

The MSU College of Engineering

Spring 2010

Design Day

Proudly sponsored by

Auto-Owners Insurance

MICHIGAN STATE
UNIVERSITY



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



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

April 30, 2010

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 me 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.

We are particularly pleased to partner with MSU on this event. 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 on display 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, I 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 as an alum, I could not be more proud.

I 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 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!

Sincerely,

Ronald H. Simon
Chairman and CEO



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

-- J.D. Power and Associates



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A note from the Design Day Coordinator

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.

The support of an Executive Partner is a key addition to Design Day this year. We are proud to recognize Auto-Owners Insurance as our Executive Partner. As a Lansing based Fortune 500 company, Auto-Owners Insurance has a rich history of engagement with Michigan State University.

As you visit our various exhibits throughout the MSU Union, please make sure you 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 150 middle school and 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.

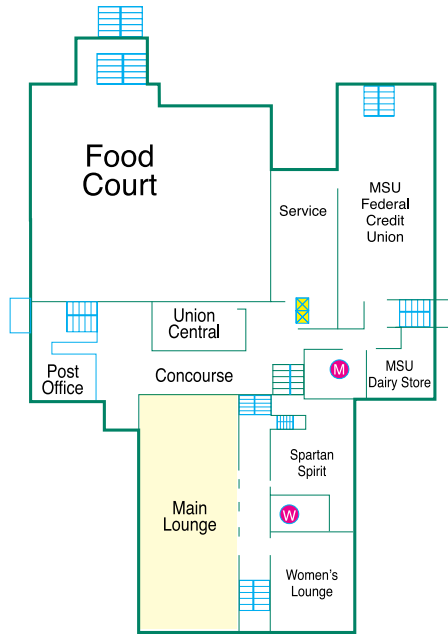
Along with our Executive Partner, Auto-Owners Insurance, we thank our Supporting Partners Dow Chemical Corporation, Medtronic and Norfolk Southern.

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.

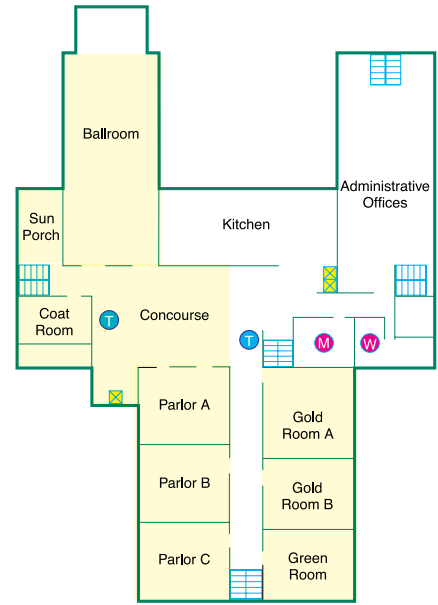
Sincerely,

A handwritten signature in black ink that reads "Maureen E. Blazer-Adams". The signature is written in a cursive, flowing style.

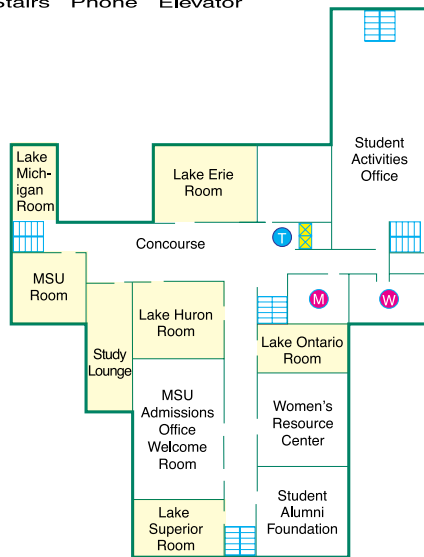
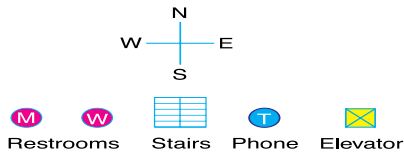
Maureen E. Blazer-Adams
Design Day Coordinator
MSU College of Engineering



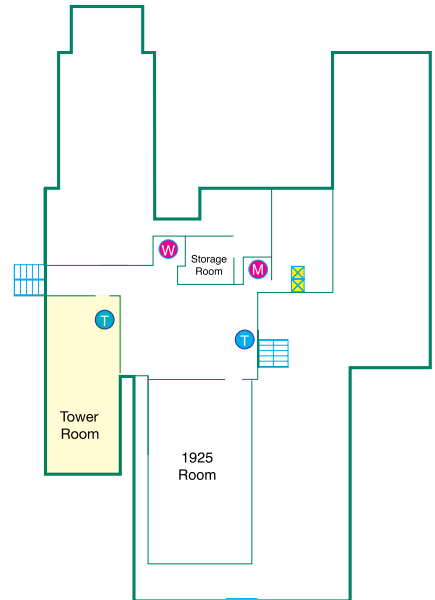
First Floor



Second Floor



Third Floor










Fourth Floor

MSU Union Floor Plan

Design Day Events Schedule: Friday, April 30, 2010

| 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. – noon | | | | |
| ECE 101 Robot Competition | 11:00 a.m. | 2nd Floor Concourse 9:30 – 11:00 a.m. | | | | |
| EGR 100 Presentations | | 2nd Floor Ballroom 9:00 a.m. – noon | | | | |
| ME 371 Demonstrations | | 2nd Floor Ballroom 9:00 a.m. - noon | | | | |
| ME 412 Competition | | 2nd Floor Ballroom 9:00 a.m. - 11:15 | | | | |
| ME 471 Competition | | 2nd Floor Ballroom 9:00 a.m. - 11:06 | | | | |
| CAPSTONE COURSES | | | | | | |
| All Capstone Posters Including BE 485/487, ChE 434 and MSE 466 | 1st Floor Lounge 8:00 a.m. - noon | | | | | |
| AES 410 Project Presentations | 2nd Floor Gold Room B 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 7:30 a.m. - 11:20 a.m. | | | | | |
| ECE 480 Project Presentations | Lake Huron Room 8:00 a.m. - 11:40 a.m. | | | | | |
| ME 481 Project Presentations | Tower Room 8:00 a.m. - 10:00 a.m. | | | | | |
| ME 481 Project Presentations | Lake Superior Room 8:00 a.m. - 12:30 p.m. | | | | | |
| LUNCH AND AWARDS | | | | | | |
| Woodcreek Lunch | | Green Room 12:00 p.m. - 12:30 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. | | | | |
| School Lunch | | Parlor C Noon - 12:30 p.m. | | | | |
| School Awards | | Ballroom 12:30p.m. - 1 p.m. | | | | |

KEY:  AES event  CE event  CSE event  ECE event
 EGR event  ME event  School event

STAFF ACKNOWLEDGEMENTS:



Roy Bailiff



Jill Bielawski



Linda Clifford



Kelly Climer



Cathy Davison



Craig Gunn



Phil Hill



Ken Horne



Matt Jennings



Debbie Kruch



Jamie Lynn Marks



Garth
Motschenbacher



Mary Mroz



Gregg Mulder



Roxanne Peacock



Adam Pitcher



Norma Teague



Teresa VanderSloot



Brian Wright

MACHINE SHOP AND DESIGN LAB STAFF:

Ken Barlage
Russ Tindall
Colin Perrault



"Our future lies in some very precious hands..."

Our children are our future. Without the next generation of engineers, scientists and other professionals, the advances we enjoy today would quickly grind to a halt.

At the Dart Foundation, we are committed to developing scientifically literate students in Michigan. Therefore we are delighted to help fund the MSU Department of Mechanical Engineering's Design Day for pre-collegiate students.

An investment in our children's future will pay big dividends for this generation, and also generations yet unborn, in Michigan, America and ultimately the world.

Middle & High School Innovation & Creativity Day

April 30, 2010

Precollege Student Voting: *During the first session 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.



CIVIL ENGINEERING TOWER BUILD

Humans have been building towers since we first started erecting structures thousands of years ago. Are the pyramids simply towers with wide bases necessary to support such structures of tremendous weight? Towers also hold up bridges such as the Mackinac and Golden Gate. Towers like the Sears Tower in Chicago are capable of housing offices, businesses, and living spaces. We also use towers to project radio signals beyond the curvature of the earth. This is accomplished by broadcasting the signal from a great height. The higher the tower, the greater the distance the signal is broadcast without interference from the Earth. This brings us to our challenge today. Given limited amounts of space and material, how does an engineer design a tall tower that is able to support a load while remaining stable? You and your team will need to figure this out!

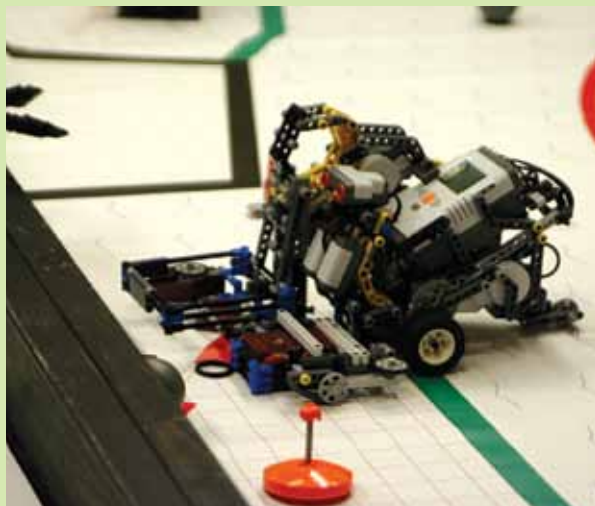
| | Civil Engineering Parlor B – 2nd Floor | Alternative Energy Parlor C – 2nd Floor | Robotics Green Room – 2nd Floor |
|--------------------|---|--|------------------------------------|
| 8:50–9:35 | All students vote for engineering displays on the first and second floors | | |
| 9:45–10:35 | Schools 1 & 2 | Schools 5 & 6 | Schools 3 & 4 |
| 10:40–11:15 | Schools 3 & 4 | Schools 1 & 2 | Schools 5 & 6 |
| 11:20–12:00 | Schools 5 & 6 | Schools 3 & 4 | Schools 1 & 2 |
| 11:55–12:05 | All students in Parlor C for the awards ceremony. Lunch will immediately follow. | | |

Schools attending on April 30, 2010: Haslett, Dwight Rich, Albion, C.H.E.S.S., Pattengill, Okemos

SCIENCE & ENGINEERING FOR A NEW ENERGY

As demand for fossil fuels increases in almost every corner of the world, the environmental impact of combustion becomes more apparent. This reality creates an unprecedented need for technological advances which can provide energy from alternative sources and reduce our dependence on foreign oil. This presentation will show why today's energy issues are so important, provide insight into key problems, and examine how science and engineering can bring profound changes.

The first part of the presentation will focus on the technical innovations related to the evolution of human civilization and the need for a revolutionary change in our energy infrastructure. The second part of the presentation will provide an in-depth perspective of the energy issue and why it is so important to our nation. In conclusion, we will discuss potential solutions which can bring alternative and renewable energy into our everyday lives. Integrated in this presentation LEGO Renewable Energy demonstrations will be given by the curriculum designers.



NXT ROBOTICS

Our team of experts has designed a lab experience to give pre-college students an introduction to robots. Students will learn to program robots using the LEGO NXT Mindstorm Robot. Using the graphical software (NXT G), students will write programs to control their group's robot. 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.



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



John Thon
Holt Junior
High School and
MSU NSF RET
SITE Lead

MEMBERS OF THE ORGANIZING COMMITTEE

EGR 100

9:00 – 12:00
Second Floor
Parlor A

INTRODUCTION TO ENGINEERING DESIGN

INSTRUCTIONAL TEAM: Dr. Neeraj Buch, Dr. Jongeun Choi, Dr. David Grummon, Mr. Timothy Hinds, Dr. Bradley Marks, Dr. Jon Sticklen, , Dr. George Stockman, Dr. Xiaobo Tan, Dr. S. Patrick Walton, Dr. Thomas Wolff

TA STAFF: Wouter Brink, Jacob Co, Brian Romanowski, Brad Rutledge, Greg Schafer

MENTOR STAFF: Michael Bekkala, Austin Crawley, Nicholas Lehman, Allison Mills, Michael Opperman, Justin Raymond, Noel Saxton, Nick Sears, Steven Soave, Russell Tindall, Patrick Triscari, Jessica Warda

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 350 students are enrolled in EGR 100 this semester.

The final course project had teams of EGR 100 students design a new product or process to remove a frequent inconvenience in their daily lives. Their design concepts were to be something new or a significant improvement to an existing product or process. The teams were to approach the project using the perspective of the engineering discipline they plan to pursue through their academic careers. The teams built prototypes of their concepts not exceeding a total material cost of \$20. The teams will display their prototypes at Design Day along with a poster detailing their concept designs. Pre-college students will recognize the most outstanding projects with awards.



Dr. Buch



Dr. Choi



Dr. Grummon



Mr. Hinds



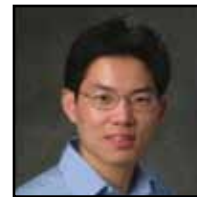
Dr. Marks



Dr. Sticklen



Dr. Stockman



Dr. Tan



Dr. Walton



Dr. Wolff

EGR 100 Outstanding Prototype and Poster Award

The EGR 100 Outstanding Poster and Prototype Award recognizes the best project presented by an EGR 100 design team as judged by area middle and high school students.

FALL 2009 EGR 100 OUTSTANDING PROTOTYPE AND POSTER

First Place

Jung-Chun Lu,
Jarret Nelson
Jacob Piepszowski
Scott Wisniewski

Second Place

Robert Coleman
Steven Harvey
Tyrone Mattison
Karen Wood

**APPLIED ENGINEERING SCIENCES
CAPSTONE PROJECTS**

PRESENTATION SCHEDULE – Gold Room B

| Time | Company | Project Title |
|----------|---|---|
| 8:00 am | MSU Outreach Office | Fill the Bus - Logistics Analysis |
| 8:20 am | Mid Michigan Girl Scouts | Long Term Strategic Development Plan |
| 8:40 am | MSU Extension | Ingham County Fresh Foods |
| 9:00 am | Greater Lansing Food Bank | The Garden Project: Packaging & Procurement |
| 9:20 am | Greater Lansing Food Bank | Food Bank Collaboration |
| 9:40 am | Greater Lansing Food Bank | Food Bank Route Optimization |
| 10:00 am | Break | |
| 10:20 am | Mid Michigan Red Cross (Mid MI Food Bank) | Training Program for Volunteers |
| 10:40 am | Mid Michigan Red Cross (Mid MI Food Bank) | Volume Analysis |
| 11:00 am | XG Sciences | Graphite Nano-composites: Market Analysis for Use in Fuel Cells |
| 11:20 am | XG Sciences | Graphite Nano-composites: Market Analysis for Use in Batteries |
| 11:40 am | XG Sciences | Graphite Nano-composites: Market Analysis for Use in Super Capacitors |

Capstone Project Sponsors and Award Sponsor

We thank the following project sponsors for their generous support of the Applied Engineering Sciences capstone course.

MSU Center for Service Learning and Civic Engagement (CSLCE)



**Girl Scouts
Heart of Michigan Council**



MSU Extension



Greater Lansing Food Bank



**Mid Michigan Red Cross
Mid Michigan Food Bank**



XG Sciences



Mr. Phil Fioravante, alumnus of our program, is the 2010 sponsor of awards for AES Capstone projects. Winners are determined based on both final written project reports and on oral presentations at Design Day. We thank Mr. Fioravante for his generous support of the AES program.

MSU CENTER FOR SERVICE-LEARNING AND CIVIC ENGAGEMENT (CSLCE)

“FILL THE BUS” LOGISTICS ANALYSIS

For over 40 years, the Center for Service-Learning and Civic Engagement (CSLCE) has been getting students involved in their community through a number of service opportunities. The Fill-the-Bus program debuted during welcome week in September 2009 and targeted freshman, instilling in first year students the importance of civic responsibility to the Spartan community. Each academic college requested that freshman bring an item to donate such as pencils, notebooks, cans of soup, non-perishable snacks, soap, shampoo, combs, band aids, etc to be donated to organizations such as the Lansing School District, Boys and Girls Club, and the MSU Food Bank.

We collaborated with CSLCE to make the Fill-the-Bus event an even greater success this upcoming year by reaching a larger number of students and maximizing the impact on the community. We did this by developing a plan that optimizes sorting, scheduling, and sourcing activities during the event. Improving the distribution of these donations will ensure that each recipient organization receives goods best suited to their needs. This was accomplished by utilizing process mapping and project planning software. In addition, we developed an enhanced marketing plan to broaden the campaign this year to target all students. This will not only increase the amount of donations, but will simultaneously better reinforce the message of civic engagement to the entire Spartan community.

<http://www.servicelearning.msu.edu/>



Michigan State University
Team Members (left to right)

Sarah Crete
Allen Park, MI

Kelsi Franckowiak
Traverse City, MI

Amy Gerstacker
Midland, MI

Jon Wiita
Kalamazoo, MI

Kevin Bowen
Lake Orion, MI

Center for Service-Learning and Civic Engagement - Michigan State University
Sponsors

Karen McKnight Casey
East Lansing, MI

Kevin Schwemmin
East Lansing, MI

GIRL SCOUTS HEART OF MICHIGAN COUNCIL LONG TERM STRATEGIC DEVELOPMENT PLAN

Our capstone group created a comprehensive plan for The Girl Scouts of the USA, headquartered in Lansing, Michigan. The plan is geared towards increasing sales revenue and reducing reliance on cookie sales while increasing revenue from donations and merchandise sales. The plan was partially completed by our group throughout the semester and can be continued by future capstone groups. Our team came up with ways to keep a record of where sales were both made and attempted, which can increase the number of customers asked to buy products, reduce redundancy in attempted sales, and reveal trends in sales. Making customers more aware of how they can purchase products and how their support helps Girl Scouts and the community was also part of the comprehensive plan. Surveying potential customers allowed our team to better understand the effect on sales if customers were made more aware of how supporting Girl Scouts is both tax deductible and a good cause. By giving customers discounts on cookies and merchandise, overall sales and advertising from merchandise distribution can be increased. Through looking at the success of selling cookies in unconventional ways, such as at sporting or holiday events, Girl Scouts may potentially increase overall sales revenue considerably. By helping make The Girl Scouts of the USA more successful, our team helped support their mission of increasing young girls' independence, confidence, and sales experience, all of which help improve the rest of their lives.



<http://www.gshom.org>



Michigan State University
Team Members (left to right)

- Cory Gregory
- Sam Moser
- Clayton Rice
- Tom Herzog
- Steven Moyers

Girl Scouts
Heart of Michigan
Council
Corporate Sponsor

Regina Riddle

MSU EXTENSION

INGHAM COUNTY FRESH FOODS

The MSU Ingham County Extension is committed to helping American families in Ingham County who are experiencing stress during these current economic times. Working together with Michigan State University, the Ingham County Fresh Food Initiative is designed to give the citizens of the Greater Lansing area fresher fruits, vegetables, dairy, and meat. This, compared to the boxed and canned food they mainly receive now, will give people more nutritious food along with decreasing food waste.

The Greater Lansing region is home to many seasonal and year-round fresh food producers; however the Greater Lansing Food Bank only collects a small amount of these fruits and vegetables. Therefore, a gap exists between potential production and connecting interested growers to supply the food bank with greater amounts of fresh food. The main objective is to help make recommendations on the feasibility of incorporating fresh-foods into the emergency food networks' supply chain. This can be done by identifying farmers interested in donating to emergency food providers, finding incentives for farmers such as tax breaks, and developing good marketing strategies to promote this cause.



MSU Extension has a long history of outreach



Michigan State University
Team Members (left to right)

MSU Extension
Corporate Sponsor

Craig Maser

Randy Bell

Brett Neumann

Randy Bell (Sponsor)

Damon Chang

Mathew Vogg

GREATER LANSING FOOD BANK

THE GARDEN PROJECT: PACKAGING & PROCUREMENT

The Greater Lansing Food Bank operates a field gleaning program called The Garden Project. It provides food pantries with fresh produce that would normally go to waste. It also supplies organizations, residents of subsidized housing and others in need. Area farmers and growers allow volunteers of the project to come and harvest the extra crops out of the fields and distribute them directly to those in need.

In previous years, volunteers of the gleaning program have relied on donated banana boxes from a Meijer distribution center to store and distribute the produce. In 2009, the program used over 7,600 boxes to move 336,000 pounds of fresh produce – including over 225,000 pounds of apples. Due to the closing of the distribution center and a change in the supply chain, Meijer can no longer provide packaging materials to The Garden Project.

While our clients had the food and volunteers to distribute to the hungry, our team accepted the challenge to make sure that The Garden Project had a reliable and sustainable alternative to package and distribute the food. We were able to procure reusable as well as disposable packaging in an efficient and cost effective manner. This enabled The Garden Project to concentrate on feeding the hungry in the greater Lansing area.



*Moving Food to the Right Place/
At the Right Time*



The Garden Project
Growing Healthy Food,
Cultivating Connections
A Program of the Greater Lansing Food Bank

<http://www.greaterlansingfoodbank.org/>



Michigan State University
Team Members (left to right)

- Adam Briggs (Mentor)
- Anne Rauscher
- Amarpreet Gill
- Jonathan Stratton
- Nicholas Dietz
- Jamarr Lewis-Whately
- Timar Hughes
- Kyle Kirkby

Greater Lansing Food Bank
Corporate Sponsors

- Anne Rauscher
- Kyle Kirkby

GREATER LANSING FOOD BANK FOOD BANK COLLABORATION

The Greater Lansing Food Bank, in conjunction with the Mid-Michigan Food Bank and the Ingham County Food Bank, has been working for years to distribute food to families in need in the Tri-County Area. Recently, a lack of information sharing and data collection has become a roadblock in their operations, causing inefficiency and redundant measuring systems. As a result, food is not being distributed equally as some individuals “play the system” to receive more donations, while others go without any assistance at all.

This project is particularly meaningful to the sponsors because it allows them to determine the number of individuals fed each year, which they have previously been unable to determine.

We implemented a system which improved the data collection and processing within the Food Bank system. This system measured the amount of food entering and leaving the system, in order to produce reliable data about the number of people served, the number of meals provided, and the amount of food collected.

A uniform information system was implemented throughout the food collection system in order to increase the quality of data. Up to this point, the data collected was unreliable and inconsistent. This system improved the quality and regularity of the entire system. The improvements we made to the Greater Lansing Food Bank, and its partners, will undoubtedly improve the data collection and processing within the Food Bank system. This will allow for better external reporting and identification of internal problem areas.

<http://www.greaterlansingfoodbank.org/>



**Pantries
and
Agencies**



**Michigan State University
Team Members** (left to right)

- Chi Heng Huang
- Terry Link (Sponsor)
- Dembe Ndiaye
- Justin Kanera
- Gregory Swears
- Bob Chalou (Mentor)
- [Missing: Myung Yeo]

**Greater Lansing
Food Bank
Corporate Sponsor**

Terry Link

GREATER LANSING FOOD BANK

FOOD BANK ROUTE OPTIMIZATION

The Greater Lansing Food Bank (GLFB), servicing the tri-county area of Ingham, Eaton, and Clinton counties, provides food to tens of thousands of people each year. These people include seniors, children and the “working poor,” those individuals that don’t earn enough to meet their daily basic needs. The Greater Lansing Food Bank works closely with the Mid-Michigan Food Bank, which provides similar services in seven counties that overlap with GLFB’s three counties.

Our challenge was to optimize truck route coordination between GLFB and Mid-Michigan Food Bank, ultimately saving gas, time, and money. Often times, trucks from both entities would perform similar tasks on the same day in the same area. With an overlap it was evident that communication and collaboration was needed.

Our Capstone class allowed us to bring together our engineering and business skills to create a viable solution to this challenge. We used a Six Sigma approach to process design in order to eliminate redundancies. We were able to present our sponsor, GLFB, with an efficient route alteration, utilizing Mid-Michigan Food Banks resources and vice versa. Our technical and business training, along with our creative skills, enabled a route fusion that demonstrates savings in gas, time, money and results in revenue generation.

<http://www.greaterlansingfoodbank.org/>



Michigan State University

Team Members (left to right)

Lisa Christman

Heather Wilkinson

Terry Link (Sponsor)

Salvatore Grillo

Brian Tanis

Bob Chalou (Mentor)

Greater Lansing

Food Bank

Corporate Sponsor

Terry Link

MID MICHIGAN RED CROSS (MID MI FOOD BANK) TRAINING PROGRAM FOR VOLUNTEERS

As the economy declines, Mid-Michigan families are finding it harder to make ends meet. The demand for food assistance is growing throughout Michigan. Several agencies and non-profit organizations, such as the American Red Cross and Feeding America, fund the Mid-Michigan Food Bank.

While partnering with other food banks and programs, effective time utilization and minimization of costs are key factors in effectively managing a volunteer based non-profit organization.

Working with the Mid-Michigan Food Bank, training modules and operating procedures for different volunteer tasks were created. The modules allow volunteers to quickly and easily acclimate themselves to various job duties and business processes. This will help optimize use of time and resources by volunteers and staff members.

Some of the new training modules consist of reading electronic material, and watching videos on how to correctly and efficiently execute volunteer tasks: assembling, sorting, and organizing. Ultimately, volunteers will complete tasks more efficiently and spend less time training with staff. Consequently, staff members will have more free time to devote to serving food to the hungry and homeless.

<http://www.midmichiganfoodbank.org/>



A current training session at the Mid Michigan Food Bank



Michigan State University Team Members (left to right)

- Janette Miller (Sponsor)
- Shawn Adams
- Stephanie Cieslinski
- Kevin Guimont
- Allison Marshall
- Bob Chalou (Mentor)
- Dave Karr (Sponsor)

Mid Michigan Red Cross and Mid Michigan Food Bank Corporate Sponsors

- Mr. Dave Karr
- Ms. Janette Miller

MID MICHIGAN RED CROSS (MID MI FOOD BANK) VOLUME ANALYSIS

The Mid-Michigan Food Bank (MMFB) is a non profit organization that provides food to local communities, churches, shelters, and kitchens. They support over 200 agencies in seven different Michigan counties with the help of local donations and also the American Red Cross.

Currently, the MMFB is facing the challenge of volume optimization. With the varying size and weight of the distributed products, the challenge lies in creating an accurate picture of the volume of the items they are trying to ship. This is resulting in extra transportation legs and increased costs due to their current distribution process.

By correlating outgoing shipments with the pick up of the donations, the MMFB would have a more accurate way of utilizing the volume of their transportation. Our objective is to develop better distribution modes and increase planning accuracy. Measurements of both vehicles and common items will allow for recommendations for optimal transportation strategies. The creation of a standardized system will provide a more accurate receiving and distribution process, while maximizing volume capacity.

<http://www.midmichiganfoodbank.org/>



Working a volume problem on site



Michigan State University Team Members (left to right)

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Truc-Mai Nguyen
Carsten Loewe
Jamie Clavette
Bob Chalou (Mentor)
Katie Walker
Dave Karr (Sponsor)

Mid Michigan Red Cross and Mid Michigan Food Bank Corporate Sponsors

Mr. Dave Karr
Ms. Janette Miller

XG SCIENCES GRAPHITE NANO-COMPOSITES: MARKET ANALYSIS FOR USE IN FUEL CELLS

Recently great importance has been placed on developing an effective alternative fuel source. One of the most promising technologies developed has been the fuel cell.

One main issue holding back the fuel cell market is cost. The materials needed for a fuel cell are very expensive. Most of the high cost is directly attributable to how the materials are processed.

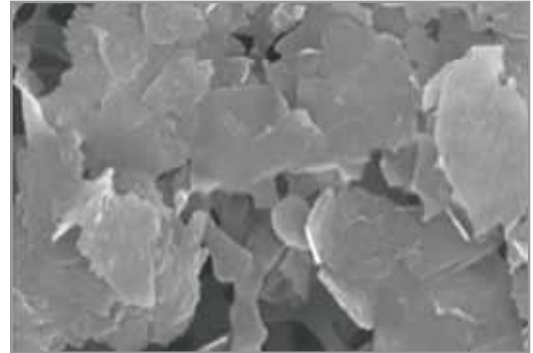
XG Sciences develops and produces multifunctional materials, one of which is xGnP graphene nanoplatelets. When added to other materials these nanoplatelets can greatly increase their properties. One such property is electrical conductivity, a key property for a fuel cell material.

The way in which these graphene nanoplatelets are processed greatly reduces production costs. This, along with the high electrical conductivity and other properties, has shown great promise for use in fuel cells.

The goal for this project is to analyze the advantages that would stem from replacing current materials used in production with xGnP as well as generate comparative analysis of competitive materials.

Working with XG Sciences we will determine the advantages to venturing into the fuel cell market, providing the graphene nanoplatelets for use within fuel cells. This will require great technical skill, having to know the material, applications, and technology

<http://www.xgsciences.com/>



Exfoliated Graphite Nano-platelets



Michigan State University
Team Members (left to right)

- Jason Shalla
- Ashley Fox
- Jessica Fox
- Allison Mills
- Kevin Pasch

Project Mentor

Adam Briggs

XG Sciences
Corporate Sponsors

- Dr. Lawrence Drzal
PhD, Chief Scientist
- Michael A. Knox
CEO
- InHwan Do
PhD, Scientist
- Hiroyuki Fukushima
PhD, Scientist

XG SCIENCES GRAPHITE NANO-COMPOSITES: MARKET ANALYSIS FOR USE IN BATTERIES

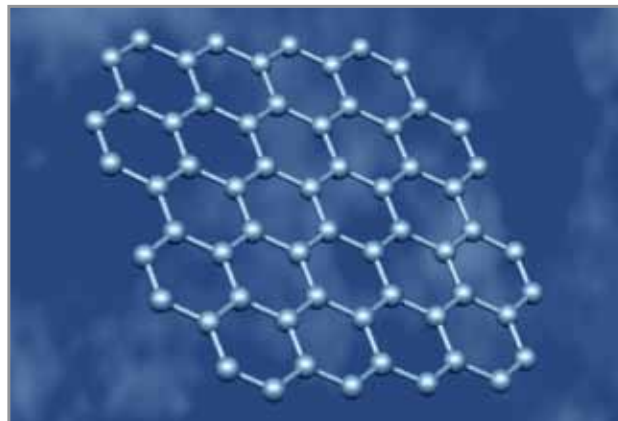
Today's batteries are built for either power or capacity, but not both. XG Sciences Inc. offers graphene technology that will revolutionize the battery industry.

Working with Dr. Lawrence Drzal, the Chief Scientist at XG Sciences, we have conducted an analysis of the high performance battery market to recommend growth strategies.

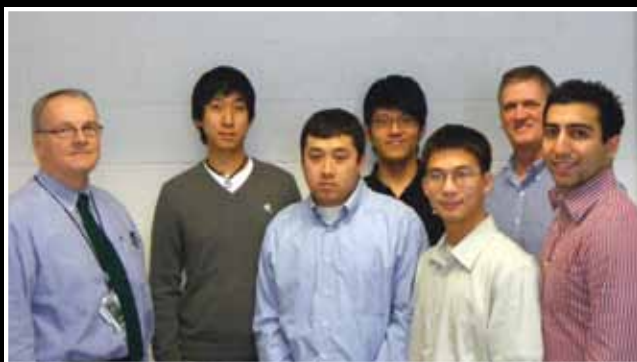
Functionalized graphene-based batteries have the capacity to overcome conventional trade-offs, thus providing the best of both worlds – a high-capacity, high-powered battery. This enhancement to cycle life leads to more energy per charge, less time per charge, and more charges before the battery needs to be replaced.

Graphene-based battery electrodes have the potential to transform the future of the energy industry. Wind and solar energy industries have always been set back by the lack of mass energy storage capacity. Graphene-based battery electrodes could very well be the key technology needed to boost the green energy industry to a level of self-sustenance.

<http://www.xgsciences.com/>



Artist's rendition of graphene molecule



Michigan State University

Team Members (left to right)

Dr. Larry Drzal (Sponsor)

Donald Wu

Andrew Schock

Jui-Yao Chen

Khoi Tran

Mr. Bob Chalou (Mentor)

Anthony Mistretta

XG Sciences

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InHwan Do
PhD, Scientist

Hiroyuki Fukushima
PhD, Scientist

XG SCIENCES GRAPHITE NANO-COMPOSITES: MARKET ANALYSIS FOR USE IN SUPER CAPACITORS

The core principal operation of supercapacitors is to store electric charge by using large surface areas created with numerous tiny hollow spaces. Within the field of super capacitors, Carbon Nanotubes technology is leading the market as it allows for the creation of uniform size surface areas with maximum utilization of space.

In this age of constant evolving of technology with a use of innovative materials, it is essential for companies to continuously stay on top of developments while creating and adapting to competitive technologies. Manufacturers of supercapacitors are able to replace Carbon Nanotubes and other comparable materials with a new material developed by XG Sciences, xGnP Graphene Nanoplatelets, which still retains similar electrical properties. Moreover, the use of Graphene will provide up to 99% cost savings to the manufacturers.

Collaborating with XG Sciences, we conducted a full market analysis for supercapacitors based on costs, safety and its current specification for the xGnP brand of Graphene Nanoplatelets. We utilized the internet, library database resources, SWOT analyses and comparisons of current and potential materials. The market analysis helped us give recommendations to XG Sciences on current areas where xGnP Graphene Nanoplatelets technology can be implemented, as well as possible emerging fields in which this technology can be developed for the future.



XG Sciences Advanced Lab Facility



<http://www.xgsciences.com/>



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XG Sciences
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PhD, Scientist

Hiroyuki Fukushima
PhD, Scientist

Project Mentor

Jon Sticklen

**BE 485 BIOSYSTEMS DESIGN TECHNIQUES
AND BE 487 BIOSYSTEMS DESIGN PROJECT**

PROJECT INSTRUCTOR: STEVEN SAFFERMAN, PH.D., P.E.

PROFESSIONAL DEVELOPMENT INSTRUCTOR: HOPE CROSKY, P.E.

Biosystems Engineering

Biosystems engineers integrate and apply principles of engineering and biology to a wide variety of socially important problems. The MSU biosystems engineering program prepares graduates to:

- Identify and solve problems at the interface of biology and engineering, using modern engineering techniques and the systems approach and
- Analyze, design, and control components, systems, and processes that involve critical biological components.

MSU biosystems engineering graduates are having a positive impact on the world, working in areas such as ecosystems protection, food safety and biosecurity, bioenergy, and human health.

2009-2010 Design Project Sponsors



PILOT BIOENGINEERING FOR STABILIZATION OF THE RED CEDAR RIVER

The Red Cedar River, on Michigan State University's campus, presents signs of riverbank erosion. Widening of the stream channel and bank undercutting has exposed infrastructure and damaged riparian habitat along the river corridor. The MSU-WATER initiative requested a sustainable stabilization plan that enhances biodiversity while being resistant and resilient to flood events, cost effective, and aesthetically appealing.

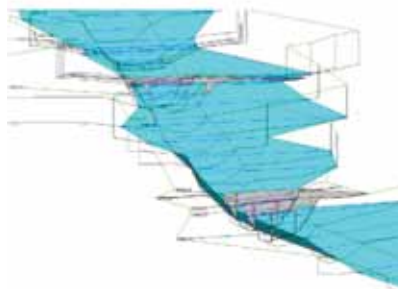
In order to model the stability of the system, geomorphologic, geotechnical, and hydraulic analyses were performed. Tributary discharges and dimensions were compared, and the watershed was found to be in a state of quasi-equilibrium. Site-specific hydraulic analyses were then performed using HEC-RAS to predict key design parameters of shear stress, velocity, and water surface elevation.

Vegetated cobble will provide a stable foundation at the toe of the slope, grasses and hardwood cuttings will reinforce the soil, and "terracing" with live branches will reduce sediment transport. The design provides a sustainable solution by combining mechanical stabilization with biological resilience.

Further recommendations to reestablish floodplain connectivity include the expansion of riparian buffer strips and reshaping of channel geomorphology.



Surveying Deer Creek Tributary



Hydraulic River Modeling



Dawn Reinhold



Team Members

Brad Wardynski
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MSU-WATER Initiative

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LSG Engineers & Surveyors

Valerie Novaes
Tetra Tech

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NESTLE ASEPTIC FILLER

The Nestle-Gerber pilot-plant requires an efficient sterile, or aseptic, process for filling a diverse array of products into varying sized and shaped packages for research and development testing. An aseptic filling environment needs to be designed, constructed, and validated for implementation in the pilot plant.

This design includes four components: chambers, sterilization system, product filler, and controls. Three connected chambers are used to isolate and sterilize packages for filling. Next, sterilization is performed using vaporized hydrogen peroxide (VHP). The filler loads packages precisely with a predetermined volume. An electronic interface controls and monitors temperature, relative humidity, hydrogen peroxide concentration, air flow rates, and internal chamber pressure.

Theoretical results are simulated using computational fluid dynamics modeling software. With this model, a baseline VHP cycle time is established to optimize the sterilization process and assure sufficient surface contact. The goal is to prove a log four reduction of microbial pathogens. Economic analysis is used to optimize the design for long-term operations.

Statistical testing of the pathogen reduction inside the filling chamber will be completed on site. Standard operating procedures will be established to assist operators in using the aseptic filler properly. Documentation of the project is recorded to help Nestle operate and maintain the aseptic filling chamber.



Kirk Dolan



Team Members

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Gerald Hessell
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Brimley, Michigan

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Industry Advisors

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Kraft Foods/
Oscar Mayer R & D

Scott Millsap
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Mike Potts
General Mills

INTEGRATED ANAEROBIC DIGESTER AND TREATMENT WETLANDS FOR PASTURE BASED DAIRY FARMS

The objective of this project is to utilize mathematical models to develop and optimize a preliminary engineering design that produces renewable energy while also biologically treating waste. This project focuses on the design of an anaerobic digester coupled with a treatment wetland for small dairies using the Kellogg Biological Station (KBS) as a case study.

Because KBS is a pasture based dairy farm, manure from its 100 lactating cows is only available in significant quantities during winter months, when the cows are housed inside. Results predict that sufficient manure is not available for the production of large amounts of gas for electricity or heat generation. However, by adding wetland plant material, such as duckweed grown in the treatment wetland, to the digester during the summer months, this project could be economically feasible.

Designing a comprehensive waste management system for any small farm requires a substantial capital investment. Additional and sometimes nontraditional methods will be needed to achieve sustainability.



Wei Liao



Team Members

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St. Johns, Michigan

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Dawn Reinhold
MSU BAE

EPA P3 Competition Proposal

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Michigan Department of
Agriculture

Chad Ducey
e-biofuels

Dave Prouty
Heat Transfer International

DETERMINING RESTRICTION POTENTIAL & ENGINEERING ALTERNATIVES FOR CARCINOGENIC SUBSTANCES

Under the growing concern for global health safety and environmental sustainability, various regulatory agencies, such as the U.S. Environmental Protection Agency (EPA) and European Chemicals Agency (ECHA), are seeking to restrict the use of substances shown to be hazardous to humans and/or the environment. Inconsistencies in the restriction criteria exist between agencies and the lists are frequently updated as new information is found. Abbott Labs is seeking a standardized method of predicting restriction potential in order to determine whether the substances of concern used in their manufacturing of products or packaging are likely to become restricted and a procedure to evaluate alternatives.

In order to accomplish this goal, a flow chart model was developed to determine restriction probability of carcinogenic compounds of concern to Abbott. By integrating toxicological research on currently restricted substances from the International Agency for Research on Cancer (IARC) and U.S. regulatory agencies, the model assesses restriction probability on a global and qualitative scale. Carcinogens of concern to Abbott, deemed to yield the highest restriction probability, were quantitatively assessed in order to recommend sustainable alternatives.

Abbott seeks to be proactive about assessing the increase in global restriction of hazardous chemicals. Thus, the developed prediction model will serve as a foundational method for addressing such regulatory concerns and provide the means to predict chemicals that may be restricted in the future.



Evangelyn Alocilja



James Pestka



Team Members

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Perrigo

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Private Consultant

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Abbott Labs

SUSTAINABLE URBAN DETROIT GOAT FARM

With the plummeting population and increase of inexpensive unused land, urban agriculture has become a business opportunity within many cities including Detroit. Goat farming provides unique opportunities for the production of meat while providing employment and educational facilities in an urban environment. However, goat farming produces problems such as managing waste and creating a sustainable cash flow. Project objectives are to create a computer model that optimizes energy inputs with meat outputs, waste management, land availability, and employment. The project constraints require a minimum of forty goats to optimize meat production with useable land that contains both pasture and feeding space within a building.

The model includes multiple Excel routines to enable the optimization of a desired inputs. One optimization option matches the number of goats desired to housing and feeding needs, expected profit, and land area required. A second option requires the amount of land available to determine the herd size, feed requirements, and net profit. The third inputs a desired profit margin and outputs the number of goats and land requirements.

Included in the model outputs are the amount of waste produced, number of goats, and the heating and space requirements. A plan to compost the waste into a desirable product (fertilizer) is also provided. To substantially reduce the odors, gas emissions from the compost will flow through a biofilter.

Results from the model found that over forty goats are required for an urban farm to be financially sustainable. Donations or grants are required to keep the business viable. However, the model contains many assumptions that should be further explored prior to construction of an urban goat farm.



Detroit Goat Farm



Dana Kirk



Team Members

Michael Wandersee
Temperance, Michigan

Julio Martinez
San Antonio, Texas

Andrew Sommerlot
Lansing, Michigan

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Detroit Goat Farm

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Saied Mostaghimi, Virginia
Technical University

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USDA-NRCS

Juanita McCann
USDA-NRCS

DESIGN FOR IMPROVING AIR EXCHANGE IN POTATO STORAGE

Potatoes are cooled and stored in bulk storage for 1 to 12 months after harvesting and before being processed into potato chips. Respiration occurs during storage; the sugar in the potatoes combines with oxygen in the air to produce carbon dioxide, water, and heat.



Proper air exchange removes carbon dioxide and heat while retaining the potato moisture content, which provides a higher yield when sold. Techmark, Inc., advises farmers on ventilation techniques and is therefore, interested in how variable frequency drive fans impact potato quality and electrical consumption requirements. The objective of this project is to use an air, heat, and mass transfer computer model to design an improved fan setting strategy. Computational Fluid Dynamic modeling is used to show how pressure differentials through the potato pile relate to the air flow, which corresponds to the respiration of the crop.

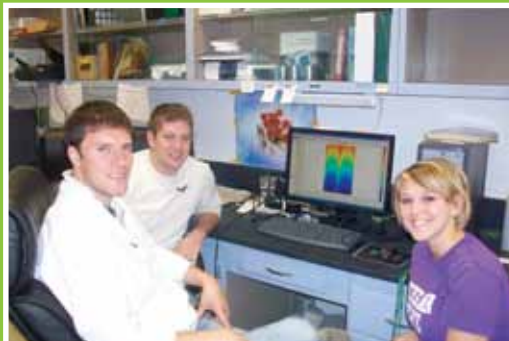
The project design uses potato characteristics and air properties, such as temperature and humidity, to solve heat and mass transfer equations. Different fan speeds are simulated to determine the most efficient strategy. Use of this model leads to improved air exchange settings, which result in reduced energy costs and improved crop yields.



Bradley Marks



Fred Bakker-Arkema



Team Members

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Fred Bakker-Arkema
Department of Biosystems
and Agricultural Engineering

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Kevin Evans
PepsiCo

David A. Hamilton
Michigan Department of
Environmental Quality

Steve Richey
Kellogg's

CE 495

8:00 – 12:00 noon
MSU and Lake
Michigan Rooms

CE 495 SENIOR DESIGN IN CIVIL ENGINEERING

FACULTY ADVISORS: : Professors: Chatti, Hatfield (emeritus), Maleck, Masten, and Wallace



Chatti



Hatfield
(emeritus)



Maleck



Masten



Wallace

Six student teams developed preliminary designs for elements of MSU’s Facility for Rare Isotope Beams (FRIB) – the \$550 million cutting-edge research facility to advance understanding of rare nuclear isotopes and the evolution of the cosmos. Teams developed preliminary plans for the following issues associated with construction of the linac tunnel: temporary shoring and excavation scheduling; maintaining water, waste water, and storm water services during and after construction; maintaining access for campus vehicular and pedestrian traffic; ensuring human health and safety during construction and operation.

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 Dept of Public Works; Fishbeck, Thompson, Carr & Huber; HNTB; LJB Inc.; Nat’l. Cyclotron Lab. MSU; NTH Consultants; Soil & Materials Engineers; Tetra Tech MPS; URS Corporation; and Wilcox Professional Services. We gratefully acknowledge their generous contribution.

Rick Chelotti, PE
Bergmann Associates
Lansing, MI

Peter Margules, PE
NTH Consultants
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Anthony Thomas, PE
Soil & Materials Engineers
Shelby Twp., MI

Daniel Christian, PE
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George McKenzie, PE
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John Saller, PE
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Todd Sneathen, PE
Director of Public Works
E. Lansing, MI

John LeFevre, PE
FTCH, Inc.
Lansing, MI

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

Thiru Thiruvengadam, PhD, PE
Consumers Energy (retired)
Okemos, MI

**Award
Sponsors**

BARR

ftc&h

CE 495 SENIOR DESIGN IN CIVIL ENGINEERING



Team 1: Back, l-r: Matt Morris, Jordan McNally, Tom Covington, Mike Fucinari. Front: Xenia Serbina, Lindsey Diggelmann, Jeanette Benzie



Team 2: Back, l-r: Kevin Hjetmanek, Romel Castro, Brandon Simon, Brian Goldberg. Front: Cole Ernsberger, Dan Elliott, Abigail Varner, Daniel Umulis



Team 3: Back, l-r: Richard Chouinard, Michael Ellis, Ryan Laruwe, Joseph Paquette. Front: Dave Metz, Emily Winn, Cassandra Fasano, Matt Schlicker



Team 4: Back, l-r: Kristy Currier, Stephanie Fredline, Ryan Kussmaul, Goran Arya. Front: Sean Johnson, Joseph Nguyen, Brandon Lebster (Not shown: Nathan Brejidak)



Team 5: Back, l-r: Danny Strayer, David Stringer, David Roth, Nick Elliott. Front: Michael Bertapelle, Erik Zuker, Charles Schallhorn



Team 6: Back, l-r: Julie Kubacki, Scott Zsenberg, Phil Armstrong, Tiffany Guo. Front: Tonderayi Allan Kujenga, Kyle Konz, James Pritchett

Team 1
8:00 a.m.
MSU Room

Team 2
8:00 a.m.
Lake Michigan Room

Team 3
9:20 a.m.
MSU Room

Team 4
9:20 a.m.
Lake Michigan Room

Team 5
10:40 a.m.
MSU Room

Team 6
10:40 a.m.
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; their student project manager coordinates the effort. 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 workplace 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.

ChE 434

8:00-Noon
First Floor
Lounge



CHE 434: PROCESS DESIGN AND OPTIMIZATION II

INSTRUCTOR:

Professor Martin Hawley

TEACHING ASSISTANTS:

Susan Farhat and Shengnan Xie

This course is a logical extension of the first semester of chemical engineering senior design. The abilities developed over a wide range of chemical engineering courses are now applied to a problem extending over a somewhat longer period of time; requiring more initiative, enterprise, care, and a greater measure of individual responsibility. For the 41st successive year, we have worked the American Institute of Chemical Engineers (AIChE) Student Contest Problem. We use these industry designed problems for three reasons: 1) they are well-rounded problems, 2) they tell our students and our faculty something about the kind of abilities that industrial companies would like graduating chemical engineers to have, and 3) there is the advantage of seeing how well our students compare with graduates of other universities in a national competition of this quality.

From the class of 68 students, 14 teams of two and 40 individuals completed this project. For Design Day, 5 teams and 5 individuals were chosen to present their design via a poster presentation. From this final group, 2 teams of two and 2 individuals will be chosen to compete in the national AIChE competition in the fall. Since 1968, about half the students whose reports rated first or second at MSU also finished among the top six nationally.

PROBLEM STATEMENT: Manufacturing Facility for a Biopharmaceutical: Monoclonal Antibody

The goal of this project was to design a large-scale manufacturing facility that has the flexibility to produce a variety of Monoclonal Antibody (MAb) products, specifically the humanized MAb against Vascular Endothelial Growth Factor (VEGF), from Chinese hamster ovary (CHO) cells. Today monoclonal antibodies are being used to treat a variety of illnesses, such as rheumatoid arthritis, Crohn's disease, transplant rejection, and a variety of cancers. It is important that the designed facility will allow the MAbs of today as well as the MAbs of tomorrow to be manufactured. The final design should include an economic analysis showing the profitability of this venture.

AIChE[®]



Team 1: Philip Lehman



Team 2: Allan Morris



Team 3: Peter Rossman



Team 4: Brian Starr



Team 5: Alexander Warning



Team 6: (l-r) Chelsie Backus, Melissa Ghislain



Team 7: (l-r) Justin Biega, Joshua Woods



Team 8: (l-r) Christopher Gelinias, David Hasselbeck




Team 9: (l-r) Daniel Janicki, Joseph Zalokar



Team 10: (l-r) Adam Loyson, Benjamin Kremkow





TO SEE CHEMISTRY THROUGH THE EYES OF
HUMANITY IS TO SEE THE PROMISE OF A BETTER
FUTURE. That's the power of the Human 

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Day and the hope for the future it represents.

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Westport, Connecticut



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Detroit, Michigan





COMPUTER SCIENCE AND ENGINEERING CAPSTONE COURSE PROJECTS

PRESENTATION SCHEDULE – Lake Ontario Room

Prof. Wayne Dyksen

| Time | Company | Project Title |
|---------|-------------------------------|--|
| 7:30am | Auto-Owners Insurance Company | Weather Incident Verification System |
| 7:50am | The Boeing Company | XML Texture Composition |
| 8:10am | Chrysler | Manufacturing Dashboard Migration |
| 8:30am | GE Aviation | Flight Deck Lateral Map Display |
| 8:50am | Medtronic | Mobile Health Management System |
| 9:10am | Meijer | Chief Information Officer Dashboard |
| 9:30am | Break | |
| 9:40am | Motorola | Mobile User Generated Video Service |
| 10:00am | Raytheon | Camera Control Appliance |
| 10:20am | TechSmith | Facebook Study Group Application |
| 10:40am | Terex | Enterprise Features for eCommerce |
| 11:00am | Urban Science | Automobile Dealer App for Mobile Devices |

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:

- Learning to architect, develop, and deliver 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.

Corporate clients are local, regional, and national, and have included Accident Fund, Auto-Owners Insurance, Boeing, Chrysler, Ford, GE Aviation, GM, IBM, Medtronic, Meijer, Microsoft, Motorola, Raytheon, Sircon, TechSmith, Terex, Toro, the Union Pacific Railroad, and Urban Science.

AUTO-OWNERS INSURANCE WEATHER INCIDENT VERIFICATION SYSTEM

When bad weather happens, insurance companies have their hands full with all the claims they receive. It is the job of the claims associates to determine whether a claim should be accepted or denied.

These often multi-million dollar decisions must be made very carefully. Proper research on recent weather events in the area of the claim will aid the associates in determining its validity.

To aid Auto-Owners Insurance in this research, we have developed a Weather Incident Verification System.

This web application allows a claims associate to easily search the weather history for the location in which the claim was made. The results can then be compared to the claim to see if a weather event may have caused the damage.

Searching can be done by first entering a date, or date range. Then, the user may enter either an address, or a specific latitude and longitude. Policyholders can be searched by last name to look up their address as well.

Once the associate submits the information, the results are neatly displayed along with a map of the area. Individual events can be clicked on for more detailed information. Results can also be saved to a file for recordkeeping.

Although this program cannot decide the validity of the claim on its own, it may provide valuable information for the claims associate to consider in their decision.



Michigan State University

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Evan Dontje
Dewitt, Michigan

Edward Waller
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Auto-Owners Insurance

Corporate Sponsors

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Lansing, Michigan

Scott Lake
Lansing, Michigan

Jim Walsh
Lansing, Michigan

Ed Keen
Lansing, Michigan

THE BOEING COMPANY

XML TEXTURE COMPOSITION

The amount of memory and power needed in graphics processing today is continually growing. Applications need a way to get as much power and memory out of as little resources as possible. Utilizing Sparse Virtual Texturing technology, the XML Texture Composition project allows ways to manipulate multiple image textures and draw them on a 3D model. The texture formats used maximize the amount of memory required to draw high-resolution images. The location and priority of how these textures are drawn will be decided through an XML text document loaded into the application.

Previous applications only allow one sparse virtual texture to wrap around the entire 3D object. This restriction does not allow Sparse Virtual Textures to be used to their maximum potential. The XML Texture Composition project extends this technology's functionality. Currently, multiple textures can be applied to a model at very precise user specified locations determined by the text document.

The sub feature of this project includes a menu option that allows the user to select an image and a location from a dialog box and place it as top priority on the 3D model at the specified location.

The XML Texture Composition project is implemented as an extension to Open Scene Graph. This project will also be integrated with the Boeing Company's modeling and simulation software.



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Pete Clive
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Matt Daniels
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CHRYSLER GROUP LLC

MANUFACTURING DASHBOARD MIGRATION

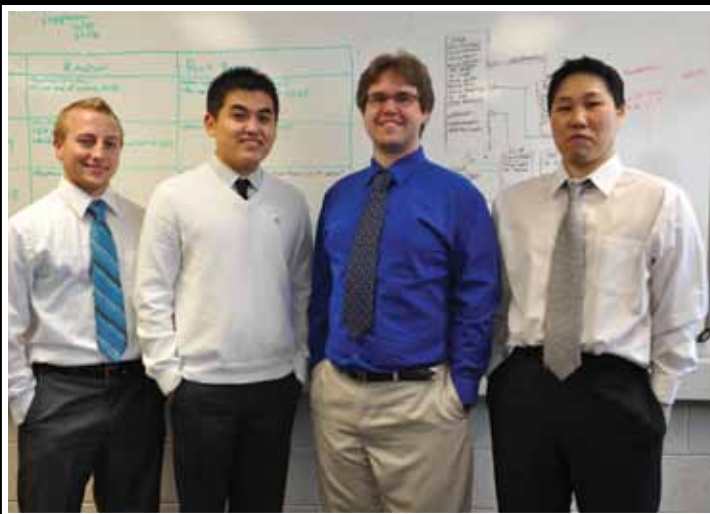
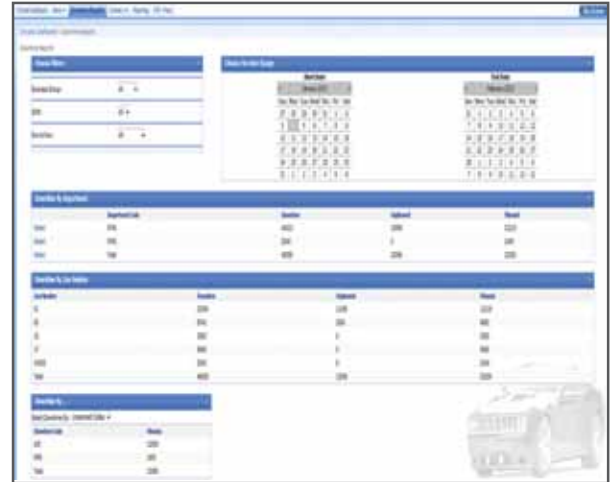
Currently Chrysler uses a dashboard to track key performance indicators for all of their plants. Managers can review this data to determine if company goals are being met and where improvements need to be made.

However, the current dashboard is a custom-made solution that has grown increasingly difficult to maintain and improve. Our project is to re-design this dashboard using modern methods, particularly Microsoft SharePoint Server, while preserving the functionality of the original. To make the project feasible within a semester, we focused on the Warren Stamping plant.

While the first goal of the dashboard migration is to increase maintainability, the second is improving usability. Currently, the dashboard offers a large variety of reports. Part of our task is to reduce the number of reports while providing the same information via drill down capability. If a particular piece of data presented in a table or chart is interesting to a user, they can click on it and get an expanded view.

On the right you can see an example page from our dashboard. This page displays downtime for parts of the plant and offers the users several filters for which data is displayed. In addition, when a department and line are selected from the tables at the top, the remaining tables reflect only data for that line.

Along with displaying overall performance data, the site will contain a more advanced news section. This section will display the overall news of the plant, as well as more specific news, such as Financial, Corporate, and Human Resources.



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Chrysler Group LLC

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Sandra D. Rose
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GE AVIATION

FLIGHT DECK LATERAL MAP DISPLAY

Given the safety critical task of piloting an aircraft, the aviation industry is continuously seeking to improve pilot performance. One such tool aimed at improving situational awareness is the Flight Deck Lateral Map Display (LMD). This software provides multiple views of an aircraft's situation, giving a pilot valuable flight data that might otherwise not be available.

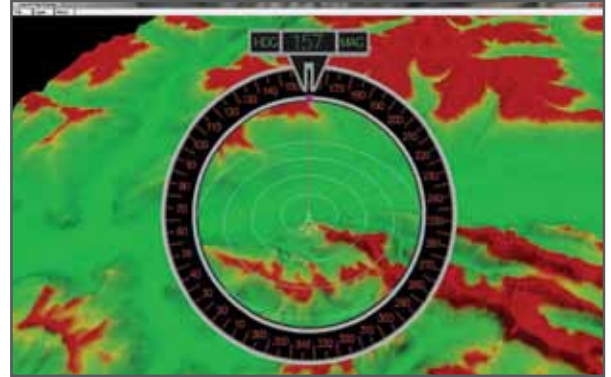
By utilizing flight simulation software to stream data over a simulated aircraft network, the LMD is capable of displaying a multitude of information in various layers.

Terrain elevation and distance are rendered in multiple ways. A top down (or plan view) rendering is displayed around the plane icon and is shaded depending on the theoretical danger level. Terrain that is significantly above the aircraft is color coded red while terrain significantly below the aircraft is colored green. A second form of display is a side (or profile) view where the danger levels are shaded in the same manner.

Other features include weather, waypoints, other air traffic, airports, state and country lines, wind speed, and ground speed. The weather layer uses a worldwide map to accurately display the current weather at a given location. Location data is derived using the aircraft's latitude and longitude and updates based upon rotation and zoom.

The Lateral Map Display is particularly useful when visibility is poor. Using this tool, the pilot has the ability to determine their heading, see their flight plan, and avoid hazards such as terrain, air traffic, and weather.

The LMD is written in C and utilizes the OpenGL API.



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MEDTRONIC MOBILE HEALTH MANAGEMENT SYSTEM

In an effort to help patients manage their health we have developed the Mobile Health Management System. The goal of this product is to show the correlation between food and exercise choices and the patients' health. Patients will be able to track a wide range of goals that consist of weight, heart rate, blood sugar, and other various related health risks.

This product consists of both a web and iPhone application. Patients will be able to input their daily activities and view data from their implanted Medtronic devices. The correlation of this data reinforces healthy choices and helps patients actively participate in their rehabilitation.

One example could include an overweight patient struggling with a chronic heart disease. The patient could use the application to track weight, heart rate, and sodium levels. The activity data that they entered can be viewed along with data from their implanted Medtronic devices. Over time, the patient can see how their health has been affected by their lifestyle choices.

Medtronic's mission is to contribute to human welfare by the application of biomedical engineering to alleviate pain, restore health, and extend life. For over 40 years they have been transforming the way the world treats chronic diseases so patients can live a fuller life.

The web application is developed in Javascript and Groovy and Grails. The iPhone application is developed in Objective-C. The database used is MySQL.



Medtronic

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Medtronic

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MEIJER CHIEF INFORMATION OFFICER DASHBOARD

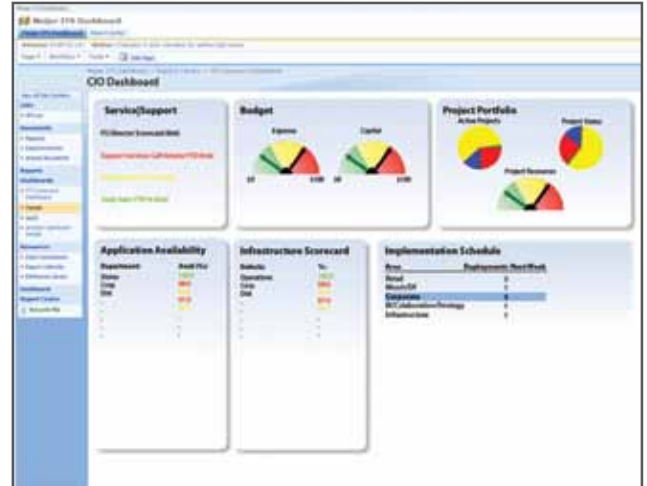
For retail giants like Meijer, information technologies provide strategic competitive advantages for everything from point-of-sale systems to inventory control. The Chief Information Officer is responsible for leading and managing information technology for the entire enterprise.

What we have come up with is a dashboard, that is built upon Microsoft SharePoint, which has several “widgets” that all help to portray different information, whether it is financial information or period support call volumes or any other performance metric related to the ITS department.

Each one of these “widgets” portrays information in a way that is best fitting for that information. This ranges from pie charts, to graphs, to color-coded text.

While all of these “widgets” provide a brief glimpse into the performance metrics, some also allow for a “drill-down” into the information to see specific parts of that performance metric. “Drill-down” simply means you can click to see a more detailed view of that performance metric.

The hope of our project is that we can provide a highly customizable and interactive dashboard to Meijer’s CIO and ITS Managers. This dashboard allows the user to quickly glance at key department metrics, highlighting areas that are under performing, and allowing for quick “drill-down” to more detailed information. By providing this dashboard, the user can potentially save valuable minutes by only spending time on areas that require their attention.



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MOTOROLA

MOBILE USER GENERATED VIDEO SERVICES

Video on demand services like TiVo or Comcast On Demand have become very popular over the past decade because of the many benefits they offer to their users. However, these benefits are limited. You can only watch shows and movies you record or watch the programs provided to you by your service provider. Now, think of the ability to take control of this service. The ability to watch your own videos anywhere you or your friends and family watch TV.

We have developed a system that allows users to upload their own content and make this content accessible via a cable box. The user does this by uploading a video from their computer, iPhone, or Android device to a web service. The user gives the video a name and description, and then selects which of their buddies can view the video.

Once the video is uploaded to the service and buddies are associated, the service alerts the appropriate cable headend that a new video is available to be viewed. The headend then downloads the video and converts it to a stream-capable format and saves it to be watched at any time.

The user can navigate through their list of movies on their cable box and select which one they want to watch. Upon selecting a video, it is then streamed to their television.

All services are implemented in Java, deployed on a Glassfish application server and use a MySQL database. The Android app is developed in Java and the iPhone app in Objective-C using Xcode. All Java is developed in Eclipse.



Michigan State University

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RAYTHEON

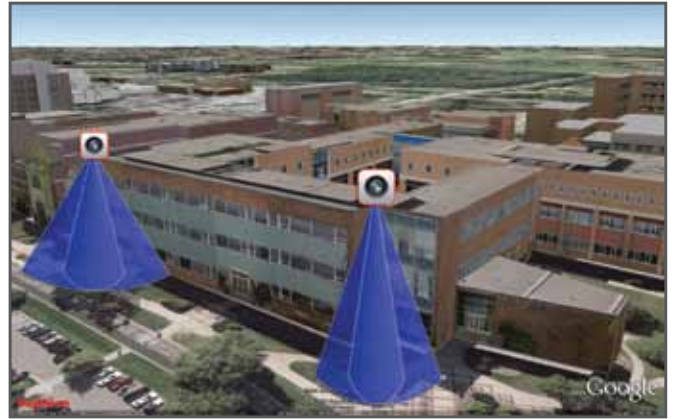
CAMERA CONTROL APPLIANCE

One of Raytheon's primary functions is to provide security solutions for clients. A current problem is accessing and controlling pan-tilt-zoom security cameras. This is a problem because there are many different types of security cameras, and many different protocols are used to communicate with them. This is why Raytheon wishes to have a camera control appliance that provides a way to easily communicate with many different types of security cameras.

The camera control appliance is a software application that will allow remote sensors, such as security cameras, to communicate with Raytheon's Command Assurance - Civil situational awareness software. The appliance must be extensible, meaning it must be designed to easily allow the addition of new sensors. It will allow clients to effortlessly integrate various types of security cameras into their local networks and Raytheon's various situational awareness tools.

The camera control appliance integrates with Raytheon's Command Assurance software, Sensor Resource Manager and Command, Control and Display Equipment. The end result allows the sensors to be controlled and visually represented through Google Earth.

The camera control appliance uses the standards established in the ICD-101A security document. These standards are used as a guide to create an XML-based standard for universal communication with sensors.



Raytheon



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Barry Peterson
Ft. Wayne, Indiana

Dan Sheline
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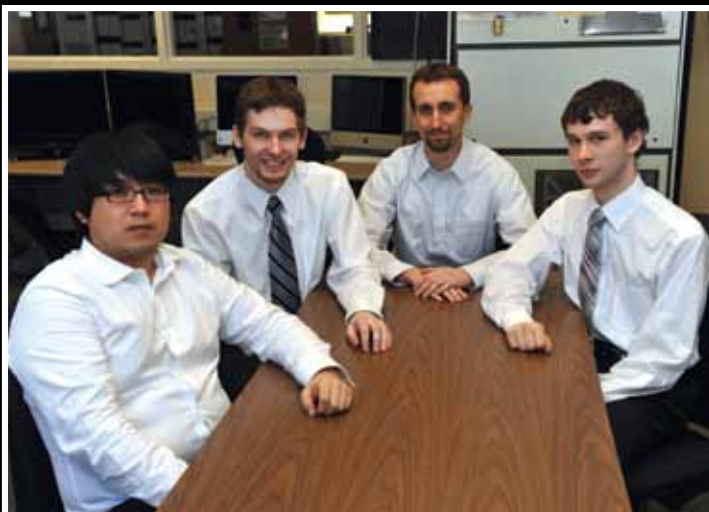
TECHSMITH FACEBOOK STUDY GROUP APPLICATION

Study groups are common for college classes as well as certain K-12 ones. Some challenges students in these classes must often overcome include finding others interested in a study group, distributing content, organizing meetings, and identifying as well as eliminating people harmful to the group.

The Facebook Study Group Application addresses each of these challenges. On its own, social networking provides untapped opportunities for study groups and academic collaboration. This application makes use of that potential to create an environment where students can spread and obtain knowledge. It furthermore enables the quick and easy sharing of various types of class content. The incorporation of existing TechSmith products such as Camtasia and Jing allow students to get the maximum benefit of the Facebook Study Group Application's content sharing capabilities.

The application features forum-like discussion capabilities with real time response where content can be posted and accessed. It also uses internal groups with various configuration options similar to Facebook. Calendars are available for tracking deadlines and important dates. Finally, it allows the creation and tracking of individual user rankings based on accomplishments or other user input.

This Facebook application was developed using various programming languages including PHP and JavaScript.



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Mike Simons
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TEREX

ENTERPRISE FEATURES FOR ECOMMERCE

Online shopping has grown to be a common experience in the past decade and will become even more common in the coming years. Terex is an example of a company that sells their products to dealers from their online store.

Terex has dealers located all over the globe, often times in places that do not have a permanent internet connection. Terex has the desire to allow customers to access the electronic catalog where internet connection is not available.

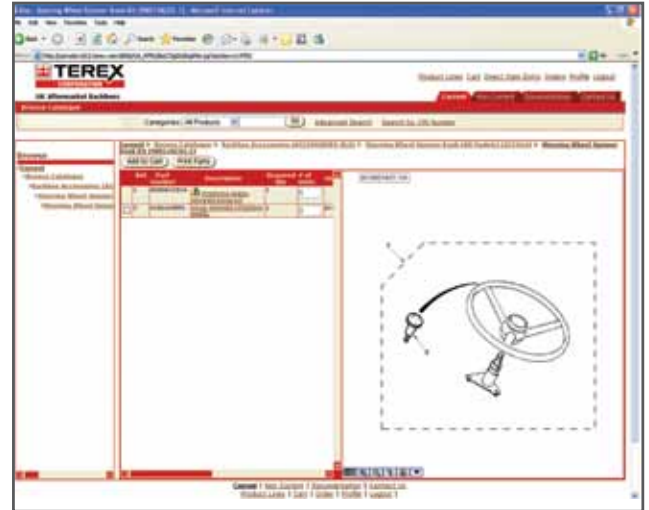
One of the features of the software is the ability to browse and search the product database while disconnected from the internet. The customer may also add items to a shopping cart and submit the cart when an internet connection is available.

When a customer selects a product they will be shown more information about it. This information is shown in the document viewing area. This new feature shows all of the documents related to the product they are currently looking at, such as images, PDF's, and videos.

The customer may also choose to download a PDF manual for the product. This manual is created by the software and includes all related product information.

Due to the requirement to run on any customer's laptop, the software is compatible with older computers.

Enterprise Features for eCommerce is written in Java. The software looks like a web page even when the customer is not connected to the internet and is just as easy to use.



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Plano, Texas

URBAN SCIENCE

AUTOMOBILE DEALER APPS FOR MOBILE DEVICES

In today's rapidly changing business environment, automotive dealerships have to make important decisions to remain profitable. But in order to make these decisions, an automobile dealer has to be well informed about how they are performing.

Dealerships use various categories of statistical data to assess themselves in a variety of areas such as sales, repair, and customer satisfaction. Previously, an automobile dealer had to log onto their desktop or laptop computer in the office or home to get these statistics.

Now a dealer can access these statistics on their mobile device, regardless of where they are. By using the Automobile Dealer Apps for Mobile Devices, a dealer has the power to view their performance at their fingertips.

Our application gives users the ability to access dealership performance statistics while "on the run." Not only does the application allow users to conveniently access statistical data from a cellular device, the application also displays the data in an easy to read fashion via charts, graphs, and maps.

The application's search functionality, ability to sort dealership performance across numerous key performance indicators, sleek user interface, and slew of other great features make the Automobile Dealer Apps for Mobile Devices the perfect tool for automobile dealers that are constantly on the go.



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Joshua Mackaluso
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Urban Science

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Randy Berlin
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Suzanne DuBois
Detroit, Michigan



Beyond Imagination

TRANSFORMING TECHNOLOGY TO CHANGE LIVES

At Medtronic, we're changing what it means to live with chronic disease. We're creating therapies that help patients do things they never thought possible. Seeing our work improve lives is a powerful motivator. The more we do, the more we're driven to push the boundaries of medical technology.

To learn more about career opportunities at Medtronic, visit www.medtronic.com/careers.

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Design Day Awards:

MICHIGAN STATE COLLEGE OF ENGINEERING

Computer Science and Engineering 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 Insurance Exposition Award



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

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

Team 3. GE Aviation
Synthetic Vision Display



Jesse Hacker, Justin Kienle, Andy Inman, Andrew Gerber
Presented by Ron Simon of Auto-Owners Insurance
December 2009

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 2. Boeing
Sparse Virtual Texturing



Adam Starks, Jim Drallos, Alex Kobylarek, Patrick Ohren
Presented by Karen Wrobel of Chrysler
December 2009

Design Day Awards:

MICHIGAN STATE COLLEGE OF ENGINEERING

Computer Science and Engineering Awards

December 2009 Design Day Judges

David Asiala
Dow Chemical

Richard Enbody
Michigan State University

Adam Haas
Ford

Vandy Johnson
Medtronic, Inc.

Marty Strickler
Rose Packing

Michael Drazan
The Toro Company

Naim Falandino
Covisint

Louise Hemond-Wilson
IBM

Kevin Ohl
Business & Technology Consultant

Karen Wrobel
Chrysler LLC

Crowe Horwath 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 Crowe Horwath Sigma Award, which is sponsored by Crowe Horwath LLP of Oak Brook, Illinois.

Team 5. Motorola

User Generated Video Service for the iPhone



Rob Palmer, Ryan Ley, Mary Fetsco, Phil Deschaine
Presented by Dominic DiCicco of Crowe Horwath
December 2009

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 6 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 1. Auto-Owners Insurance

Applications for Mobile Devices



Lovelesh Chawla, Luke Hospadaruk, Rick Silva
Presented by Dean Craven of TechSmith
December 2009



FRESHMAN/SOPHOMORE ELECTRICAL AND COMPUTER ENGINEERING ROBOT COMPETITION

INSTRUCTOR: Prof. Robert J. McGough

Lab Consultants: Dave Seaton and Leon Voskov

PROBLEM STATEMENT

ECE 101 is an elective course that introduces freshman and sophomore students to Electrical and Computer Engineering through a series of hands-on laboratory experiments. The ECE 101 experience involves microcontroller-based activities that utilize the Parallax® Basic Stamp Board of Education. In addition to the Board of Education, electrical components ranging from capacitors to ultrasonic range finders are interfaced with the microcontroller to accomplish a task. Once the students are accustomed to working with these electronics, they form small groups for the final project. On Design Day, the groups participate in a robot competition. For this semester, the teams program robots to run on a course with various obstacles that they must manage. SONAR, Line Sensors, and Radio Frequency Identification must be efficiently programmed to successfully overcome roadblocks, a bridge, and a winding road course.



Two students, pictured above, are in the process of uploading code to the robot's onboard chip.



Pictured above, two groups of students are testing their robots to see if they are functioning correctly.



TEAM 1
Nate Kesto (left)
Blake Frantz (right)



TEAM 2
Ryan Battaglia (left)
Zach Lotoszinski (right)



TEAM 3
Brett Johnson (left)
Sungho Yoo (center)
Matt Wein (right)



TEAM 4
Mohamed Rosham (left)
Brian Cotton (right)



TEAM 5
Derek Kowalski (left)
Steven Le (right)



TEAM 6
Chadwick Osir (left)
Zach Egloff (right)



Prof. Goodman



Prof. Shanblatt

ELECTRICAL AND COMPUTER ENGINEERING PROJECTS

PRESENTATION SCHEDULE — Lake Huron Room

Course Coordinators: Professors Erik Goodman and Michael Shanblatt

Faculty Advisors: Professors Aslam, Aviyente, Balasubramanian, Biswas, Deller, Mukkamala, Reinhard, Salem

Huron

8:00 – 11:40
Third Floor
Lake Huron Room

| Time | Project Sponsor(s) | Sponsor Representative(s) | Faculty Facilitator(s) | Project Title |
|-------------------------|---|---------------------------|------------------------|--|
| 8:00 ECE 480 | MSU RCPD | S. Blosser | D. Aslam | Synchronized Audio indexed Note Taker (SAiNT) |
| 8:25 ECE 480 | MSU RCPD | S. Blosser | F. Salem | AHEAD: Accessible Home Energy Audio Dashboard |
| 8:50 ECE 480 | George & Vickie Rock and Dow Chemical Company | E. Goodman | S. Aviyente | Connect-on-Demand Satellite Link for Tanzanian Schools |
| 9:15 ECE 480 | George & Vickie Rock and Dow Chemical Company | E. Goodman | R. Mukkamala | Time-sharing Computer System with Audio Integration |
| 9:40–10:00 Break | | | | |
| 10:00 ECE 480 | Air Force Research Laboratory | S.W. Schneider | S. Balasubramanian | Small, Lightweight Speed/Distance Sensor for Skiers/Snowboarders |
| 10:25 ECE 480 | Hyundai Kia America Technical Center (HATCI) | J. Shtogrin | J. Deller | Capacitive Rain Sensor for Automatic Wiper Control |
| 10:50 ECE 480 | Texas Instruments | J. Reinhart | D. Reinhard | Ethernet Integrity Analyzer |
| 11:15 ECE 480 | Norfolk Southern and Triple Crown Services | M. Theisen | S. Biswas | Roadrailer Air Brake Fault Locator |

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 and accommodation issues, and in 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 (Wochholz Endowment), Marathon Oil, Texas Instruments, Norfolk Southern, Triple Crown Services, Dow Chemical Company, George and Vickie Rock, Hyundai Kia America and the Air Force Research Laboratory

MSU RESOURCE CENTER FOR PERSONS WITH DISABILITIES: SYNCHRONIZED AUDIO INDEXED NOTE TAKER

The purpose of the Synchronized Audio indexed Note Taker (SAiNT) is to assist persons with disabilities with class work and note taking during lecture. Specifically, accessibility to blind students will be considered due to the fact they have difficulty taking notes during lecture. SAiNT will help the user record entire lectures as well as type time-synchronized notes into the device concurrently. The lecture and text can be downloaded to a computer, allowing the user to search the text for keywords later and begin playback of the lecture at the point in the lecture when the notes were taken. In other words, the device will record audio, annotate it with synchronized text from the keyboard and allow for file transfer to a PC for search and playback.

<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group01/>



T. Nguyen
Computer Eng



L. Chen
Electrical Eng



H. Lin
Electrical Eng



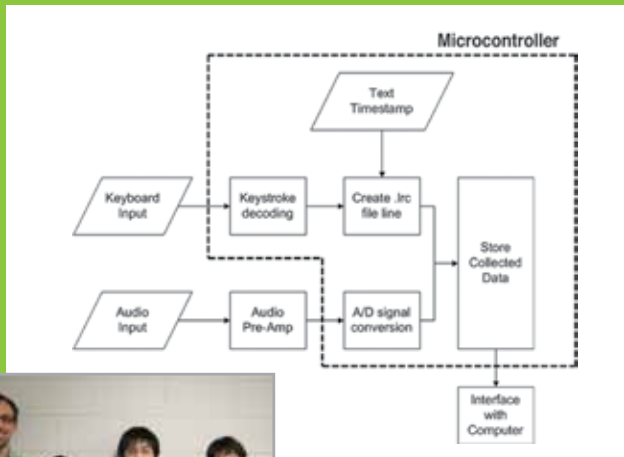
C. Johnson
Electrical Eng



Dr. Aslam



Mr. Blosser



Project Sponsor
MSU Resource Center for Persons with Disabilities

Sponsor Representative
Mr. Stephen Blosser

Faculty Facilitator
Dr. Dean Aslam

Team Members & Non-Technical Roles
Huan Lin
Manager

Trieu Nguyen
Webmaster

Christopher Johnson
Documentation Prep

Li-Shian Chen
Presentation Prep and Lab Coordinator

MSU RESOURCE CENTER FOR PERSONS WITH DISABILITIES: AHEAD: ACCESSIBLE HOME ENERGY AUDIO DASHBOARD

Power companies and consumers alike have been clamoring for a new ‘smart-grid’, an intelligent power network that streamlines energy distribution and reduces the stress on the current power grid. This initiative is aimed at reducing carbon emissions and reducing costs for both energy consumer and provider.

Our team has been tasked by MSU’s Resource Center for Persons with Disabilities (RCPD) to design a smart-grid enabled energy management system that is universally accessible and addresses the needs of people with disabilities. Since there is no established industry standard for accessible design in energy management systems, our team is at the forefront in creating one such standard.

The key feature of our energy management system is the integration of a Home Area Network (HAN). In addition to displaying up-to-date information about electricity rates and energy consumption, AHEAD provides the user a centralized interface that allows them to turn household appliances on and off. Pre-configured operation modes are provided so the user can tailor AHEAD to their own energy-saving needs. For those with visual impairment, AHEAD has a text-to-speech option allowing them to interact with control features via multi-touch gestures. A built-in flashing LED notifies people with hearing disabilities of important alerts and power consumption status. AHEAD is also compatible with external devices for motorically impaired persons. In effect, AHEAD not only enables people with disabilities to participate in green initiatives and save money, it also provides them a robust automated HAN control device to facilitate a more independent lifestyle.



D. Wey
Electrical Eng



J. Grimes
Electrical Eng



J. Grover
Computer Eng



A. Al-Qudaihi
Electrical Eng



RCPD
Maximizing
Ability & Opportunity

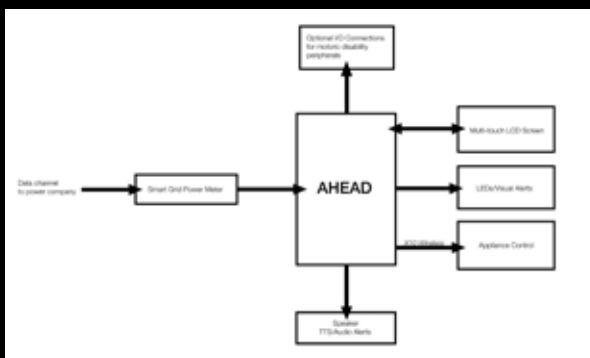
<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group02/>



Mr. Blosser



Prof. Salem



Project Sponsor
MSU Resource Center
For Persons with
Disabilities

Sponsor Representative
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Faculty Facilitator
Dr. Fathi Salem

Team Members & Non-Technical Roles

Ahmad Al-Qudaihi
Manager

Dennis Wey
Webmaster

Joe Grover
Documentation Prep

Jason Grimes
Presentation Prep

GEORGE & VICKIE ROCK AND DOW CHEMICAL: CONNECT-ON-DEMAND SATELLITE LINK FOR TANZANIAN SCHOOLS

Our project—one of a series—involves establishing a more power-efficient internet connection for rural Tanzanian schools, in particular, Baraka Primary School, Manyara Secondary School, and Rift Valley Secondary School. Earlier teams have designed modules for accessing the internet, and our objective is to improve this system, under generous support from George & Vickie Rock and a matching grant from Dow.

The team has been challenged to design a solar-powered, “connect-on-demand” satellite/radio link. With this new design in place, the system will draw minimum power from the batteries while optimizing the time of its usage. This will allow the Tanzanian users to gain the most out of their internet while staying well within their power limitations. In essence, the students at any of the three schools will be able to connect to the internet at any time, causing it to power up when accessed. Currently, the initial set up of this system is implemented such that only Baraka has control over the satellite antenna, which sometimes limits the availability of the internet for users at Manyara Secondary School. We will eliminate that limitation and extend similar capabilities to Rift Valley Secondary School.

Our design team includes five electrical engineering students and one telecommunications student. Through our diverse backgrounds and various experiences, we will test various technologies to accomplish our design. Following the semester, the design team will travel to Tanzania in order to install the final system.

<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group03>



R. Singleton II
Computer Eng



E. Hatch
Computer Eng



M. Moulton
Elec.Eng/Physics



R. Ocampo
Electrical Eng



L. Garcia
Electrical Eng



J. Larsen
Telecomm

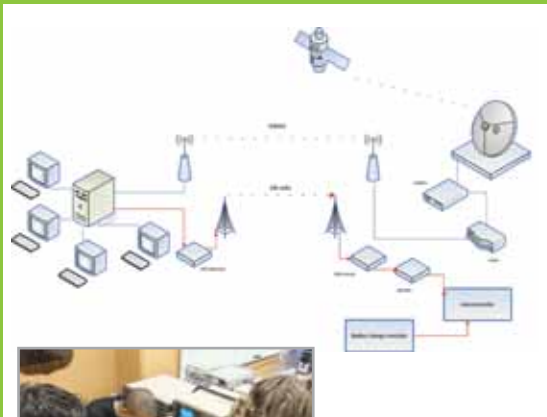
George & Vickie Rock and



Dr. Goodman



Dr. Aviyente



Project Sponsors
George & Vickie Rock and Dow Chemical

Sponsor Representative
Dr. Erik Goodman

Faculty Facilitator
Dr. Selin Aviyente

Team Members & Non-Technical Roles

Rodney Singleton II
Manager

Eric Hatch
Webmaster

Michael Moulton
Documentation Prep

Rafael Ocampo
Presentation Prep

Luis Garcia
Lab Coordinator

Joseph Larsen
Team 4 Support

GEORGE & VICKIE ROCK AND DOW CHEMICAL: TIME-SHARING COMPUTER SYSTEM WITH AUDIO INTEGRATION

Two schools near Mto wa Mbu, Tanzania currently have multi-seat computer systems, developed by earlier ECE 480 teams, that require upgrades. A third school is also scheduled to be added to this project. Michigan State University, with support from George and Vickie Rock and a matching grant from the Dow Chemical Company, will continue to support this project during another team visit in May 2010. The two currently operational systems have 6 seats running off of a single computer, to save both hardware and power costs. However, these systems do not automatically associate the keyboards and mice with the proper monitors. They instead require a manual input, which can be executed incorrectly by students with limited computer experience. The system also periodically crashes when not all of the sessions are in use. It is the responsibility of Design Team 4 to implement a system to automatically associate a keyboard, mouse and monitor to each user station. In addition, Team 4 will implement audio capabilities for each station to further the educational opportunities for the students. Team 4 will also bring the third school online when they travel to Tanzania in May, 2010.



D. Wilson
Electrical Eng



T. Haynie
Computer Eng



A. Bruinsma
Electrical Eng



B. Charboneau
Electrical Eng



B. Mattingly
Electrical Eng

<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group04/>

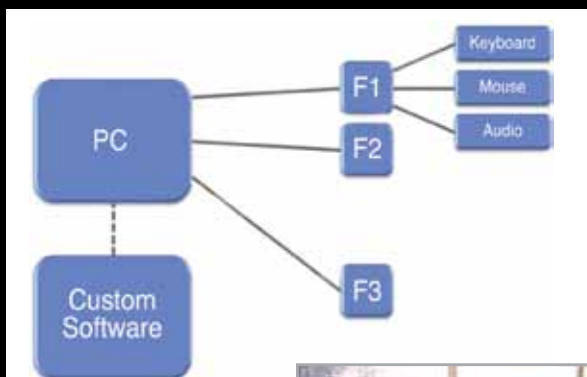
George & Vickie Rock and



Dr. Mukkamala



Dr. Goodman



Project Sponsors
George & Vickie Rock
and Dow Chemical

Sponsor Representative
Dr. Erik Goodman

Faculty Facilitator
Dr. Ramakrishna
Mukkamala

Team Members & Non-Technical Roles

David Wilson
Manager

Tim Haynie
Webmaster

Andy Bruinsma
Documentation Prep

Bret Charboneau
Presentation Prep

Billy Mattingly
Lab Coordinator

AIR FORCE RESEARCH LABORATORY: SMALL, LIGHTWEIGHT SPEED/DISTANCE SENSOR FOR SKIERS/SNOWBOARDERS

Performance analysis devices are ubiquitous tools in modern athletics. Such devices have seen little exposure in snow sports, particularly skiing and snowboarding. The objective of our project is to design and prototype a speedometer for skiers, using Doppler speed detection. This is the third iteration of the device at MSU, sponsored by the Air Force Research Laboratory.

Our goal was to develop a device that has the same utility as a pedometer, but with safety and energy saving features for our unique application. The device must measure the instantaneous velocity of a user and record velocities for a given run. At the end of a session the user must be able to access maximum and average velocity data for each one minute interval of the run as well as the total distance travelled. Temperature and power considerations for this project are crucial; the device should operate at a minimum of -10°F with 2 hours of battery life (while recording). The speedometer must also be capable of data transfer to an external device for performance analysis.

For the fastest turnaround time of a prototype the design team chose to purchase a prefabricated Doppler module and design interface circuitry to convert the frequency shift from the module output into a DC voltage level to be read by the microcontroller. The user interface was designed for ease of use and comprehensible data interpretation. Our design must save power by turning off components at key times during operation, allowing for longer battery life.

<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group05>



K. Verma
Electrical Eng



J.W.T. Erskine
Electrical Eng



T. Ross
Computer Eng



T. Cage
Electrical Eng



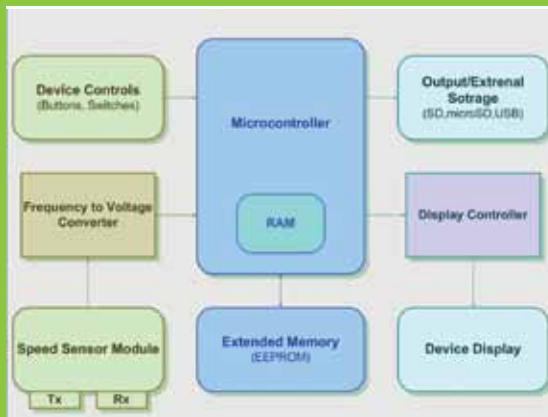
B.P. Guild
Computer Eng



Dr. Schneider



Prof. Balasubramanium



Project Sponsor
Air Force Research Laboratory

Sponsor Representative
Dr. Stephen W. Schneider

Faculty Facilitator
Dr. Shanker Balasubramanium

Team Members & Non-Technical Roles

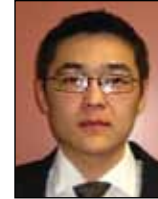
- | | |
|--------------------------------|-----------------------------------|
| Kunal Verma Manager | Temika Cage Presentation Prep |
| Justin Erskine Webmaster | Benjamin Guild Lab Coordinator |
| Tim Ross Documentation Prep | |

HYUNDAI KIA AMERICA TECHNICAL CENTER (HATCI): CAPACITIVE RAIN SENSOR FOR AUTOMATIC WIPER CONTROL

The incorporation of advanced technological features into automobiles has created an alarming number of distractions for drivers. One feature designed to ease the burden on vehicle operators is an automatic rain-sensing wiper system, which can turn on the car's wipers when rain is detected on the windshield. Current systems use an optical sensor, which has a small detection area and is prone to error. Our design team, sponsored by HATCI, is working to develop a more accurate and cost-effective sensor using capacitive-sensing technology. Our sensor will establish an electric field which will extend through the windshield and out of the glass a short distance. Objects with certain dielectric or conductive properties, such as rain, interfere with this electric field, changing the capacitance of the sensor. The capacitance of the sensor can be monitored using advanced circuitry and relayed to a microcontroller for processing. By characterizing the response to rain, we can program the microcontroller to turn the wipers on when a corresponding change in capacitance occurs.



D. Kang
Electrical Eng



A. Tazabekov
Electrical Eng



E. Otte
Electrical Eng



I. Sandhu
Computer Eng



A. Qaiser
Electrical Eng

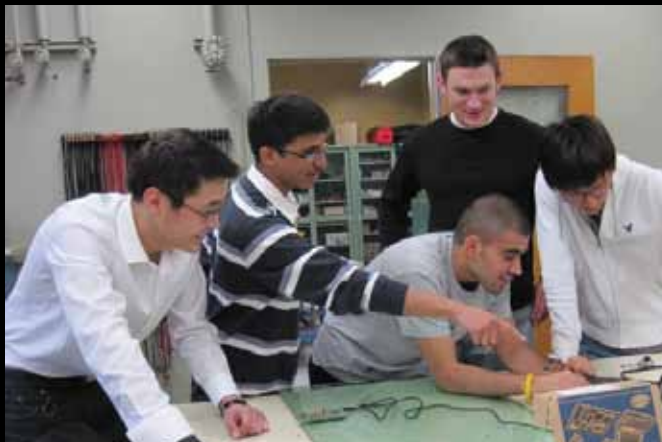
<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group06/>



Mr. Shtogrin



Dr. Deller



Project Sponsor
*Hyundai Kia America
Technical Center (HATCI)*

Sponsor Representative
Mr. Jeff Shtogrin

Faculty Facilitator
Dr. John Deller

Team Members & Non-Technical Roles
Danny (Dong-Ho) Kang
Manager

Anuar Tazabekov
Webmaster

Eric Otte
Documentation Prep

Ishaan Sandhu
Presentation Prep

Arslan Qaiser
Lab Coordinator

TEXAS INSTRUMENTS: ETHERNET INTEGRITY ANALYZER

Ethernet has become one of the most popular and widely deployed network technologies in the world. In today's increasingly complex internet and client-server environments, the need for Ethernet Analyzers is becoming more essential for network operation and maintenance. ECE 480 Design Team 7 will design and develop a handheld analyzer for Ethernet networks. Our Ethernet Integrity Analyzer (EIA) will automatically execute a diagnostic suite, and perform integrity checks when plugged into a standard RJ-45 Ethernet port. These tests include: Time Domain Reflectometry (TDR), Active Link Cable Diagnostic (ALCD), and Digital Spectrum Analyzer (DSA). These diagnostics will detect and locate faults such as, cable damage, water ingress, and manufacturing flaws.

The EIA will display the results of the tests by its onboard color touch-screen display and can optionally tag and store the results in a data log to be later uploaded to a host PC for off-line analysis. The EIA is powered from one of three sources: Power-over-Ethernet if detected on the link, a DC input supply or, if neither of the line sources are detected, batteries. This project will utilize a number of existing TI technologies and IC chips.

<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group07>



M. Jones
Computer Eng



S. Gur
Electrical Eng



A. Alsinan
Electrical Eng



B. Shulte
Electrical Eng



A. Christopherson
Computer Eng



Mr. Reinhart



Prof. Reinhard



Project Sponsor **Texas Instruments**

Andrew Christopherson
Webmaster

Sponsor Representative Mr. Jim Reinhart

Ahmed Alsinan
Documentation Prep

Faculty Facilitator

Dr. Donnie Reinhard

Brian Schulte
Presentation Prep

Sedat Gur
Lab Coordinator

Team Members & Non-Technical Roles

Mark Jones
Manager



TRIPLE CROWN SERVICES: ROADRAILER AIR BRAKE FAULT LOCATOR

Team 8, sponsored by Triple Crown Services, is designing a system in which pressure transmitters are to be integrated into the air brake system of the Roadrailer trailer cars at regular intervals along the train.

The Triple Crown RoadRailer is a Bimodal Transportation system. RoadRailer Trailers arrive at the rail terminal like any other semi-truck. A trailer is backed up onto the railway tracks and disconnected from the highway tractor. Once in place, the trailer bed is coupled to a rail bogie and the road tires lifted clear. Then the process is repeated for each trailer. Once the train is assembled, the brake lines are connected, then the air brakes are pressurized and tested. Any problems are difficult to localize on a train that may be up to 1.5 miles long.

Our transmitters, installed into the air brake line at intervals along the train, will send the pressure data to a gateway location. Team 8 has designed a sensor system to report air pressures from each instrumented bogie to a central location, at intervals while the brake line is being pressurized. The plan is to detect and localize flaws by comparing the pressure profiles along the train as the line is pressurized with a “baseline” set taken under similar conditions (temperature, etc.) when there are no flaws. This system will operate efficiently in harsh environments of all kinds. The transmitters work flawlessly in temperatures ranging from -20°F Michigan winters to 120°F Florida summers.



D. Benjamin
Electrical Eng



M. de Castro
Electrical Eng



A. Najm
Electrical Eng



S. Shrestha
Electrical Eng



T. Twigg
Electrical Eng



<http://www.egr.msu.edu/classes/ece480/goodman/spring10/group08/>



Mr. Theisen



Dr. Biswas



Project Sponsor
Triple Crown Services

Sponsor Representative
Mr. Mike Theisen

Faculty Facilitator
Dr. Subir Biswas

Team Members & Non-Technical Roles

Marcelo de Castro
Manager

Dilo Benjamin
Webmaster

Saurav Shrestha
Documentation Prep

Tia Twigg
Presentation Prep

Abdulaziz Najm
Lab Coordinator

Design Day Awards:

MICHIGAN STATE UNIVERSITY COLLEGE OF ENGINEERING

Electrical & Computer Engineering Prism VentureWorks Prize & Winners, Fall 2009

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.

First Place: Team #5 – Lowering Standby Power Consumption Via Proximity Detection (Sponsor: Whirlpool Corp.)



LEFT TO RIGHT:
Dr. Erik Goodman, Berna Saracoglu, Kevin Harrison,
Eric Hosey, Nathan Kelly, Leslie Hodges

Second Place: Team #3 – Power-Over-Ethernet For Wireless Home Automation (Sponsor: Texas Instruments)



LEFT TO RIGHT:
Dr. Erik Goodman, Hassan Abdullahi, Karthik Hemmanur,
Sasang Balachandran, David DeLuca

Third Place: Team #1 – Body Temperature Regulator Vest for Quadriplegic Patient (Sponsor: MSU RCPD)



LEFT TO RIGHT:
Dr. Erik Goodman, Muhammad Zaheer, Christa Pline,
Rachel Bouserhal, Merav Nahoom, Jarred Davis

Design Day Awards:

MICHIGAN STATE UNIVERSITY COLLEGE OF ENGINEERING

Professor's Choice Award and Winner, Fall 2009

The Professor's Choice Award (\$1,000 and a certificate) is given each semester by the faculty member teaching ECE 480, Senior Capstone Design, to the team judged to have done the most to achieve the objectives of the course and sponsor, particularly taking into account the varying levels of challenge of the projects assigned. Judging is based on reading of the teams' final reports, examination of their posters/prototypes, and communication with their faculty facilitators.

Team #2 – Low-Cost Electrochemical Sensor (Sponsor: AMSaC Research Group)



LEFT TO RIGHT:
Dr. Erik Goodman, Steven Zuraski, Nicholas Timpf, Brent Woodman,
Luke LaPointe, and Mark VanCamp

Electrical & Computer Engineering Capstone Poster Award & Winner, Fall 2009

Each team in ECE 480, Senior Capstone Design, exhibits a poster and the items they have built during the semester and answers questions, from 8:00am-noon in the Union Ballroom. Judging of the best poster/demo is done by the groups of high school students participating in Design Days, based on their appeal and effectiveness in communicating the project goals and achievements. A prize of \$1000 is awarded to the most outstanding team.

Team #5 – Lowering Standby Power Consumption Via Proximity Detection (Sponsor: Whirlpool Corp.)

LEFT TO RIGHT:
Dr. Erik Goodman, Berna Saracoglu, Kevin Harrison, Eric Hosey, Nathan Kelly, Leslie Hodges



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.



aeemsu.com

audio **AEE** enthusiasts and engineers

Design Day:
April 30, 2010
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.

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
Ann L. McCormick, Newomb, Anderson, McCormick Energy Engineering and Consulting
Asif Nasar, The Boeing Company
Clark J. Radcliffe, Department of Mechanical Engineering, Michigan State University
Brian Santhany, Dow
Jim Wilde, Beijing West Industries Co. Ltd.

Beijing West Industries Co. Ltd.



The Design Program would also like to thank Shell Oil for its continued generous financial support.



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 The Appropriate Technology Collaborative, Dow Chemical (Dow Water and Process Solutions), General Motors Company, Heartwood School, Louis Padnos Iron & Metal Company, MidMichigan Medical Center, Motorola, Motorola Foundation, MSU Department of Mechanical Engineering, Shell Oil Company, Two Fourteen, LLC, Whirlpool Corporation, and Woodcreek Elementary School.

ME Projects

Mechanical Engineering Projects Introduction & Thanks

**Shell is a proud
sponsor of MSU's
Senior Design Program.**

**Congratulations
Seniors!**

With the wind behind you and open space ahead, there's no limit to the possible directions your career could take. And at Shell, we'll support you all the way.

Our approach is collaborative – matching our business needs with your training needs, our global opportunities with your career aspirations. We aim to build a win-win partnership between you and Shell.

Right from the start, you'll be making a valuable contribution to exciting projects. Your ideas will be taken on board, your talent recognized and achievements rewarded.

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Explore it

There's a wider world
out there



Achieving more together



Design Day Awards:

MICHIGAN STATE COLLEGE OF ENGINEERING

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.



l-r: Professor Somerton, Ryan Smith, Matthew Owens, Timothy Aspinall, Michael Hines

FALL 2009 ME 481 EDISON UNDERGRADUATE DESIGN AWARDS

First Place

Motorola: Mobile Device with a Flexible Display
Timothy Aspinall
Michael Hines
Matthew Owens
Ryan Smith

Second Place

A Shell Oil Company Children's Humanitarian Project: Bus Step Simulator for Heartwood School
Michael Karoub
Joshua Samp
Thomas Theisen
Ryan Wood

Third Place

The Motorola Foundation Youth in Energy and Environment Humanitarian Project: Biomass Demonstrator for Woodcreek Elementary School
Paul Allen
Amber Beebe
Amy Bittinger
Caitlin Hojnacki
Raghav Nanda

ME 481 Oral Presentation Award

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



l-r: Professor Somerton, Ryan Wood, Thomas Theisen, Michael Karoub, Joshua Samp

FALL 2009 ME 481 ORAL PRESENTATION AWARDS

First Place

A Shell Oil Company Children's Humanitarian Project: Bus Step Simulator for Heartwood School
Michael Karoub
Joshua Samp
Thomas Theisen
Ryan Wood

Second Place

Sparrow Pediatric Rehabilitation Center: Pediatric Exercise Equipment
Christopher Cater
Kunjan Patel
Kelly Peterson
Eva Reiter

Third Place

General Motors Company: Upper Reveal Molding and Appliqué System for Applied Door Window Frame Construction
Matthew Burdick
Kaitlin Donoughe
Benjamin Llewellyn
Eric Vine

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.



l-r: Professor Somerton, Kunjan Patel, Eva Reiter, Christopher Cater, Kelly Peterson

FALL 2009 ME 481 POSTER PRESENTATION AWARD

First Place

Sparrow Pediatric Rehabilitation Center: Pediatric Exercise Equipment
Christopher Cater
Kunjan Patel
Kelly Peterson
Eva Reiter

Second Place

A Shell Oil Company Children's Humanitarian Project: Bus Step Simulator for Heartwood School
Michael Karoub
Joshua Samp
Thomas Theisen
Ryan Wood

Third Place

The Motorola Foundation Youth in Energy and Environment Humanitarian Project: Biomass Demonstrator for Woodcreek Elementary School
Paul Allen, Amber Beebe, Amy Bittinger, Caitlin Hojnacki and Raghav Nanda

General Motors Company: Re-design of the Cadillac SRX Tail Lamp Locating Strategy for Variation
Eric McElmurry, Matthew Perelli, John Stukel and Samuel Tkac

Design Day Awards:

MICHIGAN STATE COLLEGE OF ENGINEERING

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: Dr. Kiefer, Alexandre Oliveira, Thomas Michalik, Hasib Mohammed,



l-r: Dr. Kiefer, Oliver Zemanek, Jessica Warda, Michael McPhail, Eric Ford

FALL 2009 ME 471 MECHANICAL DESIGN AWARD

First Place

Neil Jessel
Thomas Michalik
Hasib Mohammed
Alexandre Oliveira

Second Place

Eric Ford
Michael McPhail
Jessica Warda
Oliver Zemanek

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.



l-r: Dr. Genik, Matthew Burdick

FALL 2009 ME 412 HEAT TRANSFER DESIGN AWARD

First Overall

Matthew Burdick
Kaitlin Donoughe
Benjamin Llewellyn

Second Overall

Alexandre Oliveira
Fernando Oliveira
Andrew Tonkovich

Most Creative

Ryan Lindeman
Michael McPhail
Hengye Zhang

ME 371 Mechanical Design I Kids' Choice Award

The pre-college 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.



l-r: Charles McGovern, Brandon Gray, Saad Khan, Jeongseop Lee

FALL 2009 ME 371 KIDS' CHOICE AWARD

First Place

Brandon Gray
Saad Khan
Jeongseop Lee
Charles McGovern

Second Place

Hassan Alzayer
Peter Anthony
John Schiefer
Robert Wooten



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

INSTRUCTOR: Professor Brian Thompson

PROBLEM STATEMENT

Teams of students were required to design and manufacture mechanisms that would thrill an audience of pre-collegiate students. 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

Team 1

Michael Fetter
Brian Gilkey
Michael Thoel
Stephanie Vasi

Team 2

Abdus Agha
Dustin Colthorp
Kevin Compau
Adam Rainbolt

Team 3

Dane Marsack
Peter Petersen
Lindsay Smith
Zachariah Sprinkle

Team 4

Adithya Kosgi
Fernando Vasquezdheming
Sara Wiederoder
Michael Wong

Team 5

Owen Carpenter
Brent Ewald
Justin Freeman
Kevin Hanley

Team 6

Kyle Anderson
Daniel Maniscalco
Adam Nellingen
Blake Wilmore

Team 7

Zachary Kadykowski
Rachel Maurer
Joshua Ringbloom
Ashley Swartz

Team 8

Evan Koleda
Michael Olsztyn
Chad Payne
Joshua Whitman

Team 9

Joseph Bickham
Taylor Darling
Sachin Golhar
Nicholas Mimikos

Team 10

Andrew Binell
Jarreau Jackson
Allison Ridder
Matthew Wolfe

Team 11

John Chancey
Kyle Kocarek
David Marsh
Justin Raymond –
Krochmal

Team 12

Hillary Gregory
Brian Jansen
Scott Shaw
Cory Waltz

Team 13

Michael Conboy
Kylar Dailey
Christopher Lutz
Andrew Starck

Team 14

Andre Chanyawatanakul
Ryan Lureau
Jordon Smart
Brian Walega

Team 15

Alexander Danaj
Michael O'Brien
Nicholas Righetti
Sarah Stoner

Team 16

Ian Forney
Jason Lyman
Kyle Urban
Jeffrey Vanandel



ME 412

9:00 – 11:15
Second Floor
Ballroom



DESIGN OF A HOT AIR GUN BOILER

INSTRUCTOR: Dr. Laura J. Genik

TA Staff: Chad Glinsky, Paul Strefling and Daniel Swain

PROBLEM STATEMENT

How much water can be boiled in 8 minutes with just hot air? That is the burning question for which the ME 412 Heat Transfer Laboratory class is designing answers. The project team, consisting of three students, is to design, analyze, build, and test a boiler fueled by an air flow heat gun. A 400 ml beaker must fit inside or on top of the device and the objective is to deliver energy to the water in the beaker with the air gun a minimum of 6 inches away from the beaker. The device will be judged on the basis of the energy delivered to a beaker of water, the mass of the device, and its cost. The device as assembled must fit inside a cardboard box of dimension 14" x 14" x 12".

| TIME | STATION | DESIGN TEAM |
|----------|---------|---|
| 9:00 am | A | Joao Paulo Goncalves, Justin Meeder, Eric Tauzer |
| 9:00 am | B | Kyle Bateman, Brian Rockwell, Oliver Zemanek |
| 9:15 am | A | Amy Jo Gizicki, Ashley Kulczycki, Jessica Warda |
| 9:15 am | B | Ryan Emmorey, James Peers, Brandon Uhl |
| 9:30 am | A | Daniel Goettlicher, Ryan Rosenburg, Eric Waggy |
| 9:30 am | B | Andrew Cawood, Kyungmin Lee, Mitchell Lee |
| 9:45 am | A | Ankit Aggarwal, Thomas Qualman, Cody Wagner |
| 10:00 am | A | Drew Darling, Kenneth Eschbach, Admir Trnjanin |
| 10:00 am | B | Clarence Huff, Keith Solomon, Eric Wickenheiser |
| 10:15 am | A | Eric Ford, Jacob Sprague, Brian Warner |
| 10:15 am | B | Ricardo De Majo, Mirsena Lekovic, James Yizze |
| 10:30 am | A | Lucas Fratta, Matthew Pung, Diana Toan |
| 10:30 am | B | Adrienne Burger, Marshall Mendoza, Jeremy Zalud |
| 10:45 am | A | Charles Baird, Dae Keun Chun, Joseph Marotta |
| 10:45 am | B | Devesh Chaphalkar, Neil Ferguson, Daniel Rabideau |
| 11:00 am | A | Christopher Fairbanks, David Schrock, Matthew Weir |
| 11:00 am | B | Muamer Abdurahmanovic, Nicholas Schock, Kyle Scicluna |



MECHANICAL DESIGN II VERTICAL LIFT DESIGN

INSTRUCTOR: Scott Kiefer

TA Staff: Oishik Sen

PROBLEM STATEMENT

Students in ME 471 were challenged to design and build a prototype apparatus for a vertical lift. The lift is representative of a device that could be used to lift people for tasks like changing lightbulbs in a gymnasium. Because of the limitations of testing on Design Day, testing will be done on a small scale model. Specifically, the students will be required to move a 100 Newton weight a vertical distance of 75 cm. Students have been required to complete a design analysis before construction so their device should safely lift the 100 Newton mass, but will become nonfunctional when loaded with 200 Newtons. Contest scoring will depend on device functionality with 100 Newton weight, how close the device failure is to 200 Newtons, the total weight of the lift, and the aesthetics of the device.

Mechanical Design II

| TIME | GROUP MEMBERS |
|-------|--|
| 9:00 | Tao Han, Andrew Nolan, Manila Ounsombath, Amar Shah |
| 9:09 | Michelle Flachs, Katelin Friederichs, Nick Huehl, Steven Soave |
| 9:18 | Trevor Betz, Nick Dallapiazza, Joengseop Lee, Charlie McGovern |
| 9:27 | Andrew Gallihugh, Motozo Horikawa, Andrew Kappler, Alexander Suradja, Nick Zhu |
| 9:36 | Darren Fung, Courtney MacDonald, Curt Mumaw, Dan Tepe |
| 9:45 | Alex Douglass, Jon Petersen, John Schultz, Erik Sundberg |
| 9:54 | Jeff Holley, Brian Smith, Joe Wesorick, Corrie Zitkus |
| 10:03 | Andrew Chiesa, Mike Magner, Chris Rawsky, Perrin VanderVeen |
| 10:12 | Benjamin Cherwinski, Harold Hill, Manpreet Singh, Justin Ward |
| 10:21 | Brendan Ayer, Kenneth Eschbach, Andrew Harbin, Andrew Vanderklok |
| 10:30 | Rachel Jacquin, Evan Racine, Caroline Skuta, Peter Strom |
| 10:39 | David Goshgarian, Garrett Kerns, Andy Ross, Joseph Rotellini |
| 10:48 | Adam Blumerich, Nate Geib, Mark Goldy, Ross Loynes |
| 10:57 | Alex Hsieh, Jack Johnson, Ahmed Mohamed, Ben Nutsch, Peter Redente |

ME 481

8:00 – 12:30
Third Floor
Lake Superior Room
and Fourth Floor
Tower Room



Prof. Somerton

MECHANICAL ENGINEERING PROJECTS

PRESENTATION SCHEDULE — Lake Superior and Tower Rooms

Course Coordinator: Professor Craig W. Somerton

Faculty Advisors: Professors Averill, Bailiff, Chalou, Jaber, Kwon, Liu, Loos, Naguib, Patterson, Pourboghlat, Priezjev, Somerton, Thompson, Wichman

Lake Superior Room

| Time | Project Sponsor(s) | Professional Advisor(s) | Faculty Advisor (s) | Project Title |
|------------------|---|-------------------------------------|-------------------------|---|
| 8:00 | Dow Chemical (Dow Water and Process Solutions) | A. Alderman K. Peacock | N. Priezjev | Brine Seal Application for Reverse Osmosis Elements |
| 8:25 | Two Fourteen, LLC | D. Kelly J. Kelly | R. Averill | Motorcycle Oil Change Adapter |
| 8:50 | Shell Oil Company Heartwood School | M. O'Brien | B. Thompson | Mobile Sit to Stand Transfer Device for Heartwood School |
| 9:15 | General Motors MidMichigan Medical Center | P. Essex | R. Bailiff R. Chalou | Steering Design of the Push Pull Recumbent Cycle |
| 9:40–10:00 Break | | | | |
| 10:00 | Motorola | J. Wojack | E. Patterson | Mobile Device with a Removable Stereo Wireless Headset |
| 10:25 | Whirlpool Corporation | K. Delgado J. Fountain | I. Wichman | Controlled Rotation Spray System for the Middle Arm of a Dishwasher |
| 10:50 | Whirlpool Corporation | K. Beber A. Ruhno | P. Kwon | Food Processor: Adjustable Blade Assembly |
| 11:15 | Whirlpool Corporation | A. Litch J. McIver G. Wu | C. Somerton | Thermal Storage System Design for a Refrigerator |
| 11:40 | Motorola Foundation Woodcreek Elementary School | D. Graham T. Ojerio J. Isham | C. Somerton | Geothermal Energy Demonstrator |
| 12:05 | The Appropriate Technology Collaborative | J. Barrie A. Hanson P. Tobias | C. Somerton | A Battery for Solar Energy in the Developing World |

Tower Room

| | | | | |
|------|--|--------------------------------------|----------------|--|
| 8:00 | MSU Department of Mechanical Engineering | B. Feeny | D. Liu | A Miniature Test Rig for Measuring Wind Power |
| 8:25 | MSU Department of Mechanical Engineering | F. Pourboghlat | F. Jaber | Design and Manufacturing of the Main Structure of a Modular Small Wind Turbine System and Its Blades |
| 8:50 | MSU Department of Mechanical Engineering | F. Jaber | F. Pourboghlat | Design and Manufacturing of a Continuous Transmission Variable System for Variable Wind Conditions |
| 9:15 | Louis Padnos Iron & Metal Co. | M. Przekadzinski C. Schrottenboer | A. Loos | Manufacturing Design of Product Diverter |
| 9:40 | Louis Padnos Iron & Metal Co. | C. Schrottenboer | A. Naguib | Sensor Bar Alignment |

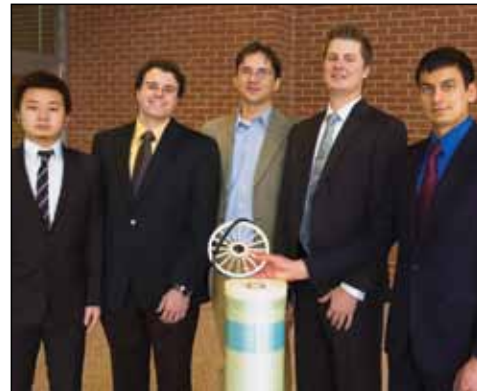
DOW CHEMICAL (DOW WATER AND PROCESS SOLUTIONS): BRINE SEAL APPLICATION FOR REVERSE OSMOSIS ELEMENTS

Dow Water and Process Solutions(DW&PS) leads the market in producing reverse osmosis membrane elements for water and fluid processing. A subsidiary of The Dow Chemical Company formerly known as FilmTec Corporation and founded in 1981, DW&PS is located in Edina, Minnesota, 15 minutes away from the heart of Minneapolis. To uphold Dow’s promise to improve consideration of the human element, DW&PS produces filters to serve a wide variety of industrial, municipal, commercial, and home drinking water applications.

Product quality is essential and cannot be achieved without an efficient and healthy workforce; Dow holds safety as a top priority. A key aspect of the eight-inch FILMTEC™ reverse osmosis (RO) membrane element, a popular Dow product, is the strategic placement of brine seals to force the stream water through the membrane and prevent leaks. Currently, application of this seal is conducted with improper hand tools and has ergonomic and safety hazards, such as a risk of repetitive motion injuries to the wrist.

In order to abide by Dow’s safety standards, the MSU design team has been challenged to develop an automated or semi-automated tool to assist operators with the application of the brine seal without the creation of new safety and ergonomic hazards. The tool should provide a benefit to the user and improve the current working conditions. At the end of the project, the tool will be integrated into DW&PS’ manufacturing process; it has the ability to impact all of Dow’s industrial reverse osmosis product lines by creating a safer work environment.

...The Dow Water and Process Solutions (DW&PS) Student Design Team



Water
& Process
Solutions



Mr. Alderman



Ms. Peacock



Prof. Priezjev

Safety is a critical value at Dow Chemical and sustaining a safe manufacturing environment is our first priority. This project scope impacts all production of Dow’s industrial and municipal reverse osmosis product lines, creating a safer work environment. Significant business benefit from the project is derived through improved safety, in addition to potential labor cost savings.

Timothy Cox
Production Leader
FilmTec Fabrication Operations
Dow Water & Process Solutions

Project Sponsor

Dow Water and Process Solutions
Edina, Minnesota

Professional Advisors

Mr. Adam Alderman
Ms. Kayla Peacock

Faculty Advisor

Prof. Nikolai Priezjev

Team Members and Home Towns

Dev Chaphalkar
Lansing, Michigan

Lucas Fratta
Marshall, Michigan

Nicholas Odell
Okemos, Michigan

Hengye Zhang
Chengdu, China

AN ENTREPRENEURIAL PROJECT FOR TWO FOURTEEN, LLC: MOTORCYCLE OIL CHANGE ADAPTER

One of the main frustrations that motorcycle enthusiasts have with owning motorcycles is the inefficient and costly oil and filter changing process. If owners are not able to change the oil themselves, they must take their bikes to a motorcycle dealership or specialty shop. These shops require an appointment to be made and the bike to be left at the shop for hours or days. Additionally, the process is expensive compared to changing the oil in cars and trucks where a typical oil change costs between \$80 and \$120.

After experiencing this process numerous times, avid motorcycle riders and working professionals Jim and Denise Kelly began thinking of alternative ways to get their motorcycles' oil and filter changed. The simplest solution was to create a way for quick lube and oil change-plus facilities to service motorcycles. With this idea in mind, the Kellys formed their company, Two Fourteen, LLC, filed for a patent, and began to research ways to design and build their product. This ME 481 design team developed a refined prototype of this new system.

The team has built an adapter that allows quick oil change stations to service motorcycles over a pit or on a hoist. The design will have a minimal impact on the daily operation of the service stations' business and operating procedures. It is simple to operate and easy to maneuver in and out of its operating position. The device has an appropriate factor of safety to prevent injury to the customer or damage to the motorcycle under the most extreme possible loading conditions. Finite element analysis and computer aided optimization were used to ensure that the device meets safety standards while minimizing its weight for ease of maneuverability.



TWO FOURTEEN, LLC
Innovation Inspired by Life

... *Two Fourteen, LLC Student Design Team*



Ms. Kelly



Mr. Kelly

The motorcycle oil change adapter is an innovative new product that will take the fast lube and oil change-plus industry into a whole new dimension of customer service. It has the potential to generate substantial revenue growth to the fast lube and oil change-plus industry as well as the manufacturing sector. Motorcycle owners can now enjoy the convenience and competitive pricing for an oil change that automobile and truck owners have experienced for years.

Jim and Denise Kelly
Two Fourteen, LLC

Project Sponsor
Two Fourteen, LLC
Macomb, Michigan

**Professional
Advisors**
Mr. Jim Kelly
Ms. Denise Kelly

Faculty Advisor
Prof. Ron Averill

**Team Members
and Home Towns**
Mohanad Bahshwan,
Riyadh, Saudi Arabia

Brandon Kelly,
Troy, Michigan

Benjamin Lindstrom,
Lansing, Michigan

Jeremy Zalud
Mt. Pleasant, Michigan



Prof. Averill

A SHELL OIL COMPANY CHILDREN'S HUMANITARIAN PROJECT: MOBILE SIT-TO-STAND TRANSFER DEVICE FOR HEARTWOOD SCHOOL

Hearthwood School is an educational institution that has a student population between the ages of two and twenty-six with serious physical and cognitive disabilities. Heartwood utilizes the MOVE (Mobility Opportunities Via Education) international curriculum. The objective is to improve functional mobility skills that enable individuals with severe disabilities to better direct their lives by improving motor skills.

At Heartwood School it is necessary to transfer students throughout the day into a variety of positions including those that allow access to therapeutic equipment as required by the MOVE curriculum. A serious obstacle for the students in this endeavor is their inability to easily transition from a seated position to a standing position and bear weight on their lower extremities during such a transfer.

This project addressed the problem. The goal was to design, build, and test a mobile sit-to-stand device for Heartwood School. The purpose of the mobile sit-to-stand device is to help the staff increase the independence and skill level of each student to his or her greatest potential consistent with the mission of the school. The use of the device is intended to be a therapeutic tool in addition to assisting the students in transitioning from a seated to a standing position. The device presents an element of safety and support during the transfer while also providing the student with positive feedback during the process as a motivational incentive. The feedback incorporates both visual and auditory stimulation when the student actively engages the device.

...The Heartwood School Student Design Team



Ms. O'Brien



Prof. Thompson

This project will enhance the educational day of the physically impaired students at Heartwood School and incorporate the philosophy of the Move curriculum. Increased abilities to actively engage in the transfer process will decrease the dependency on families and other care providers, potentially prevent staff and family injuries and improve our students' skills in this area. These increased abilities also bring new opportunities for fuller participation and involvement in family and school life. The ability to improve transfer skills will increase independence, dignity and self esteem for the physically impaired students at Heartwood School.

Marcia O'Brien
Principal
Heartwood School

Project Sponsors

Heartwood School
Mason, Michigan

Shell Oil Company
Houston, Texas

Professional Advisor

Ms. Marcia O'Brien

Faculty Advisor

Prof. Brian Thompson

Team Members and Home Towns

Ricardo de Majo
Ann Arbor, Michigan

Mirsena Lekovic
Troy, Michigan

Florian Pribadi
Jakarta, Indonesia

James Yizze
Shelby Twp., Michigan

A GENERAL MOTORS HUMANITARIAN PROJECT: STEERING DESIGN OF THE PUSH PULL RECUMBENT CYCLE FOR MIDMICHIGAN MEDICAL CENTER

The MidMichigan Medical Center has been recognized as a leader in providing state-of-the-art healthcare, specializing in cancer, orthopedics, cardiovascular service, neuroscience, cosmetic surgery, diabetes, maternity, rehabilitation, and wellness. The number of advanced technologies achieved by MidMichigan Medical Center is enormous. Deep brain stimulation, gamma knife perfusion, and SPY imaging system are a few of the technologies that make them such a renowned medical center.

Currently, the rehabilitation center in the MidMichigan Medical Center uses a Nu-step exercise bike for cardiovascular activity. This bike uses motion from both arms and legs simultaneously to strengthen patients' muscles and build their endurance.

The exercise machine used now is very effective for the physical rehabilitation of the patients. Our project will give the patients the same experience but allow them to comfortably exercise arms and legs while riding around outside or inside the hospital instead of remaining stationary. The recumbent cycle will make therapy more enjoyable and exciting. Our team would like to apply many of the same designs and elements found in the Nu-Step machine toward the formation of our recumbent cycle.

Throughout the design of our product, it was especially important to keep in mind the needs of the patients, while remaining cost efficient, durable, and safe. This was done by applying an electric steering system, safety mechanisms, and adjustable seat/handles to the design. Initially, the project goal was strictly to improve the steering system; but upon examination, we concluded that additional renovations were required to deliver an acceptable product. Using extensive research and analysis from the knowledge gained through the MSU College of Engineering Department, we were able to produce a recumbent cycle that exhibited these features.

.....MidMichigan Medical Center Student Design Team



Mr. Chalou



Ms. Essex



Mr. Butlin

NuStep's rehabilitation bicycle is currently one of the most beneficial devices for treating patients. The design of the recumbent cycle gives another tool for motivation and exercising. The cycle's movement is great for exercising, in that it simultaneously works the arms and legs. The designed recumbent cycle provides patients with the opportunity to become mobile indoors and outdoors. The overall design of the cycle will provide the next step for inspiring patients to get healthy.

Ms. Peggy Essex
MidMichigan Medical Center

Project Sponsors
MidMichigan Medical Center
Midland, Michigan

General Motors
Warren, MI

Professional Advisors
Mr. Albert Butlin, Jr.
Ms. Peggy Essex

Faculty Advisor
Mr. Robert Chalou

Team Members and Home Towns
Drew Darling
Jeddo, Michigan

Spiros Kakos
Farmington Hills,
Michigan

Marshall Mendoza
Lansing, Michigan

Eric Wickenheiser
Monroe, Michigan

MOTOROLA: MOBILE DEVICE WITH A REMOVABLE STEREO WIRELESS HEADSET

Motorola has been a leading developer in communications technology for people, business, and governments since 1928. Motorola has met the demand for greater convergence in communication technologies through their history of excellence in innovation. Motorola's focus on new mobile devices includes maximizing functionality and ease of use through truly new and unique developments.

Multimedia applications such as music, games, internet, and video have all become common functions of mobile devices. The task presented was to design and demonstrate an all-in-one stereo sound hands-free solution for managing such media with a mobile device. To accomplish this, a Bluetooth stereo headset, which integrates seamlessly with a mobile phone, was proposed. Currently, no product exists that solves this problem.

The difficulty of such a proposal is in trying to balance every design decision's impact on the end product. Factors such as size and ease of use or functionality and innovation may directly conflict for a wide variety of concepts. Balancing these factors and developing a product that makes the user wonder why it did not already exist is the best measure of success. With few design restrictions in place the challenge was to find a direction worth pursuing; minimizing size and weight without sacrificing ease of use was paramount.



A specified set of design parameters was developed and adhered to such that the needs of Motorola and its customers were met. Surveys were then conducted to analyze market demographics and validate those design parameters. Prototypes were modeled using computer assisted design, manufactured through stereo lithography techniques, and critically analyzed for refinement. This was repeated multiple times to deliver a final conceptual product.

...The Motorola Student Design Team



Mr. Wojack

The development of projects aligns with Motorola's ambition to develop compelling mobile devices that allow consumers to be more productive. The goal of these projects will be to create a new paradigm for a mobile phone experience.

Jason Wojack
Motorola Mobile Devices



Prof. Patterson

Project Sponsor

Motorola
Libertyville, Illinois

Professional Advisor

Mr. Jason Wojack

Faculty Advisor

Prof. Eann Patterson

Team Members and Home Towns

Alexander Dupay
Holland, Michigan

Christopher Fairbanks
Livonia, Michigan

Kyungmin Lee
Seoul, South Korea

James Peers
Clarkston, Michigan

WHIRLPOOL CORPORATION: CONTROLLED ROTATION SPRAY SYSTEM FOR THE MIDDLE ARM OF A DISHWASHER

Whirlpool Corporation is a leader of the global home appliance industry whose appliances are marketed in nearly every country around the world. It manufactures appliances across all major categories, including fabric care, cooking, refrigeration, dishwashers, countertop appliances, garage organization, and water filtration. It markets some of the world's most recognized appliance brands, including Whirlpool, Maytag, KitchenAid, Jenn-Air, Amana, Bauknecht, Brastemp, and Consul. Its global and North American headquarters are located in Benton Harbor, Michigan.

Traditionally, the middle arm of a Whirlpool dishwasher is powered by the pressure and flow of water spraying out of the nozzles of the spray arm. However, pressure loss and cleaning inefficiencies result from the uncontrolled spray generated from that design. The goal of this project is to develop a device to mechanically control the middle arm of a dishwasher for better cleaning. The new design must be able to change the speed of rotation on the fly and rotate in both directions: clockwise and counterclockwise. This control of speed and direction should translate to better cleaning in the dishwasher, more efficient spray systems, reduced cycle time, as well as allowing new spray system features.

The most difficult elements of this project include finding a method to transfer power to the middle spray arm, making the system work in unison with the adjustable upper baskets that can move up and down, and designing a system with a negligible impact on capacity. Finally, the group could not exceed a budget of \$1000 in project costs. Throughout the semester the team organized, developed, and analyzed the optimal design to maximize the efficiency of water consumption during the average cycle of a Whirlpool dishwasher. The design will be manufactured and implemented into future Whirlpool designs.



...The Whirlpool Corporation Student Design Team



Mr. Fountain



Mr. Delgado



Prof. Wichman

Whirlpool is the world's number one home appliance manufacturer. Dishwashers are a key appliance for Whirlpool's business. The goal of the project is to develop a system to control the speed and direction of the middle spray arm of a dishwasher. This speed and direction control will translate to better cleaning in the dishwasher, more efficient spray systems, and reduced cycle time. These benefits will lead to improved customer satisfaction and allow Whirlpool to continue to grow its business.

Mr. Kris Delgado
Technology Advantage Lead

Project Sponsor
Whirlpool Corporation
Benton Harbor, Michigan

Professional Advisors
Mr. Kris Delgado
Mr. Jordan Fountain

Faculty Advisor
Prof. Indrek Wichman

Team Members and Home Towns
Derek Baker
Grand Blanc, Michigan

Tyler Curtis
East Lansing, Michigan

Thomas Michalik
Rochester Hills, Michigan

Kyle Scicluna
Brighton, Michigan

WHIRLPOOL CORPORATION: ADJUSTABLE BLADE ASSEMBLY

Whirlpool Corporation is the world's leading manufacturer and marketer of major home appliances. With the acquisition of KitchenAid® in 1986, Whirlpool expanded the selection of its home appliances even further.

The next generation of food processors in the market utilizes an adjustable slicing blade design, allowing for different slice thicknesses with only one blade assembly. KitchenAid® does not currently utilize the adjustable blade assembly concept, as multiple blades are used to achieve different slice thicknesses with higher performance ratings. However, due to a commitment to innovation, KitchenAid® wants to improve its current product to meet market needs while still maintaining a high level of performance and quality.

Current KitchenAid® food processors come standard with 2 slicing blade assemblies, a 2 mm and a 4 mm blade cut. In order for the consumer to achieve different thicknesses, additional blade assemblies must be purchased from the manufacturer.

The design team was assigned to develop an adjustable slicing blade assembly that would be compatible with the current KitchenAid® food processor. The final design should eliminate the need for extra blade assemblies by allowing the customer to manually adjust one blade assembly to the desired height. This next generation of food processors will allow KitchenAid® to have a more competitive product by reducing cost and increasing customer satisfaction.



Alternative ways of adjusting the height of the blade assembly were discussed in order to design a prototype. Computer Aided Drawings and Finite Element Analysis were conducted to optimize the chosen design. The prototype was then built by Whirlpool's prototyping lab and was then tested to ensure that performance, quality, and safety targets were met.

...The Whirlpool Corporation Student Design Team



Ms. Ruhno



Mr. Beber



Prof. Kwon

KitchenAid®, a division of Whirlpool, is known as the premium brand in small appliances. The Michigan State Adjustable Blade project will augment Whirlpool's advanced technology portfolio for the KitchenAid® Food Processor category. The students' concept design may be utilized in Next Generation KitchenAid® Food Processor platform. The project goal is to provide a performance and quality level above our current competition in the marketplace and to set the KitchenAid® brand apart while achieving Best In Class rankings.

-- Kevin J. Beber
Whirlpool Home Appliances

Project Sponsors
KitchenAid®
Whirlpool Corp.
Benton Harbor, Michigan

Professional Advisors
Mr. Kevin Beber
Ms. Amanda Ruhno

Faculty Advisor
Prof. Patrick Kwon

Team Members and Home Towns
Joao Paulo Goncalves,
Sao Paulo, Brazil

Alexandre Oliveira
Salvador, Brazil

Fernando Oliveira
Salvador, Brazil

Eric Tauzer,
Charlevoix, Michigan

WHIRLPOOL CORPORATION: THERMAL STORAGE SYSTEM DESIGN FOR A REFRIGERATOR

Whirlpool Corporation is a global manufacturer of home appliances and a leading proponent for green engineering. Whirlpool Corporation is currently developing a product line to integrate the consumer with the national “smart-grid.” These “smart-appliances” modify their behavior to suit variable electrical rates by better managing energy use during high-demand periods. The smart-appliance will receive information from the smart-grid and will optimize its energy usage accordingly.

This shift in power usage may cause problems for appliances such as refrigeration units that require steady operating temperatures. Offsetting the times in which the energy is drawn for cooling may cause harm to the food products within the unit due to thermal leakage through the insulation and regular opening of the refrigerator door. This creates a need to store energy during off-peak times for use during periods with high energy costs. One solution is to implement phase change materials (PCMs) into current refrigeration designs.

PCMs can be used to store and release energy when the material changes phases; these materials have the ability to absorb and release large amounts of heat at a steady temperature. The PCMs will store the cooling energy generated by the refrigeration unit during off-peak periods and then release this energy during high demand periods.



...The Whirlpool Corporation Student Design Team



Mr. Litch



Mr. McIver

This project will positively influence Whirlpool Corporation by accelerating the company’s initiative to commercialize demand responsive appliances able to receive and respond to signals from the Smart Grid and modify their energy consumption. Smart Grid enabled appliances could potentially save the customer money by reduced cost of electricity, which in turn will benefit Whirlpool through increased sales.

Mr. Andrew Litch
Whirlpool Corporation



Mr. Wu



Prof. Somerton

Project Sponsor

Whirlpool Corporation
Benton Harbor, Michigan

Professional Advisors

Mr. Andrew Litch
Mr. Justin McIver
Mr. Guolian Wu

Faculty Advisor

Prof. Craig Somerton

Team Members and Home Towns

Ankit Aggarwal
Nanyuki, Kenya/
Bloomfield Hills, Michigan

Andrew Cawood
Okemos, Michigan

Jenna Sandel
Shepherd, Michigan

Admir Trnjanin
Kozarac, Bosnia

THE MOTOROLA FOUNDATION YOUTH IN ENERGY AND ENVIRONMENT HUMANITARIAN PROJECT: GEOTHERMAL ENERGY DEMONSTRATOR FOR WOODCREEK ELEMENTARY

In recent years, The Motorola Foundation has strived to reach out and educate youth on topics such as environmental awareness and energy efficiency. This spring, The Motorola Foundation teamed with the MSU College of Engineering to develop this semester's Motorola Youth in Energy and Environment Humanitarian Project. Efforts were aimed towards educating the fifth graders of Lansing Public Schools' Woodcreek Elementary. The goal is to teach the basics of the engineering design method; the engineering profession; alternative energy; and, most specifically, geothermal energy.

In order to create interest in the students, the demonstrator's design was chosen with a fifth grader's interests and tendencies in mind. It was understood that the demonstrator had to be extremely visual and interactive, while at the same time, properly enclosed to ensure the safety of the students. In the end, the demonstrator will be a mainstay in the classroom for years to come.

Throughout the design and production of the geothermal demonstrator, a series of hands-on activities and presentations were given by the Woodcreek Team to the fifth grade students, engaging them in each step of the process. Those interactions were aimed at exciting the fifth graders about learning details on the design method, the engineering profession, alternative energy, and finally, geothermal energy.

...The Woodcreek Elementary Student Design Team



Ms. Graham



Ms. Ojerio



Mr. Isham



Prof. Somerton

The main focus of Woodcreek Math, Science and Engineering magnet Elementary School is to lay a foundation within our students for future interest in the career path of engineering. The Capstone Design Project accomplishes this by engaging the students in hands-on and informative presentations about alternative energy, specifically geothermal. Weekly, our fifth graders work side by side with MSU engineering students solving a real world environmental problem. Step by step the students see firsthand how engineers think and solve problems using the design process as they learn about geothermal energy. Utilizing the finished product, the Geothermal Demonstrator, will aid in educating staff, students and parents about alternative energy and the concept and use of geothermal energy.

Diane Graham, Engineering Teacher
Woodcreek Elementary School

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A HUMANITARIAN PROJECT FOR DEVELOPING COUNTRIES FOR THE APPROPRIATE TECHNOLOGY COLLABORATIVE: BATTERY FOR ALTERNATIVE ENERGY IN THE DEVELOPING WORLD

Many communities in the developing world do not have daily access to electricity. Providing renewable energy systems can have a large impact on the citizens of a developing country. A few extra hours of light each evening will provide time for income generating domestic work and allow children more time for school assignments.

The Appropriate Technology Collaborative (ATC) is a 501 (c)(3) not-for-profit organization whose mission is to design, develop, demonstrate and distribute appropriate technological solutions for meeting the basic human needs of low income people in the developing world. The designs created by the collaborative create jobs and provide affordable products that improve the quality of life in developing countries.

The Appropriate Technology Collaborative Student Team has been given the task of choosing/designing a household energy storage system. To do this the Student Team will design a battery and create a testing device to compare their design against commercially available batteries. The MSU battery will be designed specifically for use in low income countries. The battery will be charged by solar panels to provide power for household lighting and charging cell phone.

The team will document the cost, longevity, toxicity and local manufacturability of batteries surveyed. The final Student Team report will be distributed freely online to anyone who wishes to design a home scale energy storage system.

...The Appropriate Technology Collaborative Student Design Team



The Appropriate Technology Design Collaborative



Mr. Barrie



Mr. Tobias

Providing an affordable home energy system based on renewable energy is a proven way to reduce poverty and pollution while improving the quality of life for the world's poorest people. The MSU Battery Team will help us find the optimal energy storage technology for our solar/LED lighting project and future renewable energy systems.

John Barrie, Executive Director
The Appropriate Technology Collaborative



Prof. Somerton

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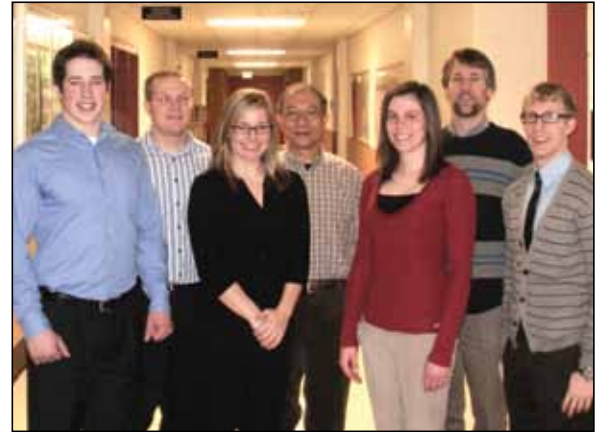
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THE DEPARTMENT OF MECHANICAL ENGINEERING AT MICHIGAN STATE UNIVERSITY: A MINIATURE TEST RIG FOR MEASURING WIND POWER

As the need for renewable energy grows, so does the demand and size of commercial-scale wind turbines. Many commercial-scale wind turbines are plagued with high maintenance costs, which can often be attributed to gearbox-bearing failures; and in most cases, the failures occur before the designed life of the bearing. The conclusion drawn from this information is simply that the failure mechanisms and loadings have yet to be thoroughly explored and understood to the extent required for proper incorporation into wind turbine system designs.

To further the understanding of these failure mechanisms, the Department of Mechanical Engineering at Michigan State University is seeking to establish the experimental capabilities to perform a dynamical study of wind turbines. The main objective of this project was to design an experimental test setup of a wind turbine to be used for the dynamical study. Through the course of the semester, an experimental test method was selected and a setup designed, established, and used to generate wind turbine power curves. The experimental test method uses controlled velocity testing to generate and simultaneously record data pertaining to upstream and downstream wind speed, blade tip speed, and generator power output. The experimental test setup and procedure were well documented to allow for comparison testing in future research. The test setup was also designed to allow for upgrades and modifications to accommodate additional research on alternate parameters.



The experimental test set-up and procedure will serve as a firm foundation for future wind turbine research in the Department of Mechanical Engineering at Michigan State University. Ideally, this project will eventually contribute to lower maintenance costs and thus more economically viable wind turbine systems.

...The Department of Mechanical Engineering at Michigan State University Student Design Team



Dr. Feeny

This project is funded by a grant from the National Science Foundation. The project has a research goal of understanding the dynamics of wind turbines and the effect on performance and reliability and an educational goal to produce engineers with knowledge about wind energy and increase the potential workforce in wind energy. This project will contribute to both the research mission and educational goals of the project.



Prof. Liu

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THE DEPARTMENT OF MECHANICAL ENGINEERING AT MSU: DESIGN AND MANUFACTURING OF A MODULAR SMALL WIND TURBINE SYSTEM AND ITS BLADES

Michigan State University is researching small modular wind turbines that can operate at low wind speeds. The goal of this group is to research wind-turbineblade characteristics to optimize efficiency in small-scale wind turbines. The wind- turbine studies are targeting those that could operate at wind speeds of about three meters per second. The team will purchase a small wind turbine and conduct research in a wind tunnel. The effects of many different blade types, angles, sizes, and number of blades will be tested for overall power and efficiency. The collected data will be compared against the results from a program called FAST (Fatigue, Aerodynamics, Structures, and Turbulence).

With the results from testing in mind, the team will begin to design a new set of optimized blades. Once the best design is determined, the blades will be modeled. If possible, the team will move to the fabrication stage and produce the modeled blades.

*...The Department of Mechanical Engineering
at Michigan State University Student Design Team*



Prof. Pourboghrat



Prof. Jaberi

The MSU team will study the effects of wind speed, pitch and blade rotational speed on the power and turbine efficiency in a wind tunnel. Results from this study will be used for design of wind turbines that are lightweight, strong, and modular in form for easy construction and repair. These data will also be used to compare against and calibrate FAST, a semi-empirical software developed for horizontal axis wind turbines by NREL.

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THE DEPARTMENT OF MECHANICAL ENGINEERING AT MICHIGAN STATE UNIVERSITY: DESIGN AND MANUFACTURING OF A CONTINUOUS VARIABLE TRANSMISSION SYSTEM FOR VARIABLE WIND CONDITIONS

Increases in the efficiencies of alternative energy conversion systems are vitally important for their success as they attempt to become competitive with traditional sources of fossil fuel based power. It has been proposed that the use of a Continuously Variable Transmission (CVT) in the powertrain design for a wind turbine could increase system efficiency, thereby lowering the Cost of Energy (COE). As part of a continued effort by Michigan State University and the College of Engineering to emphasize sustainability and environmental stewardship, a powertrain design using the NuVinci CVT was developed.



There are two major advantages to the use of a CVT in the powertrain of a wind turbine. First, variable-speed winds can be more efficiently harnessed. The CVT has the ability to simultaneously maintain both the appropriate tip speed ratio of the rotor for maximum aerodynamic efficiency and the output shaft speed to the generator. Precise control of the generator shaft speed has the potential to eliminate expensive power electronics currently being used as a frequency controller. The second major advantage of a CVT is its ability to handle large wind gusts or high-speed winds without compromising performance or damaging the system components.

Research was conducted to determine project feasibility, a CAD model was constructed, and a prototype was tested.

*...The Department of Mechanical Engineering
at Michigan State University Student Design Team*



Prof. Pourboghhrat

The student design team will be studying the effects of incorporating a continuous variable transmission (CVT) into a wind turbine system. Results from this study will be helpful in identifying the benefits of using a CVT with respect to improving the overall efficiency and reliability of a small wind turbine. The study will also help to determine whether the projected benefits outweigh the extra cost associated with using a CVT.

Dr. Farhad Jaber
MSU Department of Mechanical Engineering



Prof. Jaber

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LOUIS PADNOS IRON & METAL COMPANY: MANUFACTURING DESIGN OF PRODUCT DIVERTER

Louis Padnos Iron & Metal Company has recycled and processed metal, paper, and plastic scrap since its founding in 1905. Padnos was started in Holland, Michigan and now has facilities throughout the state.

Currently, product diverters are used to sort scrap pieces of metal during the last stage of material sorting. Large items, including cars and appliances, are fed into a shredding machine. After these items are shredded into small pieces, ferrous material is removed magnetically and aluminum is removed using an eddy current. At this point, sensors detect any metal remaining in the scrap and signal the product diverter to remove these metal pieces from the material stream. By preventing this remaining metal scrap from being sent to a landfill, the diverter system is beneficial to the environment and Padnos' bottom line.

The existing design is difficult to manufacture. Each individual diverter is welded by hand and must be ground down to meet the spatial constraints of the sensors. The present configuration of the pin joints creates a problem with the assembly of the diverter because the tight tolerances of each pin must be met to maintain functionality.

The team modified this design of a high-speed, mechanical product diverter in order to reduce operating costs and increase recyclability for the Louis Padnos Iron & Metal Company. This design improves the manufacturability, reliability, and cost of each individual product diverter to be implemented into a large paddle-arm assembly that diverts metal products at the end of a conveyor belt system.

...*The Louis Padnos Iron & Metal Co. Student Design Team*



Mr. Schrottenboer



Mr. Przekadzinski



Prof. Loos

Modification of the design for the current mechanical diverter, to incorporate current manufacturing technologies, will allow us better control over quality, cost of manufacturing, and product reliability. A more reliable and accurate system will allow us better recovery on our desired sorted products and reduce the overall operating cost of the sorting system.

Craig Schrottenboer
Louis Padnos Iron & Metal Company

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LOUIS PADNOS IRON & METAL COMPANY: SENSOR BAR ALIGNMENT

Louis Padnos Iron and Metal Co. is a leader in recycling and processing metal, paper, and plastic across the United States. Padnos uses a host of unique equipment to actively manage scrap for its clients. Relative to this project are material sorters that separate aluminum, iron, and other metals of value from discarded products. The effective implementation of these sorters prevents the loss of tons of valuable metal to the landfill.

In Padnos' current recycling process, material to be sorted travels down a conveyor and is then detected by a sensor resulting in its diversion to a separate area. For proper operation, the design hinges on the fact that the set of sensors is precisely aligned with the mechanical diverters. The design team was tasked with finding a working solution to continuously monitor the alignment of the sensors with their corresponding mechanical diverters.

Many challenges were encountered while developing the sensor bar alignment device. Harsh operating conditions, coupled with the nature of the recycling industry, necessitated that the working solution be exceedingly robust and reliable. To face these challenges head-on, many potential solutions were considered. Out of these possibilities, the most promising design was identified and developed into an effective solution.

...The Louis Padnos Iron and Metal Co. Student Design Team



Mr. Schrotenboer

The assurance of mechanical alignment in the sorting system allows us to operate with the confidence that we are accurately sorting the input material. This allows us to ensure our customers are satisfied in receiving the highest quality final product. Proper alignment also ensures that we are not losing desired material and allows us the best return on our investment.

Craig Schrotenboer
Louis Padnos Iron & Metal Company:



Prof. Naguib

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Matt Weir
Midland, Michigan

MSE 466

8:00 – Noon
First Floor
Lounge



SENIOR DESIGN CAPSTONE IN MATERIALS SCIENCE AND ENGINEERING

INSTRUCTOR: Prof. James P. Lucas

TA Staff: Yiyi Yang

PROBLEM STATEMENT

MSE 466 is a senior course for MSE majors that provides students with a team-based capstone design experience. A major objective of this course is to have students apply their course-learned background knowledge and skills in materials science to real-life design problems. Failures are a major motivating force for generating innovative designs or design changes. A failure analysis investigation provides a unique platform to design and to solve a real-world engineering problem in a systematic approach. By focusing on a specific design failure, the student teams learn how to face an open-ended problem that requires them to develop a strategic design plan and to execute the methodology for assessing how and why the failure occurred. The analysis is conducted using established investigative procedures and constraints for conducting a failure analysis investigation (FAI). This semester, there are four 3-5 member teams working on four real engineering failures.

Successfully completed team projects culminate in a comprehensive written final report and a strategic redesign plan to improve the design and mitigate future failures. The teams will give poster presentations that summarize their findings. Titles of each team's project as well as a project description are listed below.



Team 1:

l-r: Andrew Rentsch**,
Noel Saxton, Ryan Stewart,
Nick Sears, Brad Wing
(**team leader)

Team 1: Fracture of a 'Bauer' Hockey Skate Blade

Macroscopic examination suggested that failure occurred by extreme brittle fracture of the skate's blade (runner). Judging from the nature of the fracture, materials selection, heat treatment, and manufacturing processes issues are being investigated, primarily. Preliminary evidence implicates improper materials selection or materials processing methodology as the likely cause of failure.



Team 2:

l-r: Tinikia Nobles,
Jeff Alent, Ryan Hayes,
Alex Herbert**
(**team leader)

Team 2: Failure by Fracture of Tire Valve Stems

Failure resulted from complete crack propagation through the entire casing of the valve stem. Culpable in this failure appears to be embrittlement of the brass casing material during the Ni plating process. Various types of surface treatments are known to cause embrittlement with the consequence of producing cracks of the base metal.



Team 3:

l-r: Ryan Oswald,
Tori Buckley,
Elizabeth Castro**
(**team leader)

Team 3: Deformation and Failure of a Roto-Tiller Worm Gear

This project involves the failure of a worm gear fabricated from brass in a roto-tiller drive assembly. Failure resulted from severe plastic deformation and wear of the worm gear's teeth. The choice of material use to fabricate the worm gear is suggestive of a design fault. A suitable redesign would involve fabricating the gear from high-alloy steel and case-hardened to promote wear resistance.



Team 4:

l-r: Neil Murphy,
Ian Thompson**,
Bryan Khur,
Elizabeth Galea,
(**team leader)

Team 4: Bolt Fracture on a Power Roller Bed Lift Table

This FAI involves failure of a threaded connector bolt. The bolt is part of a roller-bed lift table in an automobile assembly facility. Impulse loading occurs on the bolt during normal operation of the assembly. Such loading profile contributed significantly to failure of the bolt. The severity of impulse loading on the bolt can be assessed by stress analysis. FAI evidence thus far suggests replacement of the bolts with having higher fracture strength and ductility.



**For information on
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