MICHIGAN STATE
UNIVERSITY

The Capstone Experience

From Students...to Professionals

COMPUTER SCIENCE AND ENGINEERING 2013-2014

The Capstone Experience

CSE498
Collaborative Design

Dr. Wayne Dyksen
Professor of Computer Science and Engineering

The Capstone Experience provides the educational capstone for all students majoring in computer science at Michigan State University. Teams of students build software projects for corporate clients.

During the Capstone Experience, students

- design, develop, debug, document, and deliver a software project for a corporate client,
- work in a team environment,
- develop written and oral communication skills,
- become proficient with software development tools and environments, and
- consider issues of professionalism and ethics.

Corporate clients are local, regional, and national including Auto-Owners Insurance, Boeing, Chrysler, Dow Chemical, Electronic Arts, Ford, GE Aviation, GM, Google, IBM, Meijer, Microsoft, Motorola Mobility, Mozilla, MSU Federal Credit Union, Quicken Loans, Spectrum Health System, TechSmith, Toro, the Union Pacific Railroad, Urban Science, and Whirlpool.

At the end of each semester, the College of Engineering sponsors Design Day, at which student teams from throughout the college showcase their Capstone projects in the MSU Union.

Computer science capstone teams demonstrate the software projects that they have designed, developed, and delivered for their corporate client. Teams compete for four awards, which are conferred by a panel of corporate judges.

We thank Auto-Owners Insurance of Lansing, Michigan for their continued support of Michigan State University and the Capstone Experience, including the printing of this Capstone Experience booklet.

Check out the Capstone Experience web site at www.capstone.cse.msu.edu.

For more information about the capstone experience or becoming a capstone project sponsor, contact Dr. Wayne Dyksen by email (dyksen@msu.edu) or by phone (517-353-5573).

The Capstone Experience, 2013-2014

Department of Computer Science and Engineering

Michigan State University

Corporate Sponsors

Randy Mott

Senior Vice President and
Chief Information Officer

General Motors
Detroit, Michigan

"General Motors looks to Michigan State University to hire outstanding computer science graduates. Students in the capstone course gain valuable experience with a wide diversity of state-of-the-art information technologies being used at GM. This is a tremendous chance for students to network with IT professionals and benefit from a powerful learning opportunity."

Bob Buchanan

Senior Vice President,
Information Systems
and Technology

Auto-Owners Insurance
Lansing, Michigan

"Auto-Owners Insurance is proud to be a long term capstone project sponsor. The business-like environment of the capstone experience provides a unique opportunity for students to develop into professionals. Our strategic partnership has enabled us to identify and recruit many outstanding MSU graduates."

Bob Feldmann

Vice President and
General Manager 777X Program

The Boeing Company
Seattle, Washington

"Michigan State's capstone course provides students with real-world experiences within the aviation and aerospace industries. The Boeing capstone teams continue to produce outstanding projects including an aircraft assembly line simulator and a flight simulator suite."

Jeremy Briggs

University Staffing
Manager

Microsoft
Redmond, Washington

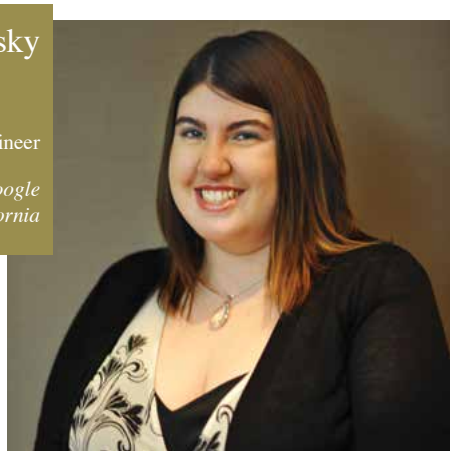
"Michigan State University's program in computer science has been a focal point for Microsoft for many years. We continue to recruit and hire outstanding graduates including 26 permanent hires and 25 summer interns in just the last five years."

Capstone Alumni

Michele Winsky

Software Engineer

Google
Mountain View, California



"The capstone experience at MSU challenges students to build innovative software solutions to complex technical problems, which was great preparation for my job at Google."

BS, CSE: May 2012
Hometown: Morrice, Michigan

Eric Zipple

Software Developer – Java

General Motors
Phoenix, Arizona

"The MSU capstone experience gave me invaluable experience working with a large company. Students get a comprehensive look at developing enterprise applications from start to finish. I was able to connect with contacts from many large companies and jumpstart my own career at GM."

BS, CSE: December, 2013
Hometown: Mount Pleasant, Michigan

Ben Pedersen

Software Engineer

TechSmith
Okemos, Michigan

"As a Michigan native, I wanted to pursue my career within the state. The capstone course project sponsors include companies of various sizes from throughout Michigan, including my company, TechSmith of Okemos, Michigan."

BS, CSE: May 2010
Hometown: Lansing, Michigan

Angela Mireau

Software Development Engineer

Amazon
Seattle, Washington

"Designing and architecting a large scale software project was a very valuable aspect of my capstone experience at MSU, which gave me a good head start for my career at Amazon."

BS, CSE: May 2012
Hometown: St. Clair, Michigan

Fall 2013

Project Sponsors

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

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

General Motors
Detroit, Michigan

IBM Corporation
Armonk, New York

Meijer
Grand Rapids, Michigan

Mozilla Corporation
Mountain View, California

MSU Federal Credit Union
East Lansing, Michigan

Quicken Loans
Detroit, Michigan

Spectrum Health System
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Whirlpool Corporation
Benton Harbor, Michigan

Auto-Owners Insurance
Catastrophe Insurance Adjuster App

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

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

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

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

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

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

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

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

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The Boeing Company
Aircraft Assembly Line Simulator

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

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

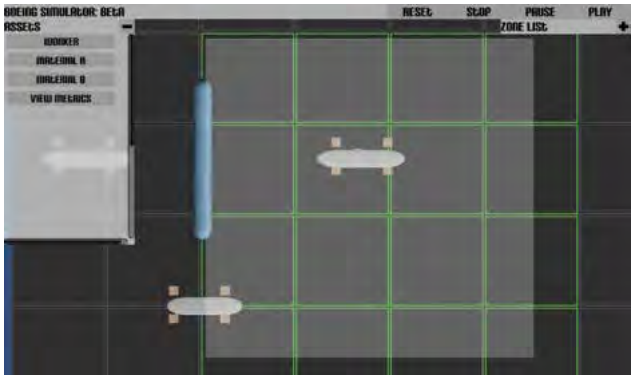
Developed in collaboration with Boeing, our Aircraft Assembly Line Simulator is used to design new assembly lines, and to optimize existing ones.

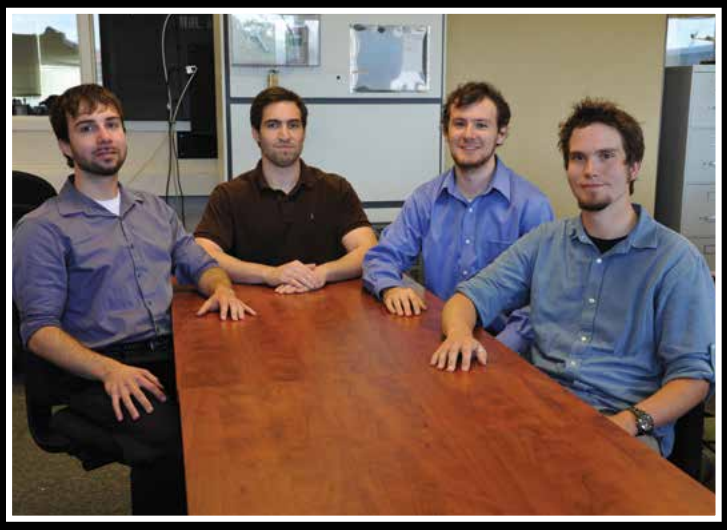
After launching our simulator, users are able to create an assembly line by placing various assets on a factory floor. After completing the factory layout, the simulation begins during which users can navigate throughout the assembly line and observe various assembly processes while they occur.

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

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

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





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General Motors
Augmented Reality Auto Mobile Guide App

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

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

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

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

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

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

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

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

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IBM Corporation
Information Technology Assessment Toolkit

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

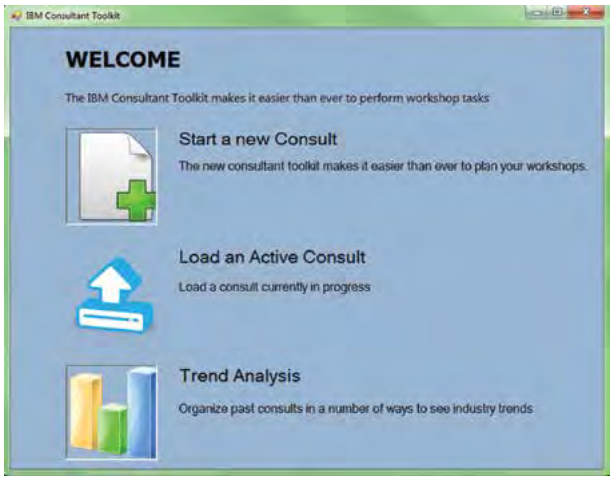
Information technology (IT) consulting is one of the primary services of IBM. Our Information Technology Assessment Toolkit is designed to improve the performance of IBM's consultants thereby increasing the benefit their clients receive from their services.

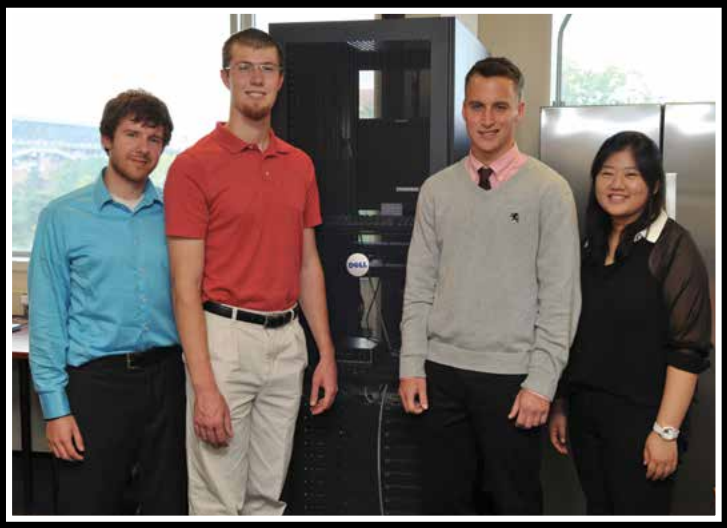
Our Information Technology Assessment Toolkit enables IBM consultants to organize and synthesize data, expedite the assessment processes, and provide feedback that is beneficial to their clients. Consultants can store data collected from their clients onto a database, quickly generate and send surveys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

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

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

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





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Meijer
Chief Information Officer Dashboard

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

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

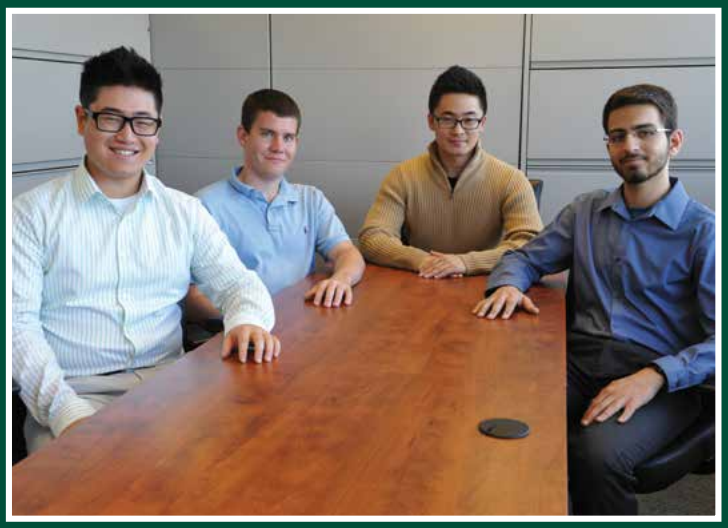
Our Chief Information Officer Dashboard provides the CIO with an at-a-glance status of all of the major IT functions throughout Meijer.

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

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

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

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



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Mozilla Corporation
Australis-Styled Widgets for Mozilla Firefox

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

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

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

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

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

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

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

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

mozilla Firefox

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MSU Federal Credit Union
Smart Start Savers

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

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

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

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

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

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

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

MICHIGAN STATE UNIVERSITY
FEDERAL CREDIT UNION
Building Dreams Together

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Quicken Loans
Survey and Voting Web Apps

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

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

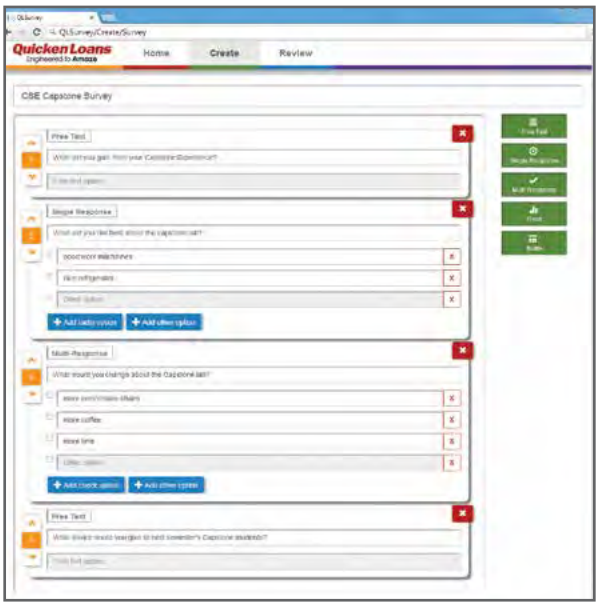
Currently, Quicken Loans uses third-party survey and voting tools. Use of these third-party tools is cumbersome and results often fail to meet the needs of Quicken Loans.

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

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

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

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



Quicken Loans
Engineered to Amaze

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Spectrum Health System
Talent Connections Careers Mobile Site

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

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

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

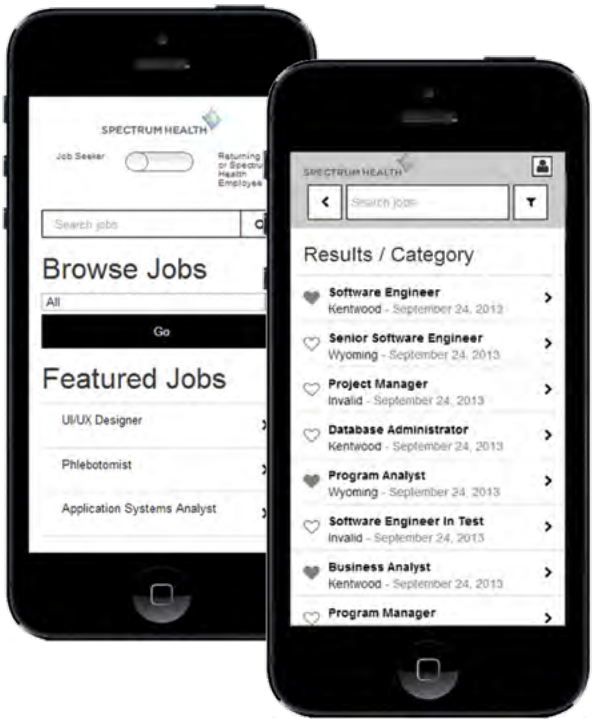
When a user expresses interest in applying for a position, they are directed to the search page shown at the right. Available jobs can be filtered by numerous criteria or sorted either alphabetically or by the date they were posted.

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

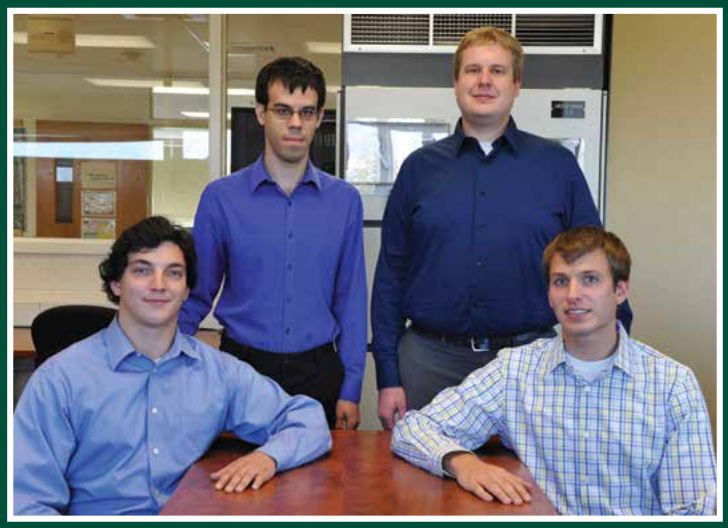
Our mobile web site uses a responsive layout, which enables it to accommodate the great variety of differing mobile device screen sizes automatically and dynamically.

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

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



SPECTRUM HEALTH



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TechSmith
Learning Activity Capture

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

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

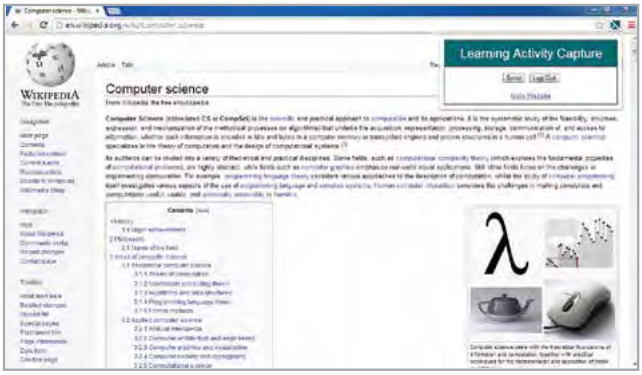
Our software is comprised of three distinct parts: a Google Chrome extension, a Microsoft Windows application and the TechSmith Smart Player. All three create and record statements that describe a user's learning experience. Users can view an organized summary of their learning activities on their individualized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

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

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

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

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



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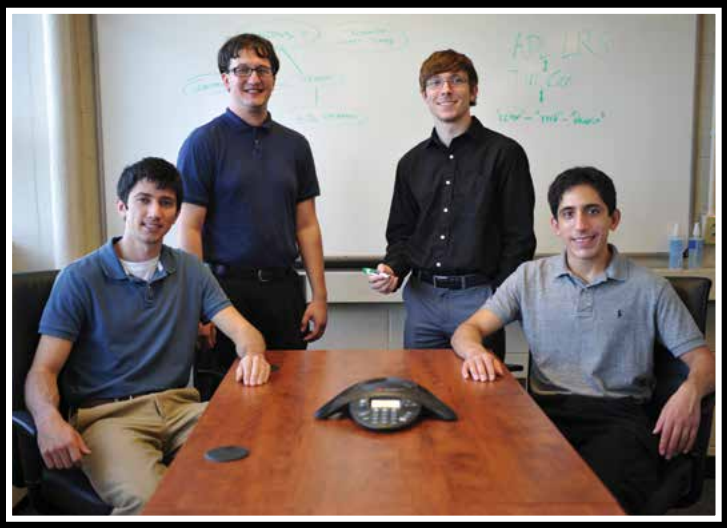

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Urban Science
Dealership Consultant Mobile App

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

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

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

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

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

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

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

URBAN SCIENCE

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Whirlpool Corporation
Connected Appliance SmartZones App

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

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

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

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

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

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

Whirlpool CORPORATION

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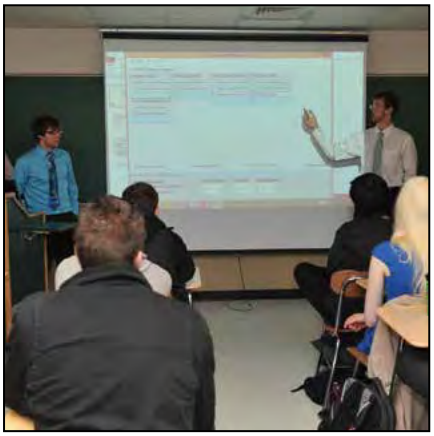
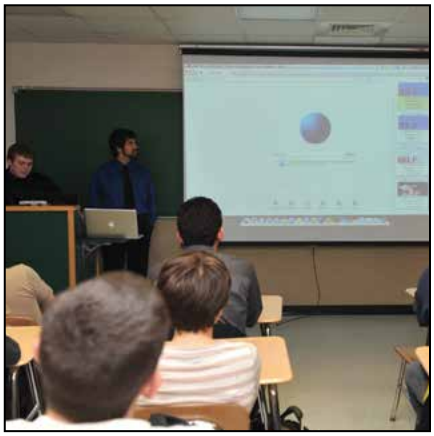
All-Hands Meetings

Fall 2013









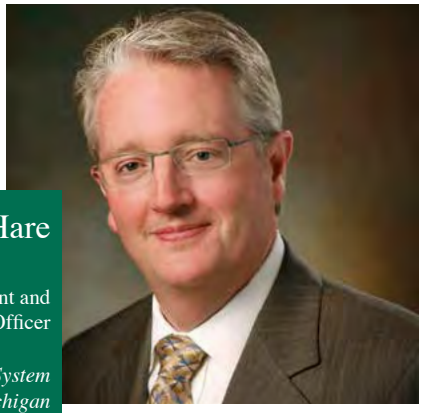
Corporate Sponsors

Dave Rodgers

Vice President,
Chief Information Officer

Meijer
Grand Rapids, Michigan

"Meijer is proud to have sponsored MSU capstone projects over the past five years. We have been impressed with both the capabilities of the students and the quality of the solutions they have developed. The latest project, the Mobile Customer Satisfaction App, will be used by Meijer to improve our services to our customers."



Patrick O'Hare

Senior Vice President and
Chief Information Officer

Spectrum Health System
Grand Rapids, Michigan

"As a Design Day judge, I have evaluated capstone projects from many of the corporate sponsors. The software systems produced by the MSU students rival that of professional developers. The Spectrum Health sponsored capstone teams have presented excellent software solution options to us for consideration."

Bill Hamilton

President and Co-Founder

TechSmith
Okemos, Michigan

"TechSmith is a global technology company located just five miles away from MSU in Okemos. Our capstone projects give students real-world experience with some of the latest trends including multimedia technologies, cloud computing and mobile applications, all of which add to their marketability. We also recruit the majority of our software engineers from MSU, so the capstone experience gives us a meaningful connection to many prospective employees."

Louise Hemond-Wilson

Distinguished Engineer and
Chief Technology Officer

IBM
Somers, New York

"At the beginning of the semester, each MSU capstone team receives a challenging business problem from their sponsor. These are not hypothetical or artificial problems. They very much resemble problems I see when working with client and IBM teams in my role as a consultant for IBM. I have had the honor and pleasure of judging capstone teams' software solutions, examining their design, development and delivery. Repeatedly and consistently, the students, their projects, and their presentations impress me with their high degree of innovation, creativity and professionalism."

Capstone Alumni

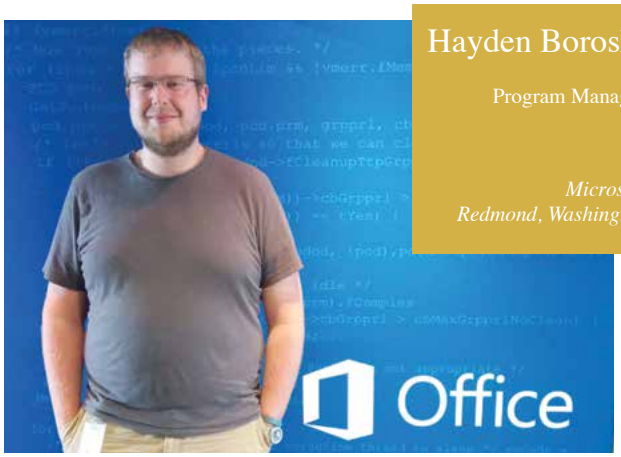
Jayson Vincent

Modeling & Simulation Software Engineer

The Boeing Company
St. Louis, Missouri

"My capstone project with Boeing was technically challenging, team-oriented, and concluded with a result that was rewarding to observe. Alongside summer internships and mentors who continually believed in me, my capstone project inspired me to pursue an exciting career in aviation and aerospace."

BS, CSE: May 2005
Hometown: Mason, Michigan



Hayden Boroski

Program Manager

Microsoft
Redmond, Washington

"Learning how to give and defend technical presentations is a key feature of the capstone experience, which I use often in my work at Microsoft."

BS, CSE: December 2013
Hometown: Lansing, Michigan

Michelle Truong

Associate

Urban Science
Detroit, Michigan

"The capstone course provided me with a challenging real-world experience working on a mobile app designed to teach American Sign Language, which has given me a strong foundation for the start of an exciting and successful career at Urban Science."

BS, CSE: May 2013
Hometown: Northville, Michigan

Josh Mackaluso

Senior Software Developer

Auto-Owners Insurance
Lansing, Michigan

"The capstone course provided me with real-world experience as a software developer while I worked on a team to deliver a finished software product within a set time constraint. The skills and experience that I gained prepared me for starting my career as a software developer at Auto-Owners."

BS, CSE: Spring 2010
Hometown: Vicksburg, Michigan

Spring 2014

Project Sponsors

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

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

Ford Motor Company
Dearborn, Michigan

General Motors
Detroit, Michigan

Google
Mountain View, California

Meijer
Grand Rapids, Michigan

MSU Federal Credit Union
East Lansing, Michigan

Quicken Loans
Detroit, Michigan

Spectrum Health System
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Whirlpool Corporation
Benton Harbor, Michigan

Auto-Owners Insurance
Mobile Audit Itinerary and Worksheet

Auto-Owners Insurance is a Fortune 500 company with written premiums of over $5 billion. Auto-Owners is recognized for exceptional financial strength and outstanding customer service as "The No Problem People."®

One key to Auto-Owners' excellent customer service is a group of mobile associates called "underwriting field service representatives" who meet in person with policyholders to audit and update policy information after a policy expires.

With our Mobile Audit Itinerary and Worksheet software, underwriting field service representatives can audit and update all of the policyholder information using a wide variety of mobile devices including laptops, tablets and smartphones.

Our system provides maps and directions to the list of customers to be visited each day. Underwriting field service representatives can re-order their visits, which causes their maps and directions to be updated automatically.

Even if an internet connection is temporarily not available, we provide most of the system's functionality. Auto-Owners' representatives are able to continue to update policyholder information, view their itinerary for the day, and generate reports summarizing all of their collected information.

Our Mobile Audit Itinerary and Worksheet software runs in most modern browsers. Our web server is Apache Tomcat with JSP (JavaServer Pages). Policyholder information is stored remotely in an IBM DB2 database. Local information is stored in XML format. The maps and directions are provided using the Google Maps API.

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Scott Lake
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Jim Schumacher
Lansing, Michigan

The Boeing Company
Flight Simulator Suite

With over 170,000 employees around the globe and a customer base spanning 150 countries, Boeing is the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft.

In order to develop state-of-the-art aircraft, Boeing relies heavily on flight simulation systems to test new designs and coordinate control, thereby saving time and money, and minimizing risks for test pilots.

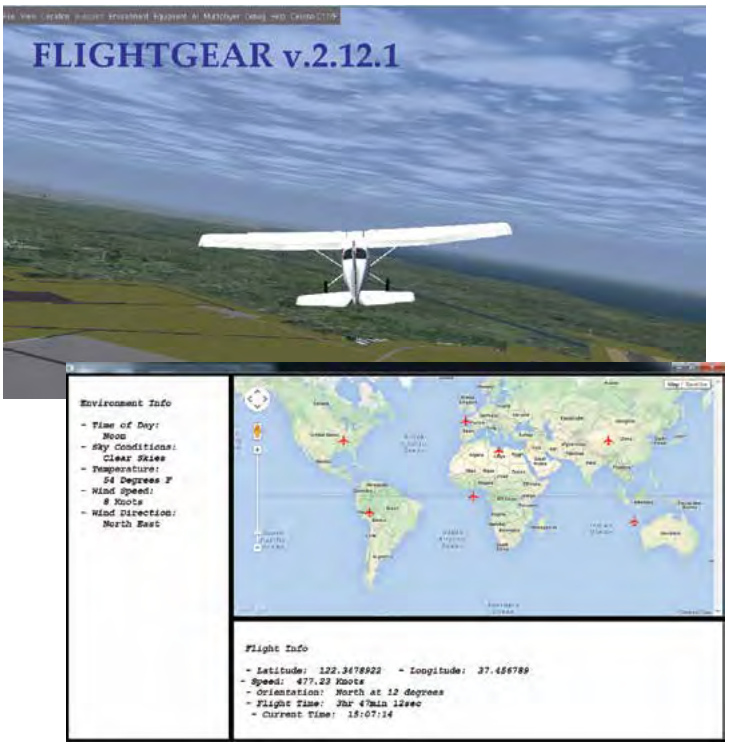
Our Flight Simulator Suite enables Boeing to take full advantage of all facets of flight simulation by improving the extendibility and the modularity of the open source flight simulation software FlightGear (FG).

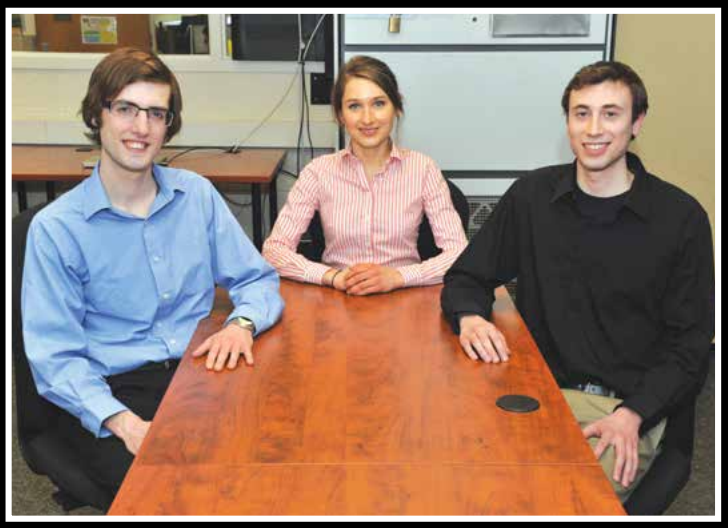
Our system extends FG's simulation engine by adding a message queuing subsystem that allows data exchange between FG and other software. For example, such data exchange is used to implement a GUI that communicates with FG to display information such as player positions.

In addition our Flight Simulator Suite features full menus and multiple views that enable users to take advantage of the full range of FG's many capabilities.

Finally, our suite utilizes FG's modular structure to improve the graphics system, incorporating an array of physics engines used to compute physically accurate flight simulations.

Our Flight Simulator Suite is written using C++ and Python. We are using the ActiveMQ library to handle the message passing and wxPython to display the Graphical User Interface.





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Jayson Vincent
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Ford Motor Company
Mobile Approver

Ford Motor Company is an iconic American brand that has been producing automobiles for 110 years. Ford's workforce of 170,000 employees produced 2.5 million vehicles in 2013.

In order to run a large global company, Ford relies heavily on structured business processes. Many of these processes are computerized and require supervisors to review and approve actions or requests. Examples include: employee timekeeping, purchasing, expense reporting and product tracking.

While Ford's current approval systems do work, they require supervisors to use many different systems to approve different types of requests. Furthermore, these systems do not support mobile computing, which is common in the modern workplace.

Our Mobile Approver system replaces these disparate approval systems with a single, unified approval portal. Ford supervisors can approve any and all types of actions or requests simply by logging into a single system using their Ford credentials.

Once a supervisor is logged in, our system retrieves all actions and requests that have pending approvals and displays them in a single, easy-to-use interface. Supervisors can quickly approve or reject requests, providing comments when needed.

Our Mobile Approver system supports all modern web browsers and runs on desktops, laptops, tablets and phones.

Devices with cameras such as tablets and phones can use QR codes to interface with Ford's inventory tracking system.

Our system is implemented using HTML5, Java, Spring MVC, Microsoft SQL Server, Microsoft SharePoint and JavaScript.

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General Motors
The Matrix: Vehicle Simulator System

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

GM customers today expect their cars to have a variety of "smart" capabilities including things like navigation, social media such as Facebook, and music streaming such as Pandora.

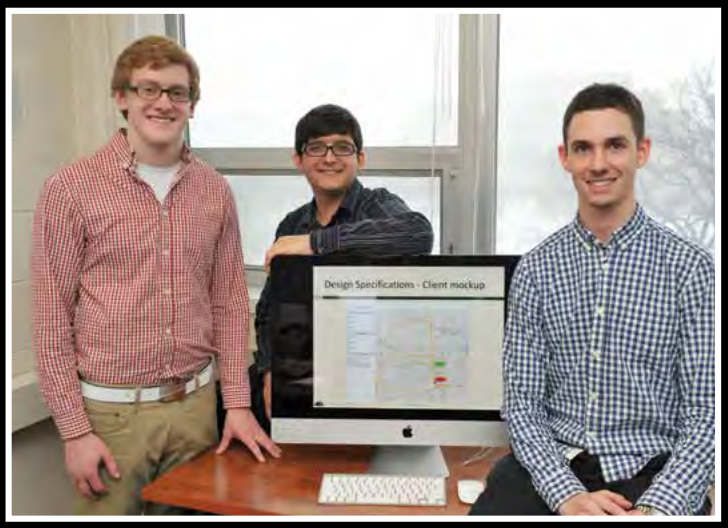
In addition to these smart capabilities, GM is developing more and more apps that enable their customers to interact with their smart cars directly from their mobile phones or computers.

Currently, in order to test a new mobile app, GM software developers must reserve and use actual cars, which can cause delays in testing and be very costly.

The Matrix is a vehicle simulator that creates virtual cars, which GM developers use to test their applications without the need of actual cars. GM can prototype and test their apps against real-world situations without real-world limitations.

Using The Matrix, GM app developers can create virtual cars traveling along specified map routes. The mobile app being tested receives regular updates of GPS coordinates along with other notifications such as a seat belt being buckled, the wipers being turned on or the air bags being deployed.

Our simulator runs on .NET, and clients connect to it via a RESTful API or through a WCF library. Our companion .NET WPF demo application shows off the features of the API.



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Google
Change Management Software

Google's mission is to organize the world's information and make it universally accessible and useful.

As such, Google operates a very large and very complex infrastructure of networks, databases and servers that store and distribute vast amounts of information throughout the world.

Google's complex data infrastructure must be maintained and customized to their needs. Naturally, all Google engineers need to be aware when services are down or have been changed in some way.

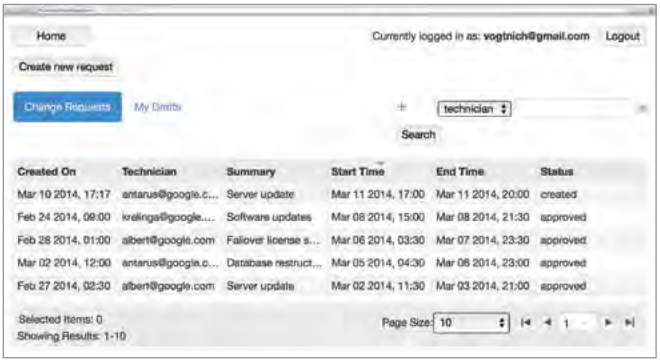
Our Change Management Software system schedules, approves and alerts users to computing infrastructure changes using a web app and email notifications.

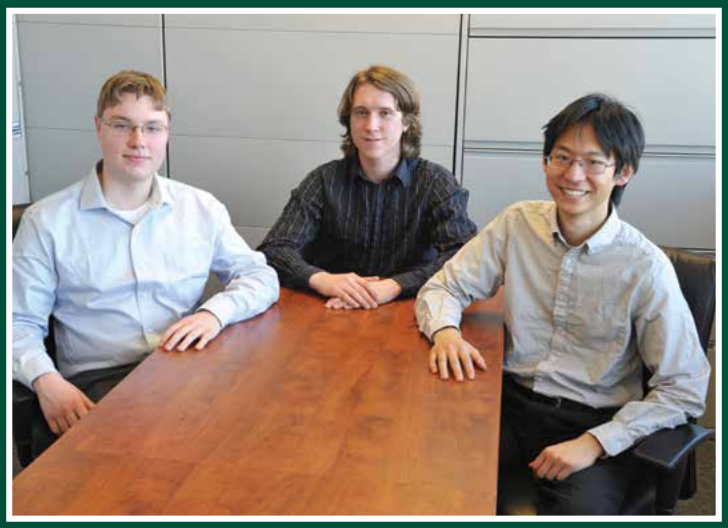
Google's engineers use our system to create change requests, which include the purpose of the change along with a proposed date. The requesting engineer receives regular email updates about the status of their requests.

After requests are created, supervising engineers receive email notifications of pending requests, which they can approve, deny or edit.

Once requests are approved, email is sent to the requesting engineers and to all affected users. In addition, notices may be added to an online board called Google Helpdesk where users can view infrastructure changes affecting wide audiences.

Our Change Management Software is built using AngularJS and Python to communicate with Google App Engine's Datastore.





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Hal Marz
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Alec Warner
Mountain View, California

Meijer
Mobile Customer Satisfaction App

Meijer is a family-owned chain of supercenters committed to providing quality food and general merchandise products to its customers throughout the Midwest. Headquartered in Grand Rapids, Michigan, Meijer has over 200 stores and approximately 60,000 employees.

Currently, Meijer collects feedback from its customers on their shopping experience through the corporate website.

Our Customer Satisfaction App is a mobile application that enables Meijer customers to give immediate feedback on their shopping experience while they are in the store. They can respond to a general survey, provide information about specific issues, view store details and view frequently asked questions. Feedback is automatically associated with a store by our app.

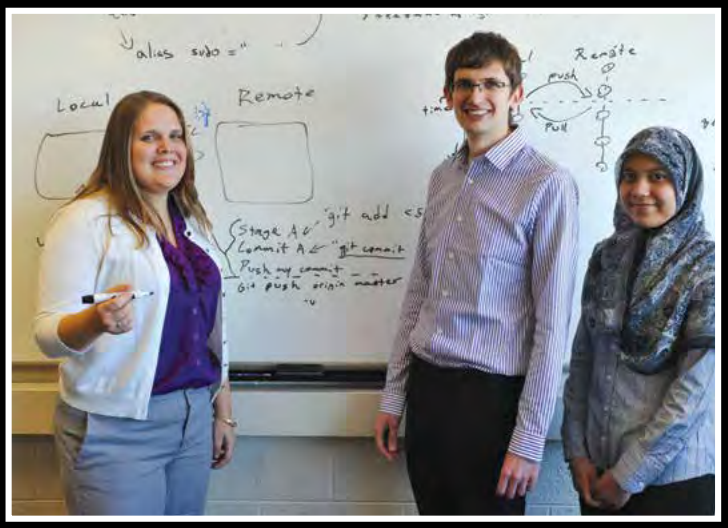
Using our mobile app while in the store, Meijer customers can provide feedback about their shopping experience in a timelier manner, thereby enabling a shorter delay between the time a problem arises and its resolution.

Our system includes a companion internal website that Meijer associates use to view the collected customer feedback. Issues can be sorted by severity and status.

Meijer team members can contact customers if requested using the email address they submitted. This way, Meijer can respond to customers faster and improve their experience.

Our Customer Satisfaction App is a native Android application written in Java using Eclipse. The companion website and database are hosted with Microsoft Azure.

meijer®



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Meijer
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Grand Rapids, Michigan

Jim Poll
Grand Rapids, Michigan

Dave Rodgers
Grand Rapids, Michigan

MSU Federal Credit Union
Mobile Financial Education App

Michigan State University Federal Credit Union is the largest university-based credit union in the world, serving more than 181,000 members. Many of their members are students and recent graduates of Michigan State University and Oakland University who are new to the complex world of finance.

Teaching students and recent alumni the importance of fiscal management and fiscal responsibility is very important, especially in our increasingly complex financial world with a wide variety of often complicated and confusing options.

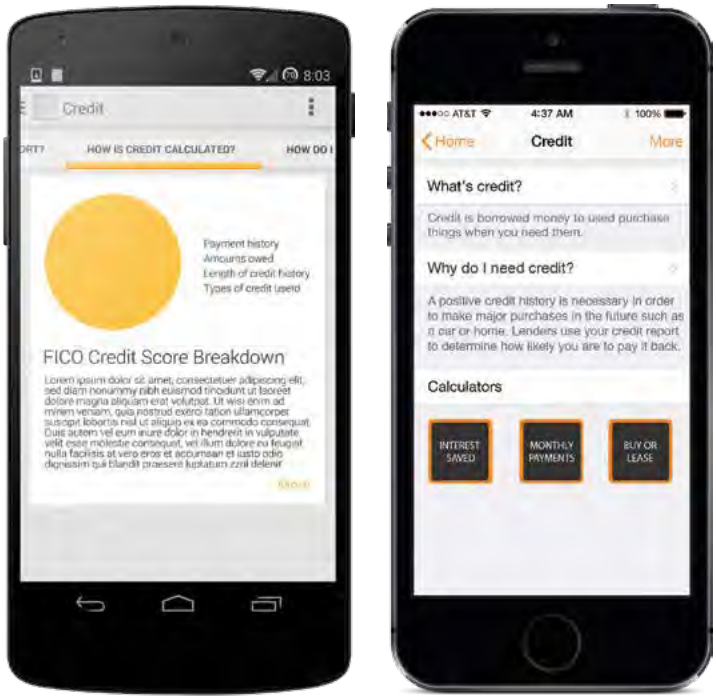
Our Mobile Financial Education App provides students and recent graduates with concise information about a wide variety of timely financial topics quickly in the palm of their hand.

Students can personalize their use of our app while navigating through topical reference materials and financial tools relevant to their needs and challenges such as student loans, credit scores and travel expenses.

Additionally, our app includes an "Ask an Expert" feature, which enables users to email questions directly to experts at the MSU Federal Credit Union.

Our Mobile Financial Education App supports a wide variety of mobile devices providing native apps for iPhones and iPads as well as Android phones and tablets.

Our iPhone and iPad apps are written in Objective-C using Xcode. Our Android apps are written in Java using Android Studio. The content for the apps is served from a knowledge base curated by MSUFCU.



MICHIGAN STATE UNIVERSITY FEDERAL CREDIT UNION
Building Dreams Together

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Kyle Ladd
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MSUFCU
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Quicken Loans
Mobile RFID Inventory Tracking System

Founded in 1985, Quicken Loans is a financial institution headquartered in Detroit, Michigan. Quicken Loans is the nation's largest online mortgage lender.

As part of its commitment to innovation, Quicken Loans is continually developing new mobile apps. To test these apps, team members may borrow a wide variety of mobile devices.

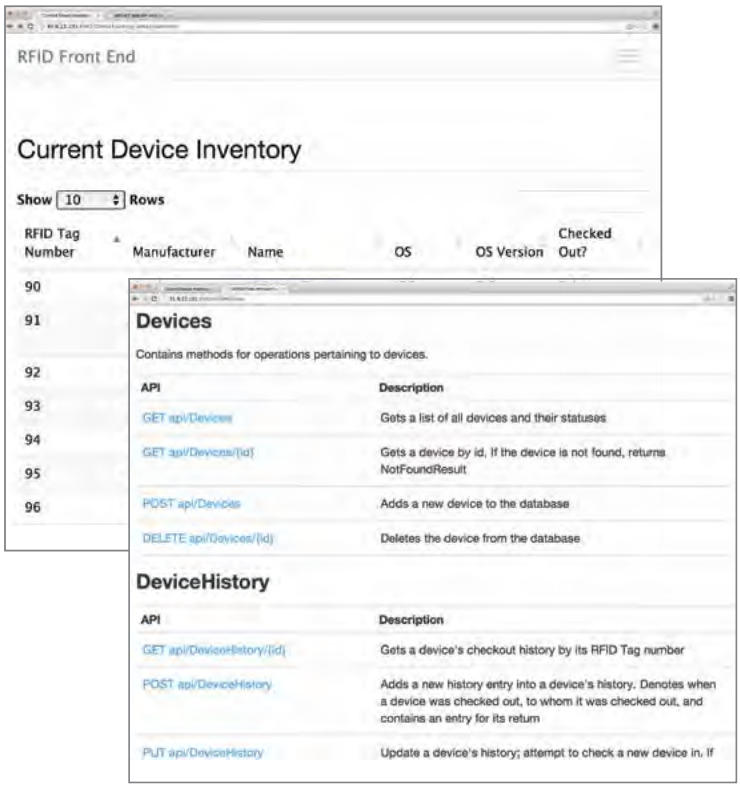
Our Mobile RFID Inventory Tracking System uses RFID (Radio Frequency Identification) technology to automate the process by which team members check in and check out mobile devices.

A team member's ID badge unlocks the cabinet where the mobile devices are stored. Devices are checked out simply by removing them from the cabinet, and devices are checked in simply by putting them back. Team members receive email notifications when devices are checked out or checked in, or if a device must be returned.

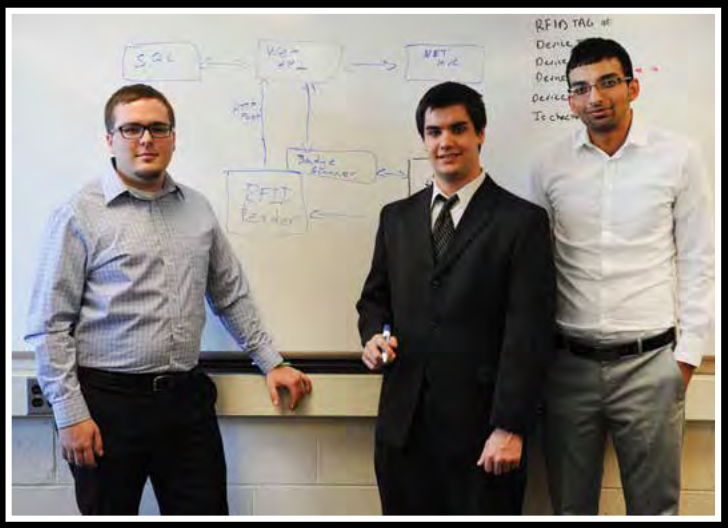
Our system identifies mobile devices wirelessly using an RFID scanner to read RFID tags attached to the devices. The scanner enables our system to determine what devices are in the cabinet and when devices are removed or returned to the cabinet.

Our Mobile RFID Inventory Tracking System is managed using a web app that supports desktops, laptops, tablets and phones. Users can view the checked-in/checked-out status of existing devices as well as add new ones.

Our web application is written in the .NET MVC framework, with a Windows Web API back end. Our system uses the Impinj Speedway Revolution R420 RFID reader.



Quicken Loans
Engineered to Amaze



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Spectrum Health System
Medications Shortages Dashboard

Spectrum Health System, located in Grand Rapids, Michigan, provides high quality, high value healthcare through its nine hospitals in West Michigan, which are maintained by 19,000 employees, 1,500 physicians, and 2,600 active volunteers.

Spectrum Health hospitals carry thousands of medications in various dosages. Having the right medication in the correct dosage at the right time is critical to providing high quality health care. One of Spectrum's many important day-to-day concerns is that of potential medication shortages.

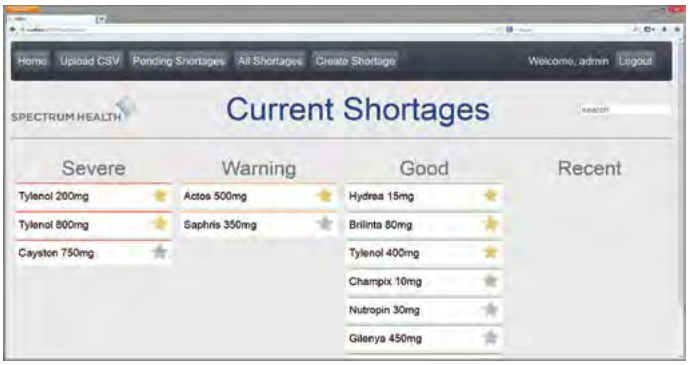
Our Medication Shortages Dashboard provides Spectrum medical personnel with an at-a-glance overview of current national drug shortages. The dashboard displays a concise color-coded synopsis that is easy to process and easy to use.

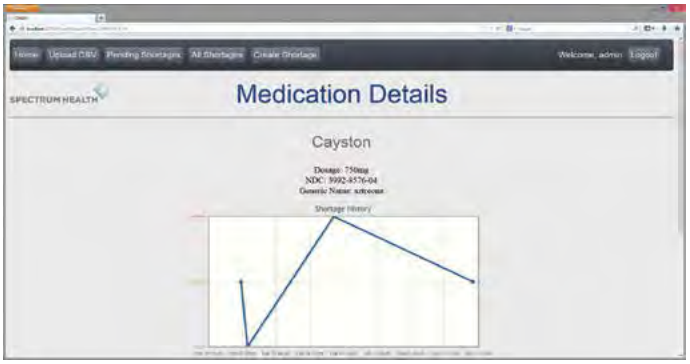
Dashboard users add the medications that they care about most to their personal watch list, which is displayed at the top of their view of the dashboard.

Our dashboard includes a details page about every medication carried by Spectrum Health's hospitals, thereby allowing medical personnel to track the history of a drug's shortage status and to display basic information about it.

Information about medication shortages is pulled in real time from the Food and Drug Administration (FDA) and the American Society of Hospital Pharmacists (ASHP).

Our Medication Shortages Dashboard is built on a Model-View-Controller architecture, using ASP.NET 4.5 with C#. Microsoft SQL server is used to store all shortage information.





SPECTRUM HEALTH

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TechSmith ClassView

TechSmith is a software company based in Okemos, Michigan and is well-known for its screen capture and recording software, which is widely used in educational settings for computer-based learning activities.

TechSmith is using the latest technology to develop a wide variety of tools to make an impact on education.

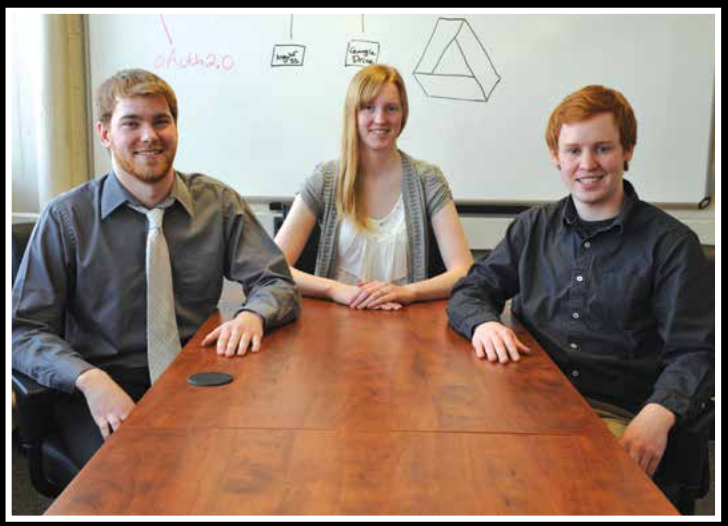
Our ClassView software models a classroom environment and is built on top of the cloud file storage provided by Google Drive. Our software is comprised of two distinct applications, the Teacher Dashboard and the Student Dashboard.

The Teacher Dashboard simplifies classroom management for teachers. Teachers have the ability to create and assign projects, and to review student progress on them. Teachers can create classes, add students to classes, and create groups within each class. Teachers are also able to monitor how students are sharing files via notifications in order to ensure file security.

While using the Student Dashboard, students can work on their assignments while having the necessary limited access to the Google Drive interface. Students are able to collaborate with classmates, view their progress on current assignments and receive reminders of homework due dates.

The ClassView Teacher Dashboard and Student Dashboard are Google Chrome applications that are written in HTML, CSS, and JavaScript. The Teacher Dashboard also uses the JavaScript framework AngularJS.

TechSmith



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Urban Science
Dealer Improvement Recommender System

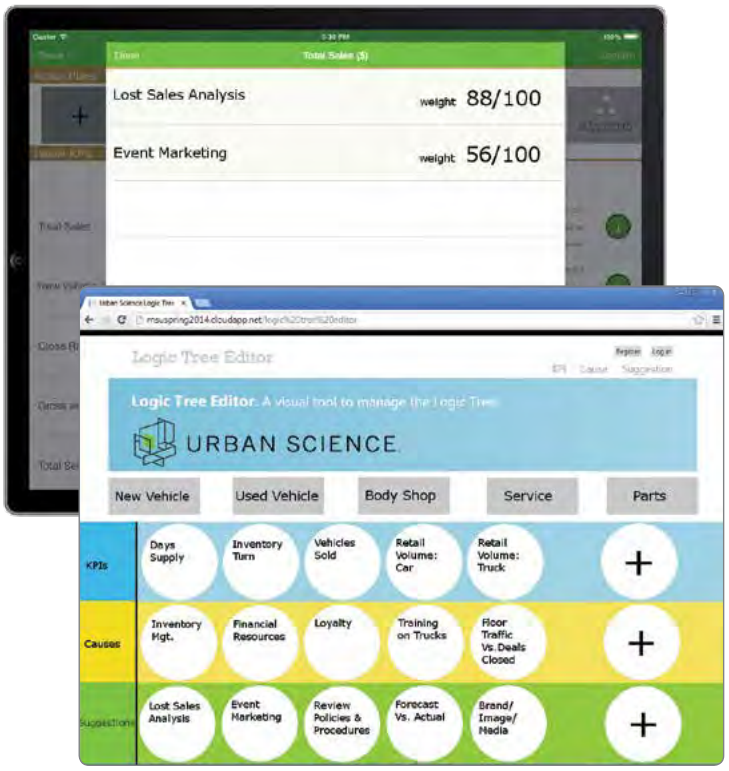
Urban Science is an analytics consultant to the automotive industry. Using data-backed analysis of key performance indicators (KPIs), Urban Science increases dealer sales and profitability.

A recent addition to Urban Science analytics is the Logic Tree, which describes important KPIs, target values for dealers, potential reasons for poor performance and potential suggestions to address problems. As Urban Science consultants learn from consulting experiences, the Logic Tree must grow and evolve.

Our Dealer Improvement Recommender System provides tools to visualize and edit the Logic Tree through a robust web app. Authenticated users can create, edit and delete KPIs, causes, suggestions and relations between them. Furthermore, these relations can be weighted to generate analytically driven suggestions based on a specific dealer's data.

Urban Science's existing Dealer Assistant iPad app is able to query the Logic Tree to provide actionable suggestions to consultants in the field. These suggestions are used to create dealer action plans. Results from tracking the implementation of these suggestions are used to update the Logic Tree, improve the system, and yield better long term suggestions for Urban Science's dealers.

Our Dealer Improvement Recommender System is written in C# using ASP.NET MVC with a Microsoft SQL backend database accessed via the Entity Framework. Visualizations are implemented using D3.js.



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Whirlpool Corporation
Virtual Appliance Simulator

Whirlpool Corporation, headquartered in Benton Harbor, Michigan, is a worldwide innovator in manufacturing a diverse range of household appliances and technologies.

Today there is much more to a Whirlpool appliance than what meets the eye. Cloud computing, digital sensor networks, and internet connectivity are but a few of the many tools used by Whirlpool to give customers a truly modern experience.

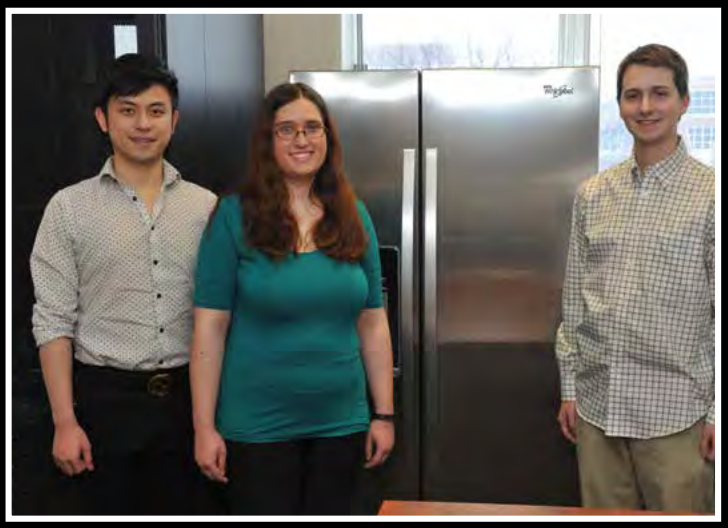
Yet, building connected appliances is challenging in an age when software can be written faster than its corresponding hardware can be built. Coding for a "smart appliance" often finishes well before a hardware prototype can be built.

Our Virtual Appliance Simulator allows Whirlpool software developers to create virtual connected appliances to test their software in a simulated environment. Instead of setting up several dozen actual appliances, an engineer can push a button and create tens of thousands of virtual appliances ready to do testing within seconds.

A Whirlpool dryer is shown at the right along with a virtual version of the exact same appliance. Using our web interface, a Whirlpool engineer is able to select the type, number of connected appliances to be simulated, and the behavior of each simulated machine.

Our Whirlpool Virtual Appliance Simulator is written in Java and is optimized for an Ubuntu Linux environment. All front end user interfaces are web based, written in PHP, to ensure cross platform compatibility with all popular operating systems and with all common web browsers.

Whirlpool CORPORATION



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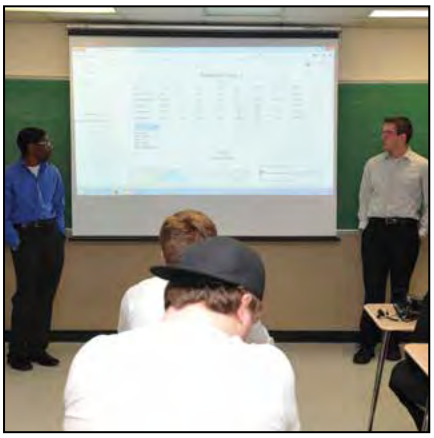
All-Hands Meetings

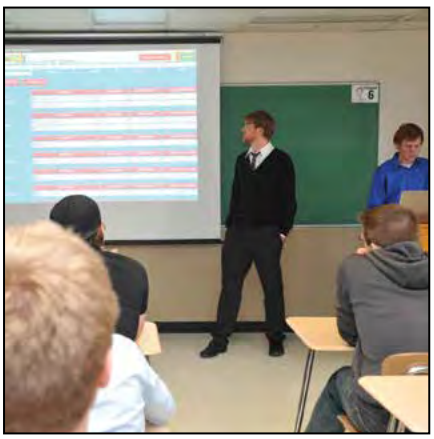
Spring 2014







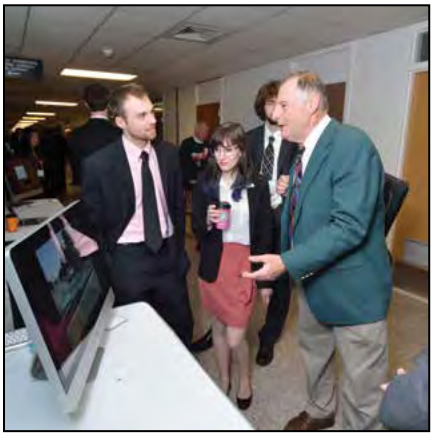


The Capstone Experience

Design Day

Fall 2013



Design Day

Spring 2014

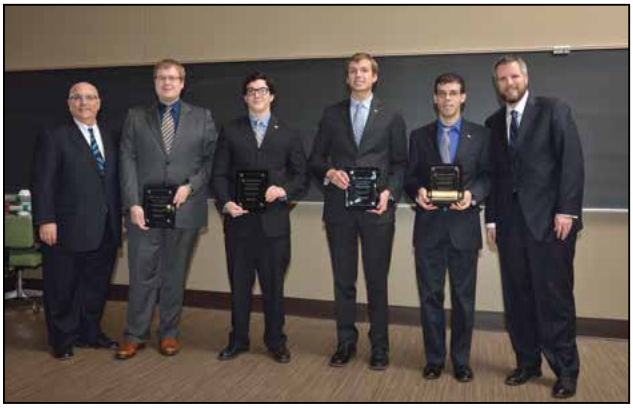
Design Day Award Winners

Fall 2013

Auto-Owners Exposition Award
Team MSUFCU: Smart Start Savers

General Motors Praxis Award
Team IBM: Information Technology Assessment Toolkit

TechSmith Screencast Award
Team Urban Science: Dealership Consultant Mobile App



Urban Science Sigma Award
Team Spectrum Health: Talent Connections Careers Mobile Site

Spring 2014

Auto-Owners Exposition Award
Team Urban Science: Dealer Improvement Recommender System

General Motors Praxis Award
Team Boeing: Flight Simulator Suite

TechSmith Screencast Award
Team GM: The Matrix Vehicle Simulator System

Urban Science Sigma Award
Team Quicken Loans: Mobile RFID Inventory Tracking System

For more information about
The Capstone Experience or
becoming a project sponsor, contact

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