertise, communication skills, and teaming methodologies they have learned throughout their mechanical engineering curriculum, along with their creativity, to solve real world problems.

• Collaborating with practicing engineers to address problems sponsored by industry.

• Developing new products or re-designing existing products to reduce costs or enhance reliability.

• Interacting with large, medium-sized, and small companies involved in orthodontic devices, furniture, aerospace structures, automotive parts, consumer electronics, materials recycling, food processing, and machine tools.

Other projects are humanitarian based, in which the students work with individuals who have special challenges.

Project sponsors include Chrysler, LLC; Ford Motor Company; General Motors Foundation; Nexteer Automotive; Whirlpool Corporation; Union Pacific Railroad; Heartwood School; Peckham, Inc.; and Shell Oil Company

Mechanical Engineering Design Program

Mechanical engineers make the world move and provide the energy to do this. The goal of the mechanical engineering program at MSU is to graduate engineers that are prepared to **Lead, Create, and Innovate** in their professional careers. The MSU Mechanical Engineering Design Program is the key element of the curriculum to achieve this goal. The five required design courses in the program provide the students with eight hands-on team-based design, build, test projects, six written communication experiences, three oral presentation experiences, and three poster presentation experiences. It is the Mechanical Engineering Design Program that distinguishes the ME program nationally and makes it one of the elite programs in the world.

The Mechanical Engineering Design Program would like to thank our Edison judges and their companies for their commitment to our design program.

Terry Cook, Shell Oil Company

Asif Nasar, The Boeing Company

Brian Santhany, Dow Chemical

Jim Wilde, Beijing West Industries Co. Ltd.

Union Pacific Railroad:
Train Wheel Magnetization Metering System

Union Pacific Railroad (UP) is dedicated to safety in all aspects of its business. Regular inspections of the trains are conducted by mechanical forces with the intention of finding defective conditions. One of these defective conditions is an accumulation of metal on the wheel's rolling surface. The protruding characteristics of this extra metal, dubbed "built-up tread," can potentially cause derailments. UP has pursued many projects that attempt to automatically detect this condition or its precursors in an effort to alleviate its threat to safety.

UP has discovered wheels containing built-up tread also exhibit magnetic properties. As a result, UP has selected this characteristic as a plausible identifier of wheels with built-up tread. A system has been proposed that will detect, measure, and catalog any magnetic field existing on the wheels of a passing train.

The data collected by this system will aid UP in its quest to fully understand built-up tread. Combining the information amassed by this system with that collected from future investigations will help UP in its quest for no derailments.

...The Union Pacific Railroad Student Design Team

Dr. Snyder

Mr. Golden

Prof. Loos

The railroad's primary responsibility is to protect the public and its investors through derailment prevention. A device that measures the level of magnetism for railroad wheels travelling along the track will enable the railroad to prevent derailments due to built-up treads.

Dr. Todd W. Snyder
Director of Advanced Freight Car Engineering
Union Pacific Railroad

Project Sponsor
Union Pacific Railroad
Omaha, Nebraska

Professional Advisors
Dr. Todd W. Snyder
Mr. Lawrence J. Golden

Faculty Advisor
Prof. Alfred Loos

Team Members and Home Towns
Taylor Darling
Grand Rapids, Michigan

Erik Durfee
Midland, Michigan

Samuel Goodsitt
Ann Arbor, Michigan

Joshua Talaga
Hope, Michigan

Brian Tew
Ann Arbor, Michigan

A Shell Oil Company Children's Humanitarian Project: Instrument Mounts

Heartwood School is an institution dedicated to teaching students with moderate to severe cognitive impairments, autism spectrum disorders, and traumatic brain injuries. This institution educates 150 students ranging from 3 to 26 years of age. Over the years Heartwood School has improved the quality of life for countless students and will continue to do so in the future.

A concentrated discipline within Heartwood is music therapy. During therapy, students play drums and xylophones in positions ranging from sitting to standing while in various types of equipment. The project task includes developing mounts for these instruments to provide a hands-free solution for the user. This will allow the students to interact with each other through music and will increase each student's playing time.

Currently, the staff members are constrained to holding the instrument for one student at a time. This suppresses the time available to focus on the other students in the classroom, and limits their ability to perform other necessary tasks associated with music therapy.

Research has been conducted to determine the best designs for a drum mount and a xylophone mount. The center of gravity and weight bearing for these mounts were analyzed. Important design constraints of primary concern are safety of the students and sound quality of the instruments.

...The Heartwood School Student Design Team

Ingham Intermediate School District
A Regional Educational Service Agency

Ms. Coviak

Prof. Priezjev

This project will make these instruments more accessible for our students, allowing them increased independence and, in turn, promoting improved self-esteem and confidence. Additionally, the mounts will relieve me of unnecessary physical strain, allowing me to function more efficiently as a therapist.

Ms. Kellee Coviak
Heartwood School

Project Sponsors
Heartwood School
Mason, Michigan

Shell Oil Company
Houston, Texas

Professional Advisor
Ms. Kellee Coviak

Faculty Advisor
Prof. Nikolai Priezjev

Team Members and Home Towns
Sarah Chrustowski
Sterling Heights, Michigan

Taryn Klinkner
Muskegon, Michigan

Ryan Sanback
Troy, Michigan

Terrence Vinson
Keego Harbor, Michigan

A Shell Oil Company Humanitarian Project:
Art at Work

Peckham, Inc. is a nonprofit community vocational rehabilitation organization. Peckham is one of the largest vocational rehabilitation programs in the state of Michigan, serving more than 7,300 local residents each year. Peckham specializes in creating positive change in the lives of people with disabilities or other barriers to employment.

Art at Work is a collaboration with the Residential College in the Arts and Humanities (RCAH) at Michigan State University. Art at Work allows people with disabilities and social barriers to express themselves via art. The project task is to design a display that showcases artwork created by Art at Work participants. The display will be located on a large wall of Peckham's manufacturing facility to create a powerful, visual statement about diversity within Peckham.

Research on art display methods was performed to create a unique solution. Using computer-aided design software, a structure of the display was modeled. Due to the construction of the wall in which the art will be displayed, support methods for the display were researched and evaluated. The main goals of the project were to create an artistic, living, and growing display that is easily maintained while keeping in mind the structural constraints of the facility.

...The Peckham, Inc. Student Design Team

Ms. McGuire

Prof. Pourboghrat

The "Art at Work" project will allow Peckham to promote creativity and showcase the personal artwork of its team members in a public display that is safe, inclusive, dynamic, and highly visible.

This project allows the display to accommodate a rotation of art and media. The success of the project will allow the display to function/co-exist in a unique workspace full of environmental and physical challenges.

Sue McGuire
Peckham, Inc.

Project Sponsors
Peckham, Inc.
Lansing, Michigan

Shell Oil Company
Houston, Texas

Professional Advisor
Ms. Sue McGuire

Faculty Advisor
Prof. Farhang Pourboghrat

Team Members and Home Towns
Kelly Burke
Shelby Twp., Michigan

Michael Douglas
Midland, Michigan

Alan Finder
Portage, Michigan

Hillary Gregory
Battle Creek, Michigan

Zachary Kadykowski
South Lyon, Michigan

Joshua Ringbloom
Dundee, Michigan

A Shell Oil Company Children's Humanitarian Project: Two Special Boys; One Shared Dream of Riding a Bicycle

The Ried family lives in Lansing, Michigan and consists of Ms. Gina Ried and her two sons: Nathan and Dakota. This is a special family who came to us with the need for a bicycle that would enable all of them to spend time together as a family, get exercise, and enjoy the outdoors. Nathan is an eleven-year-old boy with Asperger's Syndrome and gross motor problems, who has quickly outgrown his current tricycle; Cody is five and has Septo-Optic Dysplasia, leaving him blind and cognitively impaired.

There are currently many different types of bicycles on the market, with a variety of different features. However, no bike currently addresses all the specific needs of this family. It was our task to design and build a three-seated bicycle that caters to all of their needs and to allow these great kids the chance to enjoy their favorite hobby again.

Our group was honored to be given the chance to help a fellow Lansing resident and her two wonderful children.

...The Ried Bicycle Student Design Team

Cody   Nathan

Ms. Ried

Prof. Priezjev

As a single parent of two special needs boys, I have encountered many challenges in regards to finding activities that we can all enjoy together. Bike riding is the one activity that we all enjoy. But since both boys now need assistance in riding a bike, I am finding it extremely difficult to participate in this activity as a family. If we had a bike that would allow me and my oldest son to pedal and had a seat to carry Dakota, we could once again enjoy the wonderful activity of bike riding.

Ms. Gina Ried

Project Sponsor
Shell Oil Company
Houston, Texas

Professional Advisor
Ms. Gina Ried

Faculty Advisor
Prof. Nikolai Priezjev

Team Members and Home Towns
Andrew Binell
Dearborn, Michigan

Justin Freeman
Sterling Heights, Michigan

Matthew Lempke
Traverse City, Michigan

Josh Racalla
Comstock Park, Michigan

Zach Sprinkle
Milford, Michigan

Chrysler LLC: Automotive Seating Product Design Project

Chrysler, one of the Big Three American automakers, is headquartered in Auburn Hills, Michigan. The company was founded by Walter P. Chrysler on June 6, 1925. Recently, Chrysler has proven its resilience during economic hardships and remains competitive in the automotive market.

Since rolling out the Chrysler Six, its first production vehicle, Chrysler's products have defined the future of automobiles with class-leading innovations. Today, the company produces a large line of sedans, minivans, and crossover/SUVs. Commitment to innovation continues to be reflected in each new product from Chrysler. In particular, innovation is evident in the human machine interface (HMI) elements of each vehicle. These are advancements that translate directly to customer appeal and experience.

Chrysler is interested in optimizing its rear seat design. Currently, the company must commit time and resources towards custom, rear, center-occupant packages for each product model. The student team has assisted Chrysler in this endeavor by designing a parametric model to streamline the design process and balance conflicting functional requirements. The team has also designed and fabricated the interior support structure for the rear center armrest to illustrate the functionality of parametric model.

...The Chrysler Student Design Team

Chrysler LLC is known to have a competitive advantage in the automotive industry with regards to new and innovative features that delight our customers. Our Seat Engineering group has significantly contributed to this competitive advantage through the implementation of such innovations as Stow 'n go® and Swivel 'n go® seating. This project is expected to increase our competitive advantage through the identification of the next opportunity and the development of a concept that will delight our customers.

Mr. Thomas Drobot,
Seat Engineer
Chrysler LLC

Mr. Drobot

Prof. Loos

Project Sponsor
Chrysler LLC
Auburn Hills, Michigan

Professional Advisor
Mr. Thomas Drobot

Faculty Advisor
Prof. Alfred Loos

Team Members and Home Towns
Brendan Ayer
Cincinnati, Ohio

Jon Petersen
Okemos, Michigan

Matt Snell
Tecumseh, Michigan

Jeff Van Andel
Harrison Township, Michigan

Seth Wald
Farmington Hills, Michigan

Ford Motor Company: Boost Pump for Vehicle Evaporative Emission Systems

S ince 1903 Ford Motor Company has provided affordable and dependable vehicles to middle class Americans. The top-selling vehicle that Ford produces is the F-series truck, which started in 1948 and has been the top-selling truck for the past 34 years.

New environmental standards demand the highest efficiency in terms of fuel consumption and reduced impact to the environment. The project commissioned by Ford was to induce flow, in an economical way, in the carbon canister that would move the hydrocarbon emissions from refueling to the intake manifold. Accomplishing this would ensure that the vapors of gasoline from refueling would be purged faster than present conditions.

The carbon canister in a vehicle is part of the On-Board Refueling Vapor Recovery system. This system transfers the vapor from the fuel tank to a canister that is filled with carbon. The carbon in the canister adsorbs the hydrocarbons and releases fresh air to the atmosphere. When the engine reaches operating temperature and sufficient vacuum is created in the intake manifold, fresh air is drawn through the carbon canister. As the air is pulled through the canister, the hydrocarbons are drawn into the intake manifold to be burned during the combustion process.

Research on flow-inducing devices and methods has generated multiple ideas that improve the performance of the vapor recovery system as a whole. Each design was three-dimensionally modeled and

analyzed with Computational Fluid Dynamics (CFD) software to determine performance. A matrix was constructed from the results and solutions were all compared to each other.

...The Ford Student Design Team

Mr. Bohr

Mr. Bunge

Prof. Brereton

A boost pump is needed for vehicle evaporative emissions systems that are associated with engines that supply minimal engine intake manifold vacuum. Low vacuum engines are utilized to improve fuel economy by reducing pumping loss. The evaporative system boost pump would provide air flow through the vehicle's evaporative system to purge hydrocarbons that are stored in the carbon canister. The hydrocarbons are typically purged using the flow induced by the delta pressure provided from the intake manifold vacuum. The carbon canister hydrocarbons must be purged to allow vapor storage space for refueling and extended vehicle soaks. Design a boost pump for a low vacuum engine that allows the manufacture to increase fuel economy and meet regulatory emissions standards.

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Ford Motor Company: Carbon Canister Cooling System

Ford Motor Company has been a world leader in innovative automotive design for over 100 years. Ford produces a variety of vehicles catering to the needs of a diverse customer base in the U.S and international markets. To stay competitive in an ever-changing market, automobile manufacturers need innovative designs to deal with growing customer demands for vehicles with better fuel efficiency, sustainability, and less environmental impact. To achieve success in these critical areas, Ford is making a major effort to offer practical solutions.

An example of this can be seen in Ford's efforts to improve its Onboard Refueling Vapor Recovery System (ORVR). The ORVR consists of a canister filled with carbon pellets that capture the gasoline vapor generated during refueling. Capturing this vapor results in a decrease in air pollution, as well as an increase in fuel economy when the hydrocarbons are purged from the canister into the engine.

During refueling, a heat-producing reaction takes place between the carbon pellets and the fuel vapor. It is necessary to cool the carbon before and during the refueling process in order to offset this reaction and increase the carbon's absorptivity. The team's objective was to design a system to interface with the carbon canister and significantly cool the carbon pellets inside it. The desired temperature reduction was to be completed in two minutes, to coincide with the average time it takes to refuel a vehicle.

The team researched several rapid cooling methods in order to find the best combination of performance, power consumption, and practicality. A computer model was made to test the final conceptual design and submitted to Ford in order to evaluate its viability.

...The Ford Student Design Team

Mr. Pearce

Prof. Pourboghrat

Activated charcoal carbon is used on vehicles to absorb hydrocarbon vapors during refueling and the natural vaporization of fuel in the fuel tank. The activated charcoal has a normal capacity at room temperature. Heating the carbon bed will reduce the storage capacity and cooling the bed will increase the capacity. When the medium is adsorbing HC vapors the carbon increases in temperature due to the chemical reaction that occurs. During refueling this is a significant temperature rise.

The project is to design an active method to keep the carbon bed cool even when a refueling is in progress to increase the storage capacity of the bed.

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General Motors Foundation: Pedestrian Safety Sounds/Alerts for Electric Vehicles

General Motors Foundation, commonly known as GM, is a multinational automotive corporation originally founded in 1908. As the world's second-largest automaker, GM produces/sells over two million vehicles annually under its 7 nameplates. GM has net revenue of 135 billion dollars and is publically traded on the New York Stock Exchange.

A recent focus on researching and developing electric and hybrid vehicles has resulted in the production of vehicles such as the Chevy Volt. Electric vehicles (EVs) and hybrid vehicles achieve excellent fuel economies and are especially ideal with the rising gas prices. However, EVs do not emit enough sound through tire noise, wind resistance, and other factors to alert blind and other pedestrians of their presence.

The United States government will issue, no later than 2014, regulations requiring manufacturers to equip hybrid/electric vehicles with sounds to mitigate the danger these quiet vehicles pose to pedestrians.

The project tasks are to develop and implement an audible sounds/alert system that meets the legislative intent as documented in the "Pedestrian Safety Enhancement Act of 2010" and develop a test procedure to quantify how the character of the sound that conveys how the vehicle is changing speed may be measured and reported.

Research, benchmarking, and surveys were conducted in developing and validating possible sounds and alert systems to deliver the most effective design. On- and off-campus resources were utilized in verifying data, alternatives, performance and design evaluations. In accordance with GM's policies and procedures, the final design must be testable and contain a testing procedure document.

...The GM Student Design Team

Mr. Herman

Prof. Loos

Electric vehicles are found to be extremely quiet compared to your typical vehicle with a combustion engine and pedestrians need to be aware of these vehicles in their proximity. The research, design, and implementation of an audible alert/sound for Electric Vehicles such as the Chevrolet Volt will allow General Motors to produce a safer vehicle while also providing mechanical engineering students some real world exposure to engineering design and the opportunity to gain some experience working with new technologies General Motors is currently implementing in its hybrid/electric vehicles.

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Nexteer Automotive: Controller Cover for Electric Power Steering

Nexteer Automotive is the only tier-one, global automotive supplier dedicated solely to advanced steering and driveline systems. Nexteer is a leader in environmentally friendly Electric Power Steering (EPS) that reduces fuel consumption by up to 6%. Nexteer prides itself as the only EPS supplier able to steer full-size trucks at 12 volts. In fact, Nexteer EPS will be installed on 90% of North American full-size trucks by 2013. Nexteer supplies over sixty automotive manufacturers including GM, Ford, Chrysler, and Toyota.

Nexteer Automotive's electric power-steering system, which uses an electric motor instead of a hydraulic pump, improves gas mileage, reduces maintenance, and gives better response at different speeds. One of the main advantages is a sensor that detects the torque needed; therefore a variable amount of assist can be applied based on driving conditions.

Nexteer Automotive presented this project to Michigan State University to explore alternative designs for their Electric Power Steering Cover. The goal of the project was to improve upon the existing design by implementing cost-effective material and fastening alternatives to meet customer needs.

The current controller cover is produced out of steel to enclose and protect the circuit board from the environment and provide electromagnetic interference protection. The Michigan State University design team optimized the design by considering alternative materials and using advanced analysis and optimization tools. Computer-aided design programs, vibration analysis, finite-element analysis, and topography optimization was performed in order to create the most effective design.

... The Nexteer Student Design Team

Mr. Roller   Mr. McCarthy

Prof. Averill

"As a global leader in steering systems, Nexteer Automotive recognizes that innovation keeps us ahead of the curve and is the foundation of our business. An integral component within our advanced Electric Power Steering (EPS) system is the controller which is enclosed and protected from the environment. The Controller Cover project provides an opportunity for the MSU design team to explore alternative materials, improved sealing capabilities, and innovative attachment methods of this component to the mating housing while facilitating shielding for electromagnetic interference. The proposed design will improve the manufacturing assembly process along with reducing overall costs."

Mr. Neal Roller
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Whirlpool Corporation:
Chilled Water Dispense Design

Whirlpool is the industry leader in manufacturing and marketing of home appliances around the world. Celebrating 100 years of excellence comes from the commitment to go above and beyond to ensure customer satisfaction. In order to remain a frontrunner, Whirlpool is continuously revamping current designs as well as developing new technology to further enhance its products.

The popularity of refrigerators with door-mounted ice and water dispensers has increased drastically in recent years. In-door ice and water is one of many features that distinguishes Whirlpool's brands and allows for greater marketability. Unfortunately, all models to-date have a limited capacity of chilled water. Once the chilled water is depleted, the refrigerator will dispense room temperature water until the system recovers. This results in dissatisfied customers and service calls.

To develop a competitive product, multiple concepts were evaluated to optimize the chilled water quantity while maintaining current energy use, space, and product cost. Different materials, geometries, refrigerants, and heat exchanging processes were explored.

This project will allow Whirlpool to continue to be known for its innovation and environmentally friendly products.

...The Whirlpool Student Design Team

The chilled water dispense feature will provide consumers with an instant, unlimited supply of cold water. This feature will allow consumers to dispense large quantities of chilled water for cooking or beverages. The chilled water feature will also improve quality by reducing service calls for warm water dispense.

Lindsey Wohlgamuth
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Whirlpool Corporation:
Fast Flow Water Dispense

W hirlpool is the world's leading manufacturer of household appliances. On November 11th of this year Whirlpool celebrated its 100th anniversary and a century of providing quality products to consumers around the world.

Current refrigerator in-door water dispense systems meet the majority of consumer demands, which typically involve filling a standard drinking glass with cold water. Consumers who wish to fill larger containers, however, have voiced concerns regarding the time required to fill such containers. The goal of this project was to design a water dispense system capable of providing a water flow rate at least double that of the current system. The new design was required to maintain current filtration levels, as well as adhere to a number of other design constraints.

The team initially developed a variety of possible design solutions. These solutions were then analyzed using a number of methods in an effort to determine which solution offered the most viable option. In the future, such a system could be integrated into new Whirlpool refrigeration products allowing for a competitive advantage in the market.

…The Whirlpool Student Design Team

Mr. Hortin

Prof. Wichman

Understanding what people need to make their everyday lives easier and more enjoyable is what makes Whirlpool the global leader in appliance design and manufacturing.

Consumer insights are the heart of our design focus; without their voices, our products would have no purpose.

Mr. Gregory Hortin
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Whirlpool Corporation:
Ice Maker Airflow Enhancement

Whirlpool is a large conglomerate of many different brands, including Maytag, KitchenAid, and Amana. They produce a wide variety of products including, but not limited to, washers, dryers, microwaves, stoves, and kitchen appliances. With values like pride, passion, and performance, Whirlpool is dedicated to providing the latest advances in appliance manufacturing to the consumer. As one of the leading producers in the ice making and refrigeration business, Whirlpool fuels its "passion for the customers, pushing them to provide innovative solutions to uniquely meet the customer needs." (Whirlpool.com).

The purpose of this project was to understand and optimize the process of making ice in a refrigerator bottom-mount configuration. The team was responsible for designing a system that will allow for greater airflow over the ice maker for increased ice rates while paying attention to power consumption, space, noise, and cost.

Faster, cleaner ice production ranks high on the list of customer requests and is of high concern for the Whirlpool design team. Increasing the airflow over their ice makers is just another way Whirlpool is bringing quality products to the customer.

...The Whirlpool Student Design Team

Mr. Tenbarge

Prof. Wichman

"Whirlpool Corporation is a world class appliance leader striving to bring the best experience to the consumer through constant design improvements and leading innovations. This project will address the consumer by enabling a better ice experience. This is to produce ice more efficiently without sacrificing internal user volume and without compromising certain key features Whirlpool consumers are expecting along with best in class ice availability and maximizing usable storage space the product must meet Whirlpool's quiet appliance standards. All providing the end consumer a quality appliance they can depend on for years of service."

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MICHIGAN STATE UNIVERSITY

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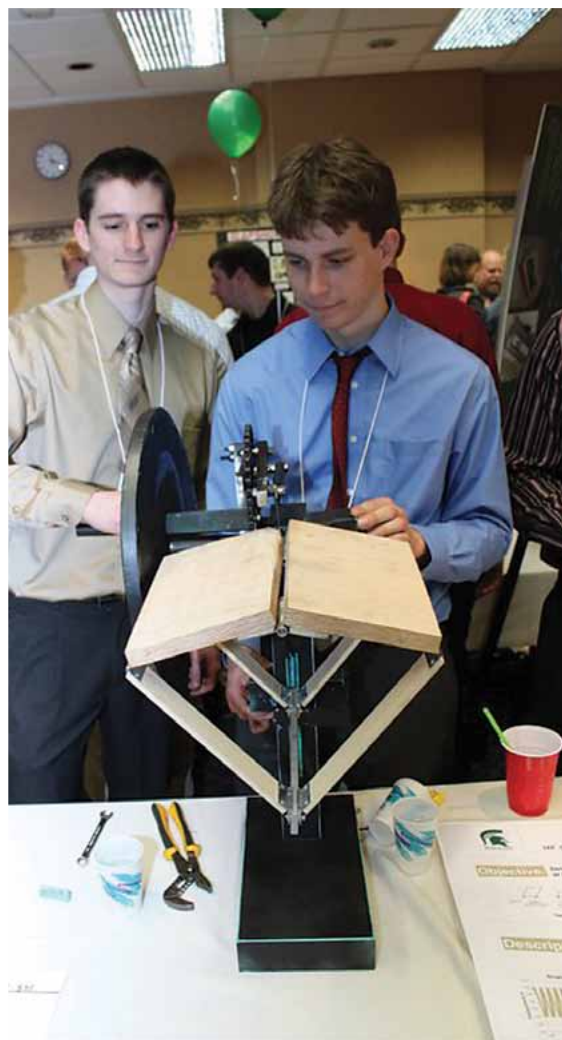Electrical and Computer Engineering
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