MICHIGAN STATE UNIVERSITY

The Capstone Experience

From Students...to Professionals

COMPUTER SCIENCE AND ENGINEERING 2011-2012

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, Ford, GE Aviation, GM, IBM, Medtronic, Meijer, Microsoft, Motorola Mobility, Mozilla, Plex Systems, Raytheon, Spectrum Health System, TechSmith, Terex, Toro, the Union Pacific Railroad, and Urban Science.

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, 2011-2012

Department of Computer Science and Engineering

Michigan State University

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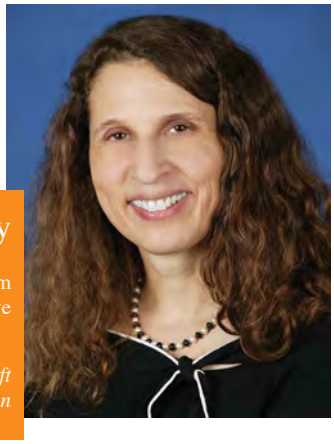


Linda Apsley

Principal Group Program Manager, Xbox Live

Microsoft
Redmond, Washington

Microsoft

"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 25 permanent hires and 18 summer interns in just the last four years."

Bob Buchanan

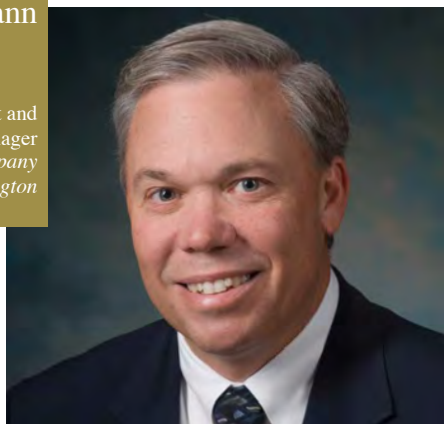
Senior Vice President, Information Systems and Technology
Auto-Owners Insurance
Lansing, Michigan

Auto-Owners Insurance
Life Home Car Business

"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."

Robert Feldmann

Vice President and General Manager
The Boeing Company
Seattle, Washington



BOEING

"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 a flight visualization system for the Navy's Blue Angels as well as complex scene rendering software for our simulation environments."

Louise Hemond-Wilson

Executive Consultant
IBM, Somers, New York

IBM

"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

Josh Kitchens

Business Analyst

Ford
Dearborn, Michigan

"The capstone course is an invaluable asset to any CSE graduate. My capstone project with Ford gave me a great understanding of what professional software development is, and gave me industry connections, which helped me start my career after graduation."

BS, CSE: December, 2010
Hometown: Ann Arbor, Michigan

Angela Mireau

Software Development Engineer

Amazon
Seattle, Washington

"Working with a business client to design and develop a large software project was a very valuable aspect of my capstone experience at MSU, which gave me an excellent head start for my career at Amazon."

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

Bill Zajac

Guardian Consultant

Compuware
Minneapolis, Minnesota

"The capstone course provided me with a challenging real-world experience working on a next generation flight deck for a commercial airliner with GE Aviation, which has given me a strong foundation for an exciting and successful career at Compuware."

BS, CSE: May 2011
Hometown: Shelby Township, Michigan

Ben Pedersen

Software Test 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

Fall 2011

Project Sponsors

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

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

The Ford Motor Company
Dearborn, Michigan

GE Aviation
Grand Rapids, Michigan

Meijer
Grand Rapids, Michigan

Motorola Mobility
Libertyville, Illinois

Sparrow Health System
Lansing, Michigan

Spectrum Health Systems
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Auto-Owners Insurance
24-Hour Road Service Mobile Apps

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

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

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

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

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

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

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

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

Michigan State University
Team Members (left to right)

Justin Hammack
Howell, Michigan

Paul Fritschen
Novi, Michigan

Lingyong Wang
Jinan, Shan Dong, China

Auto-Owners
Corporate Sponsors

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Corey Burns
Lansing, Michigan

Tony Dean
Lansing, Michigan

Priscilla Facundo
Lansing, Michigan

Scott Lake
Lansing, Michigan

Jim Schumacher
Lansing, Michigan

The Boeing Company
BAPS 2: Battle Aircraft Position Share 2

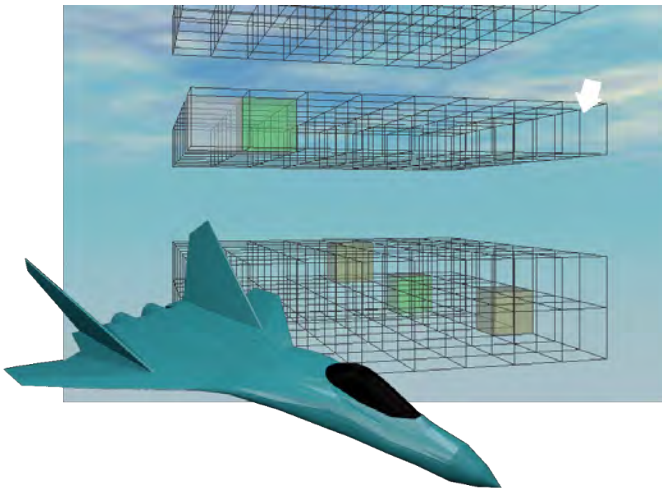
Battle Aircraft Position Share 2, or BAPS 2, is a game in which two players compete in a 3D arena to destroy their enemy's targets, which include technology centers and planes. Players must protect their own targets by intercepting enemy communications and reacting accordingly. The game occurs in real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

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

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

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

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



BOEING

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Matt Daniels
Saint Louis, Missouri

Bob Feldmann
Seattle, Washington

Jayson T. Vincent
Saint Louis, Missouri

Steve Yallaly
Saint Louis, Missouri

The Ford Motor Company
Ford Qwikboard

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

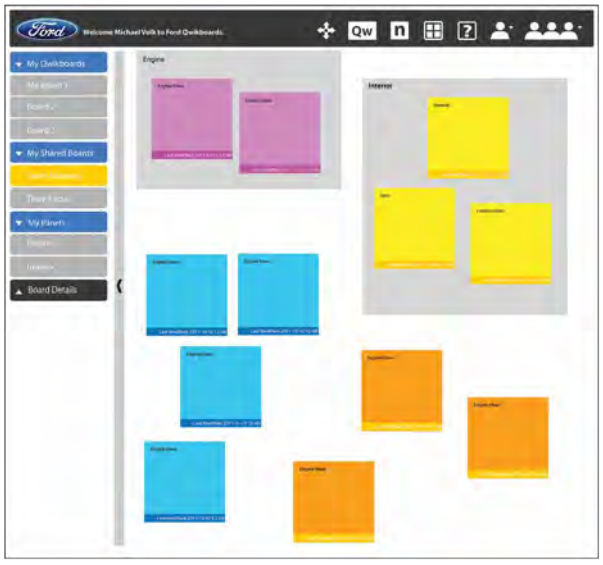
Ford Qwikboard is a "sticky note" web application that allows teams to share key ideas through text, audio, video and various office attachments. For easy organization a Qwikboard is able to be broken into different sections called panels.

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

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

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

Ford Qwikboard is written in HTML5 with Java, JavaScript, jQuery and multiple open source frameworks. It runs on any modern web browser or mobile device.



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Dearborn, Michigan

Adam Haas
Dearborn, Michigan

Gopal Kamat
Dearborn, Michigan

Michael Seneski
Dearborn, Michigan

Laura Terbrack
Dearborn, Michigan

Michael Volk
Dearborn, Michigan

GE Aviation
NextGen Aircraft Taxi Assistance

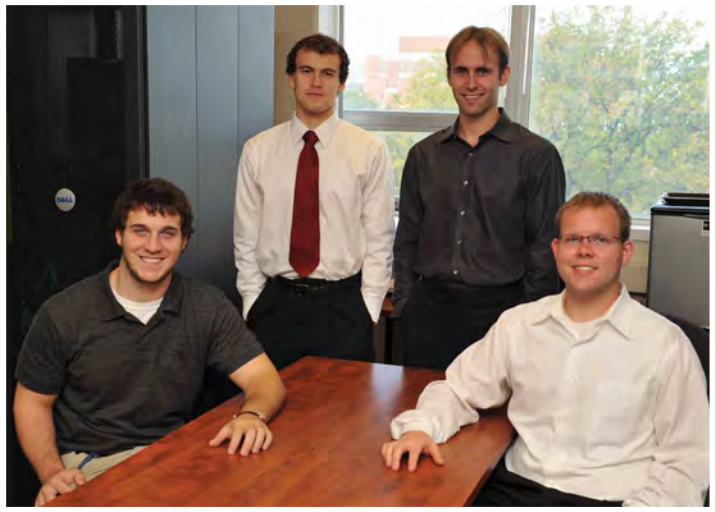
Runway and taxiway collisions account for the majority of commercial airliner accidents. In fact, the deadliest accident in aviation history occurred when two Boeing 747 jumbo jets collided in dense fog on a runway in the Canary Islands.

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

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

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

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



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Meijer
Tablet-Based Point-of-Sale System

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

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

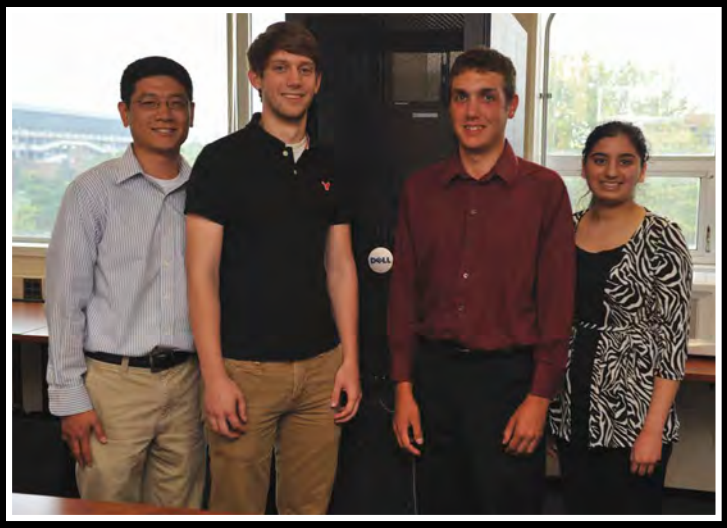
Our tablet-based system uses barcode scanners to identify each item to be purchased. It then sends a unique product identifier to Meijer's Point-of-Sale system, which responds with the specific information about the item.

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

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

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

meijer®



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Motorola Mobility
Synchronized Program Content Delivery

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

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

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

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

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

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

MOTOROLA

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Lake Orion, Michigan

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Motorola Mobility
Corporate Sponsors

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Libertyville, Illinois

Kabe VanderBaan
Libertyville, Illinois

Sparrow Health System
iSupport Device Management System

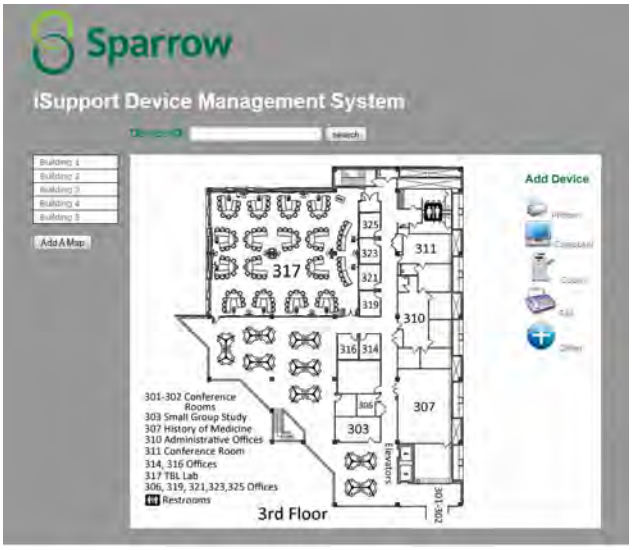
Sparrow is mid-Michigan's largest health provider, with a diverse range of services and facilities. Sparrow has two Lansing campuses, Sparrow Clinton Hospital, Sparrow Ionia Hospital, Sparrow Specialty Hospital, Michigan Athletic Club, Medical Supply, Pharmacies, Medical Groups, and dozens of other satellite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

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

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

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

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



Sparrow

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Sparrow
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Larry Leasher
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Jami Thering
Lansing, Michigan

Spectrum Health Systems
Log Monitoring Compliance

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

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

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

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

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

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

SPECTRUM HEALTH

Michigan State University
Team Members (left to right)

William D. Seeger
Bath, Michigan

Wayne Stiles
Sterling Heights, Michigan

Kathryn Bonnen
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Collin Lotus
East Lansing, Michigan

Spectrum Health
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Mary Delrue
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Grand Rapids, Michigan

Patrick O'Hare
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Grand Rapids, Michigan

Sergey Stoma
Grand Rapids, Michigan

TechSmith
Mobile Web Reporter

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

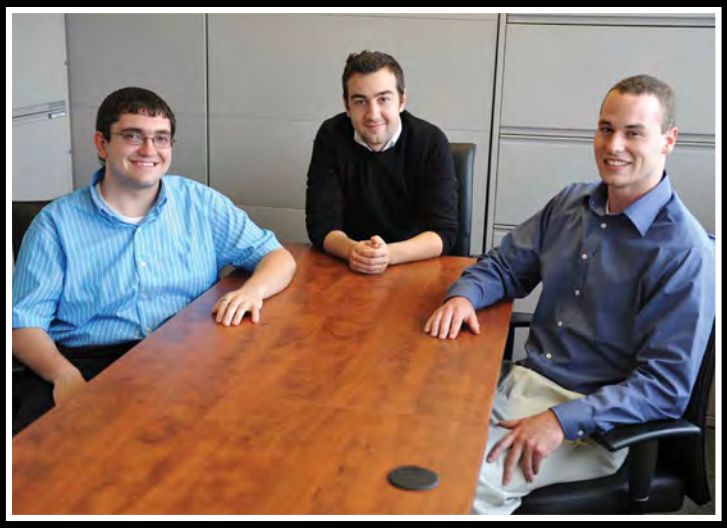
For example, let's say that you go out to eat at a restaurant with your family and, in the middle of dinner, your friends at home ask you what you think of the place. Instead of trying to explain it to them, with the Mobile Web Reporter you are simply able to take your phone, pull up online ratings,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

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

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

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

TechSmith



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Urban Science
Visual Hierarchy Selection

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

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

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

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

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

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

URBAN SCIENCE™

Michigan State University
Team Members (left to right)

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Urban Science
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Mark Colosimo
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Greg Davidson
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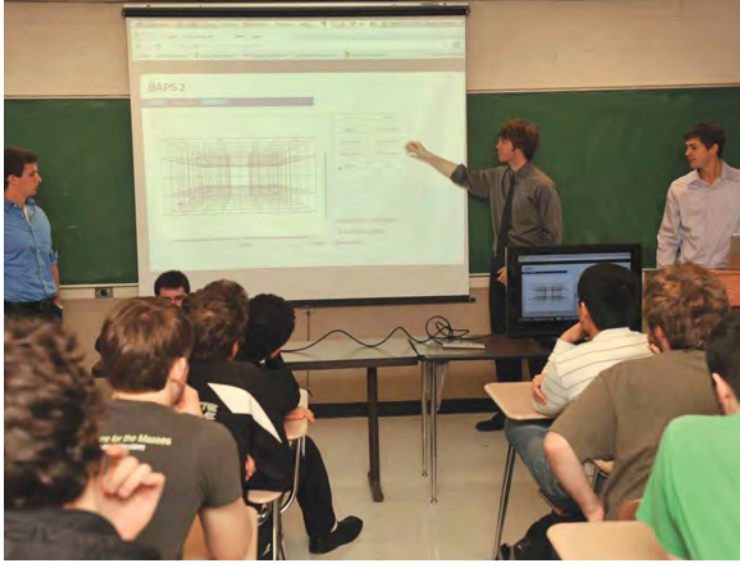

BAPS 2


meijer
Cancel
Finish


Selecting a Floor


System Architecture

Design Day Awards

CSE 498, Collaborative Design, is the senior capstone course for students majoring in computer science. Teams of students design, develop, and deliver a significant software system for corporate clients. The CSE capstone teams compete for four prestigious awards. The winners are selected on Design Day by a panel of distinguished judges.

Auto-Owners Exposition Award

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

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

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

Team Spectrum Health
Log Monitoring Compliance

William D. Seeger, Wayne Stiles, Collin Lotus, Kathryn Bonnen
Presented by Bob Buchanan and Jim Schumacher of Auto-Owners

Chrysler Praxis Award

CHRYSLER

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

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

Team Motorola Mobility
Synchronized Program Content Delivery

Paul J. Detkowski, Tareq Musleh, Timothy Belcher
Presented by Karen Wrobel of Chrysler

Design Day Judges

Ryan Abbott
Loudpixel and Science Exchange

Greg Davidson
Urban Science

Mike Drazan
Toro

Rich Enbody
Michigan State University

Adam Haas
Ford

Louise Hemond-Wilson
IBM

Vandy Johnson
Consultant

Kevin Ohl
Michigan State University

Jim Schumacher
Auto-Owners Insurance

Marty Strickler
Rose Packing Company

Karen Wrobel
Chrysler

TechSmith Screencast Award

TechSmith

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

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

Team GE Aviation
NextGen Aircraft Taxi Assistance

Johnathan Richter, Jacob Walker, Jason Cepela, Mitchell Thelen
Presented by Dean Craven of TechSmith

Urban Science Sigma Award

URBAN SCIENCE

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

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

Team Ford
Ford Qwikboard

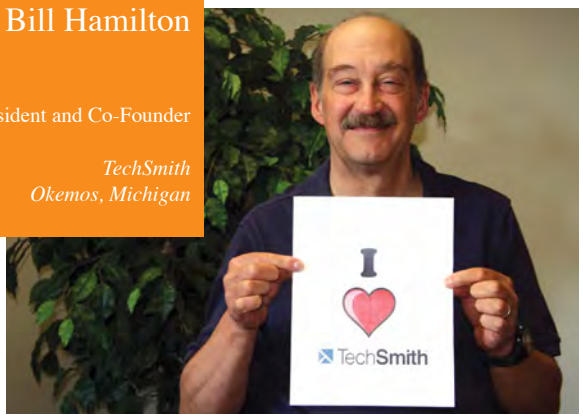
William S. White Jr., Danh Tran, Jin Hou, Luke Davis
Presented by Greg Davidson and Matt Bejin of Urban Science

Corporate Sponsors

Bill Hamilton

President and Co-Founder

TechSmith
Okemos, Michigan



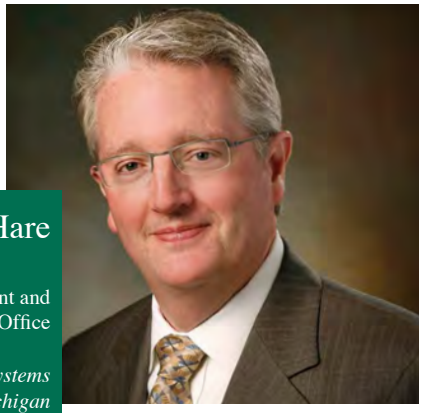
TechSmith

"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."

Patrick O'Hare

Senior Vice President and Chief Information Office

Spectrum Health Systems
Grand Rapids, Michigan



SPECTRUM HEALTH

"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."

Dave Rodgers

Vice President, Chief Information Officer

Meijer
Grand Rapids, Michigan

meijer

"Meijer is proud to have sponsored MSU capstone projects over the past two years. We have been impressed with both the capabilities of the students and the quality of the solutions they have developed. The latest project will be used by Meijer to improve the analytics within our check cashing system."

Karen Wrobel

Senior Manager

Chrysler, LLC
Auburn Hills, Michigan

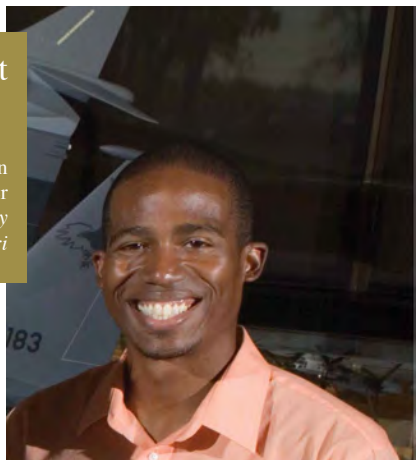
CHRYSLER

"When Chrysler recruits summer interns and permanent hires from MSU, the computer science capstone experience is an important factor on a student's resume. As both a project sponsor and a Design Day judge, I continue to be impressed by the quality of the software produced by capstone teams. The latest Chrysler capstone project will help us track key performance indicators at our Warren stamping plant."

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

Gina Chernoby

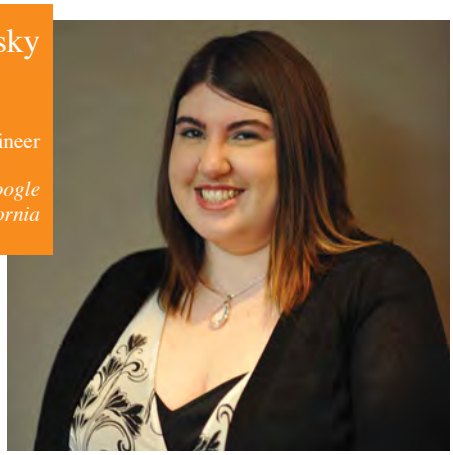
Software Development Engineer in Test II
Microsoft
Redmond, Washington

"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: May 2009
Hometown: Wyoming, Michigan

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

Joe Korolewicz

Software Developer
Auto-Owners Insurance
Lansing, Michigan

"The entire capstone course is designed to be a real-world, professional experience, which helps graduates transition from being students to professionals. Being a student member of the Auto-Owners capstone project team made me aware of the career opportunities at Auto-Owners and inspired me to apply."

BS, CSE: December 2011
Hometown: Sterling Heights, Michigan

Spring 2012

Project Sponsors

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

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

The Dow Chemical Company
Midland, Michigan

GE Aviation
Grand Rapids, Michigan

Meijer
Grand Rapids, Michigan

Motorola Mobility
Libertyville, Illinois

Mozilla Corporation
Mountain View, California

Plex Systems
Auburn Hills, Michigan

Raytheon
Fort Wayne, Indiana

Spectrum Health Systems
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Auto-Owners Insurance
Enterprise Learning Management System

Auto-Owners Insurance provides its associates many opportunities for professional development, which include courses and certifications from a variety of vendors. Our Enterprise Learning Management System (ELMS) is a web-based application designed to manage the entire professional development program of Auto-Owners.

Based on a system called Moodle, our ELMS is tailored specifically to the needs of Auto-Owners. Extensions to Moodle provide functionalities and features customized for associates, managers, and instructors, all through a web browser. Courses from many organizations such as Institute of Internal Auditors and the Life Office Management Association are integrated seamlessly providing one-stop shopping.

Our ELMS enables Auto-Owners associates to manage their own professional development. They enroll themselves in courses, view class materials, take tests, view test results, and track their progress towards each designation or certification, all within a single, user friendly web application.

Managers and instructors monitor the progress of associates, making recommendations and generating reports.

Our extensions to Moodle are easy-to-install plug-ins, making the customization of Moodle simple and easy for Auto-Owners Insurance to maintain.

Moodle is an open-source software package. Our custom extensions are written in PHP 5 and JavaScript.

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Jim Schumacher
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The Boeing Company
Design, Fly and Compete Flight Simulator

The Boeing Company is a world leader in commercial and military aircraft. They utilize complex simulation software to design and develop their products to explore how changes in design affect performance.

In order for simulations to give accurate predictions of performance, they must be a very accurate representation of actual flying conditions. Our Design, Fly and Compete Flight Simulator provides a plane flight simulator with a strong flight model, using six degrees of freedom for motion.

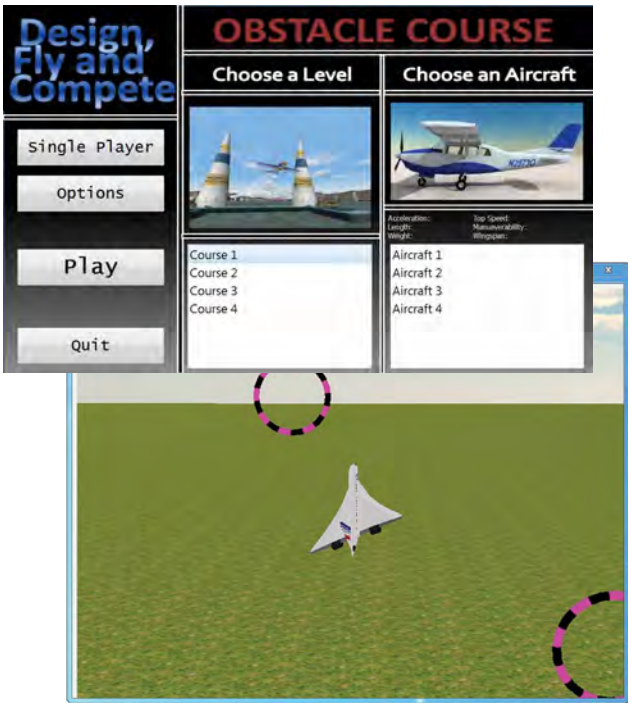
Our flight simulator features a progression system in which the user completes a series of obstacle courses, challenging their flight skills in order to unlock additional courses as well as improve their completion times.

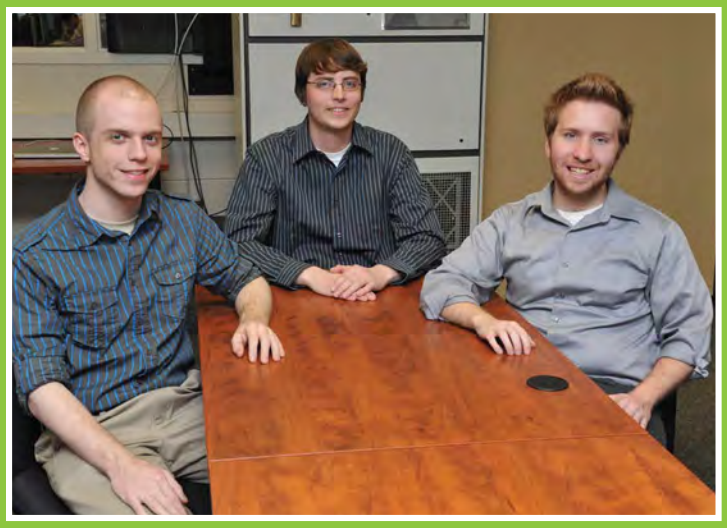
The user starts the program and enters their user name, which is used to track their progression, as well as scores on courses.

The user can choose from any of the courses available to them and see their previous best result. They can choose to run through a course in the simulator to improve their result or complete it for the first time, thereby furthering their progression through the course system.

The obstacle courses consist of a series of floating rings that must be flown through in the correct order. The rings are arranged to present various challenging maneuvers.

The program uses the Qt framework for Windows. The 3D environment is rendered by OpenSceneGraph.





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The Dow Chemical Company
Global Water Dashboard

While seemingly plentiful, water is not an unlimited resource. Without constant monitoring and proper planning, the demand for water can outpace the supply. Hence, the Dow Chemical Company continually observes water intake and stress levels at their plants throughout North America.

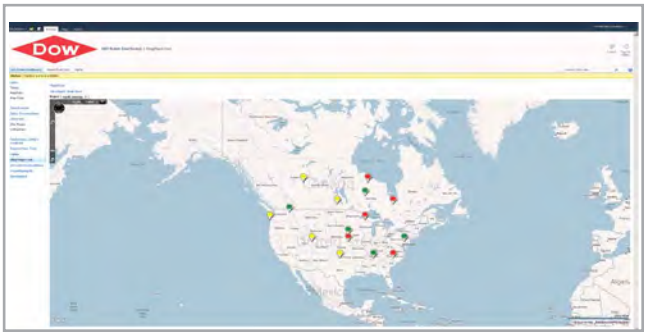
Our Global Water Dashboard is an interactive dashboard that enables Dow to analyze the water intake of their various manufacturing sites from a water basin.

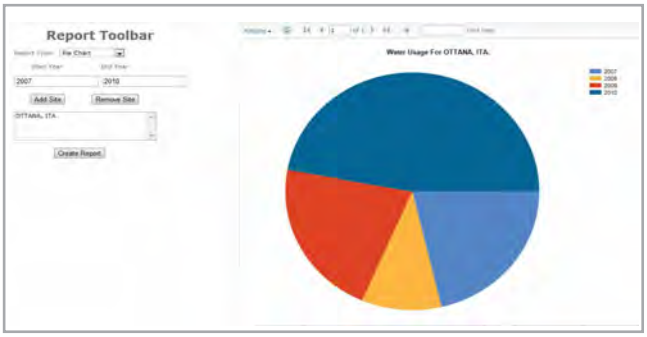
The landing page of our dashboard shows a visualization of all the data with graphs and charts, such as manufacturing units located in water stressed regions, water intake levels, and a comments section to capture water related information such as completed or planned projects and awards received.

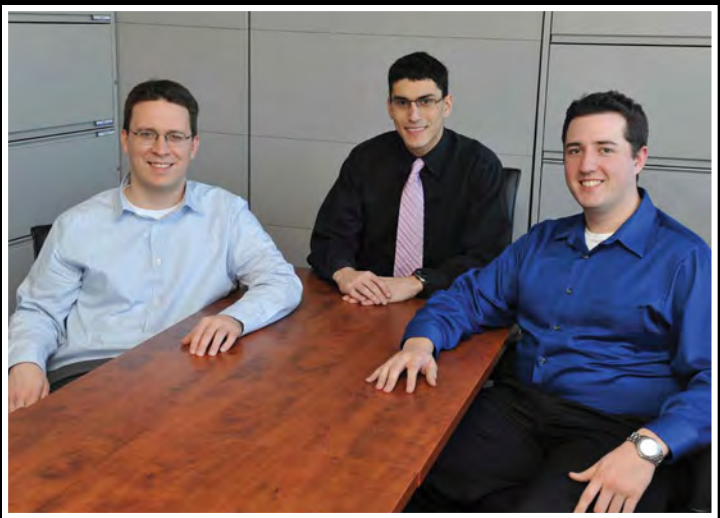
From the landing page, the user can move to the map page where the user can select sites by geographic region and view the relevant water related information. The user can then choose one or more sites for viewing the site-specific data or generating a report.

Reports can be viewed by the user on the reports page where the user can compare one or more sites based on years or other fields such as water intake type and water projects.

Our Global Water Dashboard is built in Microsoft SharePoint using Silverlight integration for Bing Maps. Sequel Server Reporting Services (SSRS) is used to generate the reports. The landing page is generated by PerformancePoint.







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GE Aviation
Mobile Avionics Weather

Pilots and air traffic controllers must have accurate up-to-date weather information both for pre-flight planning and in-flight navigation to ensure the safety of passengers and crews.

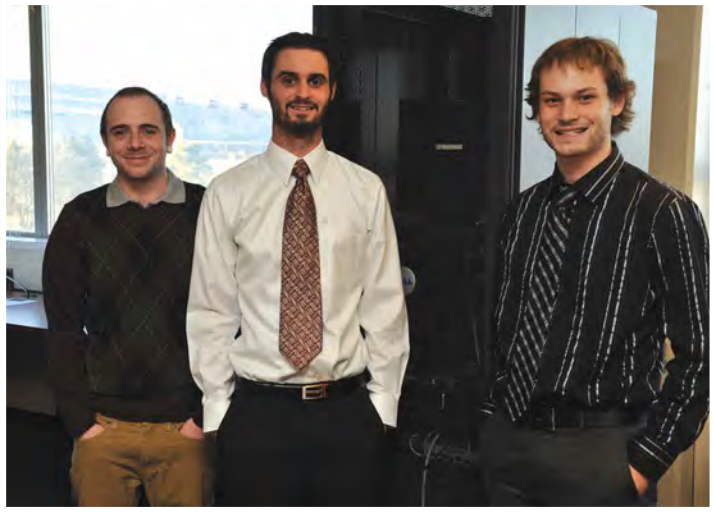
Currently, aviation professionals carry all of the necessary charts and maps in paper form. These paper charts and maps contain vital weather information such as barometric pressure, wind speeds, cloud cover and other important data relevant to their flight path.

Recently, the Federal Aviation Administration (FAA) has approved the use of iPads by pilots on the flight deck. Cutting-edge mobile technologies can now be used to provide innovative replacements for outdated technologies along with a host of new ones.

Done in collaboration with GE Aviation, our mobile aviation weather iPad application serves as a replacement for traditional paper weather charts and maps.

FAA aviation maps called sectional charts display a pilot's current location. Up-to-date weather and radar data from the National Oceanic and Atmospheric Administration (NOAA) are overlaid in a user-friendly way. Weather radar animations show the speed and direction of moving weather fronts.

Our mobile avionics weather iPad application is written in Objective-C. The aviation sectional charts are obtained from the FAA. The weather information is acquired from NOAA via RESTful web services.



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Meijer
Food Safety Audits and Reports

Meijer is a family-owned chain of supercenters committed to providing quality food and products to its customers all across the Midwestern United States. Health and food safety standards are an important part of the culture at Meijer.

Meijer has two types of health and food safety inspections, internal and external. Meijer employees complete internal audits with each department being graded with an effectiveness score. External audits are conducted by local, state, and food safety agencies like the USDA.

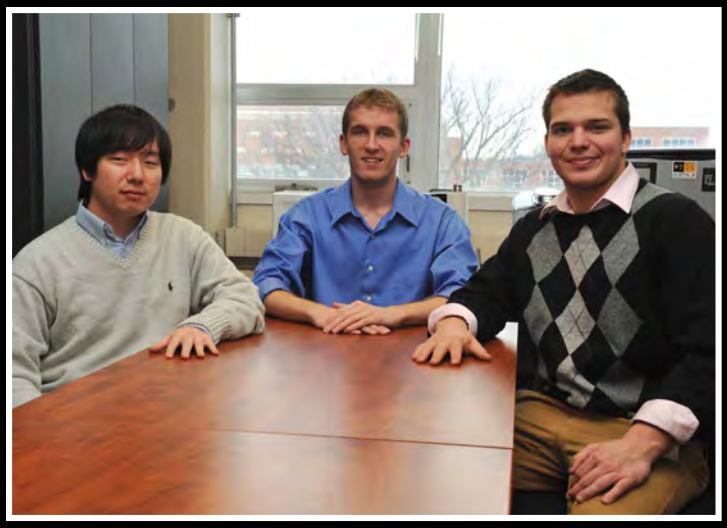
Currently, internal audits are done by paper and pencil. The resulting audits must be entered subsequently into a computer database. Safety violations are counted manually.

Our Food Safety Audits and Reports system replaces the pencil and paper system with a web-based system.

A tablet-based web application is used by internal inspectors within each store. Upon completion, the results of the inspection are automatically uploaded into Meijer's central health and food safety database.

A second web application is used by Meijer managers to view and print reports. The reports are generated by store, based on a specified date range. The reports can be viewed and printed.

Our web applications are written using HTML 5, Java Script, ASP.NET, and C#. Microsoft SQL Server 2008 is the database engine. Reports are generated using SQL Server Reporting Services.



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Motorola Mobility
Context-Driven Content Delivery

As the mobile device market continues to grow, consumers are using smart phones and tablets more and more in everyday situations.

Compared to the rapid innovations of most technology, the television viewing experience has hardly changed.

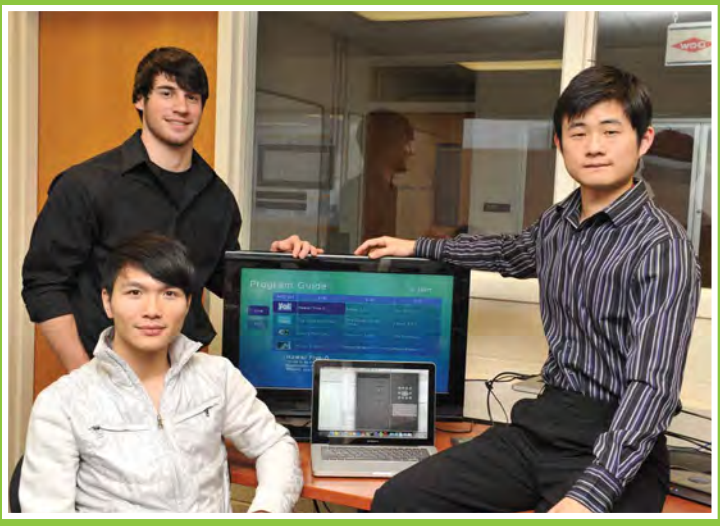
The Context-Driven Content Delivery system provides an interactive television experience. As the viewer is watching a television show, the CompleteTV Android application can display other forms of content relevant to what is currently playing on the television.

Content providers have the ability to market their products to targeted audiences by utilizing the system. For example, a content provider could set an advertisement for Walmart as soon as a character on television walks into a Walmart store.

The viewers can synchronize their mobile devices through their cable box at home or, if they are out of range of their cable box, through recording an audio sample from the program that is being viewed. The user also has the option to manually select the program from the Android application.

The Context-Driven Content Delivery system is created using Java along with the RESTful web framework and PostgreSQL. Our mobile applications are written in jQuery Mobile for optimal user experience. These applications are deployed on a Glassfish server and are optimized for the Motorola Xoom tablet device.

MOTOROLA



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Mozilla Corporation
In-Content Preferences for Firefox

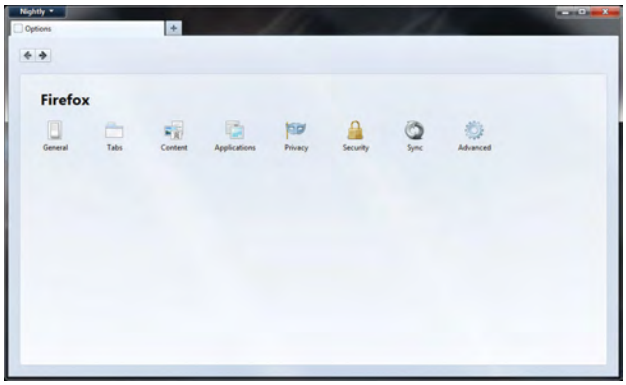
Firefox is a free and open source web browser that is managed by the Mozilla Corporation. As with all web browsers, Firefox provides users the ability to customize their experience by setting browser preferences such as selecting a homepage.

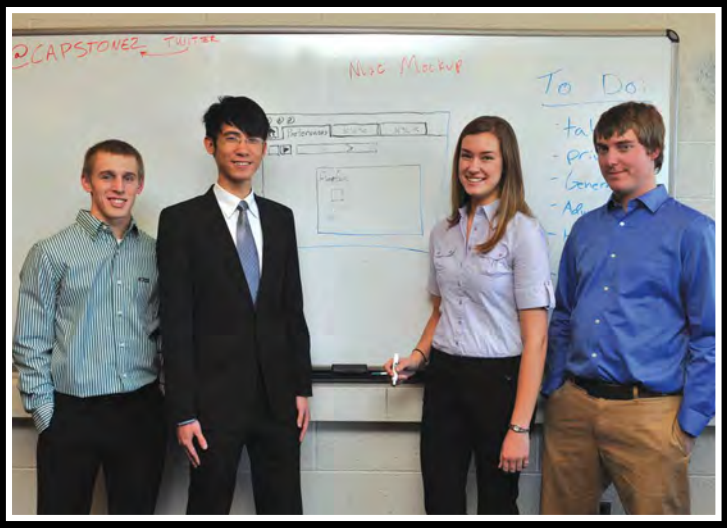
In the current version of Firefox, the controls for browser preferences are located within a pop-up window that is separate from the main Firefox window.

In their efforts to continually improve upon the web browsing experience, the Firefox User Experience team at Mozilla is working toward the goal of eliminating all pop-up windows. These will be replaced with in-content designs that appear within the main Firefox window, as shown at the right.

Done in collaboration with Mozilla, our in-content preferences for Firefox transition all of the Firefox preferences into a new in-content page within the browser. A new search feature enables users to easily find where to set particular preferences.

Utilizing an in-content design provides several benefits. The need for another easy-to-lose window is eliminated, and the experience of setting preferences is made identical across all devices. Users can more easily experiment with preferences since they can continue to use Firefox while setting preferences. Our new in-content preferences utilize XHTML and XUL to define the structure and controls on the page, CSS for visual styling and element placement, and JavaScript to specify interactive functionality.





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Plex Systems
HTML5-Based WYSIWYG Label Designer

Plex Systems is a cloud-based service provider, which offers manufacturing information technology systems to clients in a number of different industries.

A challenge for any cloud-based service is ensuring the ease of customizability of business processes to end users. One such challenge comes from creating additional customized formats for shipping labels.

Currently, the creation of a new format for a shipping label is a manual multi-step process. A customer must first lay out the desired design on paper, measure where element locations are to be placed, and provide detailed textual information describing the label to Plex. Subsequently, Plex must manually enter this information into the customer database, after which that label becomes available for use by the customer.

To simplify this process, our HTML5-Based WYSIWYG (What You See Is What You Get) Label Designer allows customers to create and format labels directly in a web application. These labels are saved into the customer database in the appropriate format for immediate use. Our software eliminates the hand work and enables customers to have direct control over which labels are available to them without required intervention by Plex.

Our HTML5-Based WYSIWYG Label Designer is built using HTML5 and JavaScript, and designed to run in common web browsers. Label layouts are stored in a SQL database using SQL Server 2008 and retrieved using JSON and ASP.NET.

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Raytheon
Android VoIP Communications System

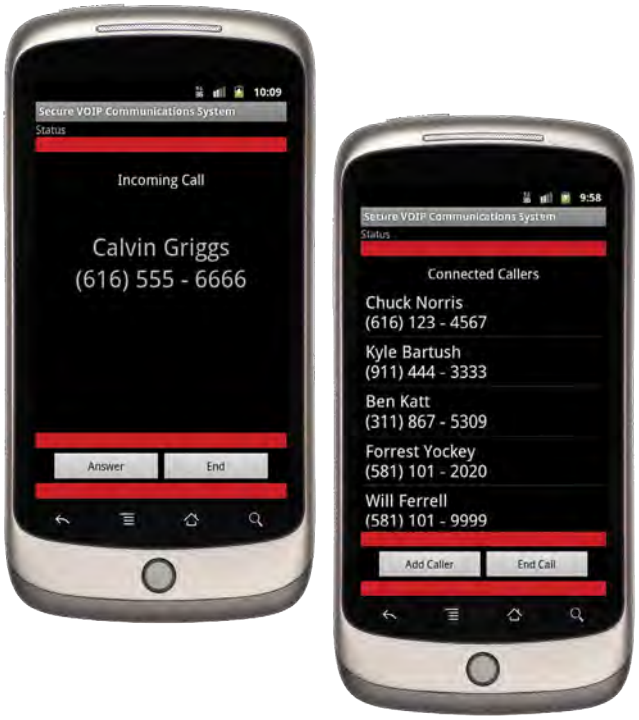
Voice communication is an essential feature for command and control (C2) applications used in emergency management situations or combat settings. The Android VoIP Communications System enables mobile C2 users to transmit critical information over multiple voice channels and thereby exchange information efficiently and effectively.

Our system provides both one-to-one communication and group collaboration. The latter enables tactical operations centers to provide groups of personnel with situational awareness data quickly.

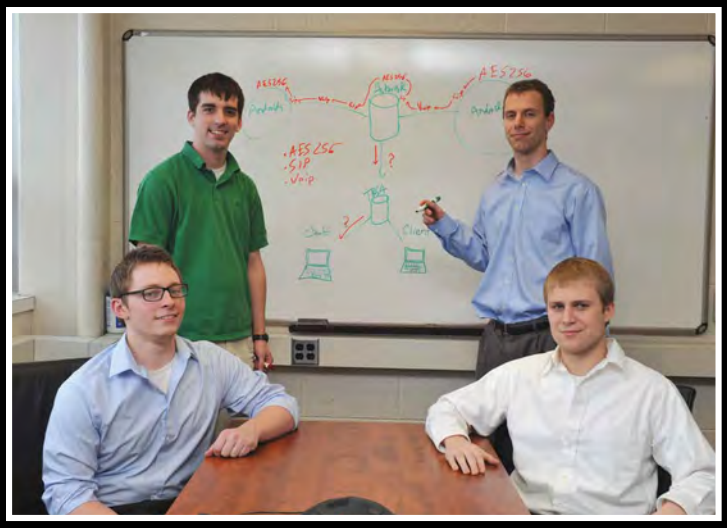
In addition to beginning and ending calls, our system also allows one user to invite another user onto an existing call. A separate desktop application enables users at operation centers to participate in calls, and to listen to previously recorded conversations.

In an effort to simplify radio configuration in a C2 setting, the system also allows radios to be configured in a hands-free manner. Nearby radios can be configured with appropriate voice commands. A confirmation message is sent back to the Android phone for the user to verify the current state of a reconfigured radio.

Our Android VoIP Communications System is developed with the Android SDK. Calls are managed with the Session Initiation Protocol (SIP) standard. An Asterisk server handles the routing of calls. The entire system is integrated into Raytheon's existing C2 application.



Raytheon



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Spectrum Health Systems
Web Applications for Healthier Communities

Healthier Communities is a volunteer health services program sponsored by Spectrum Health, the largest health care provider in Western Michigan. Healthier Communities provides medical outreach to the underserved populations.

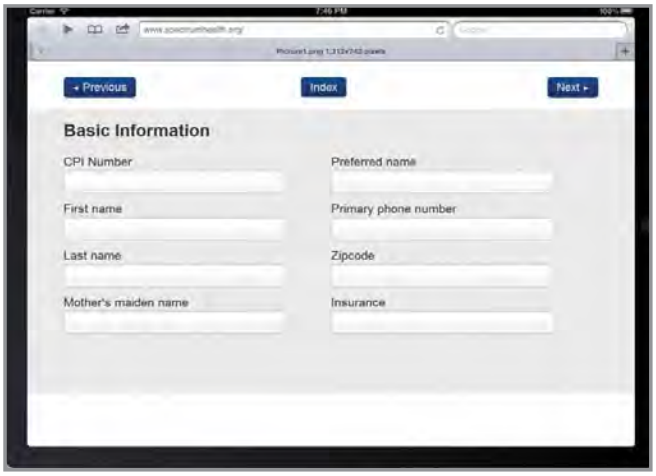
In 2010, Community Health Workers made 2,599 home visits to 477 participants to collect health data to ensure that they are getting better and staying healthy. Currently, the process of collecting this health data involves the completion of a 23-page paper form, which subsequently must be entered entered into a computer.

Working with leaders of Healthier Communities and the technical department of Spectrum Health, we have made the entire process digital. Our Web Applications for Healthier Communities system replaces the 23-page paper form with a user friendly iPad web application connected to a database at Spectrum Health.

After logging in, the user simply presses a button to select a participant, open up their file, and start collecting information. They can save, load, and manage participant information with the touch of a finger, without the stack of paper.

One of our application's most appealing features is its look and feel. Even though it is a web application, it appears to the user as a native iPad application.

Our Web Applications for Healthier Communities system is written in C# with JavaScript and is supported by a backend SQL database.



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TechSmith
Mobile Smart Video Player

TechSmith is the world leader in screen recording software with millions of users creating informational and educational content. Their content creation products generate valuable metadata that can enhance the viewing experience.

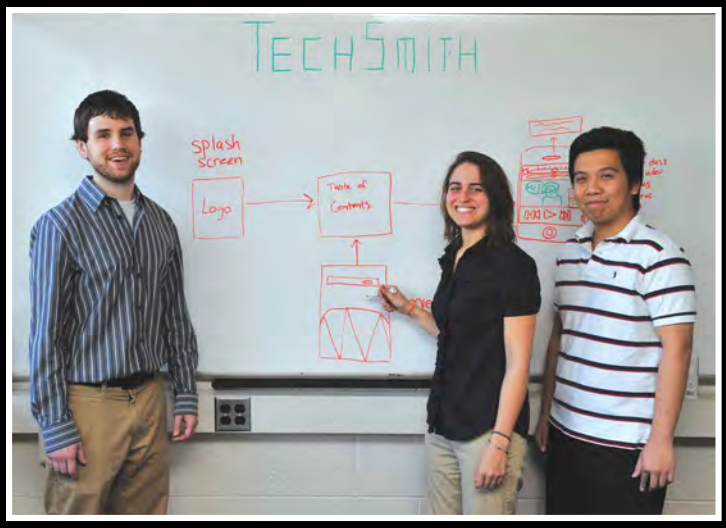
Our Mobile Smart Video Player is an iPhone/iPad application that makes use of this metadata, extending the functionality of TechSmith's Camtasia Studio screen-capture editing software to a mobile environment. It learns what video content is most relevant by sampling each user's tags and by displaying the optimal content to all users.

While watching a screen-capture movie using the Mobile Smart Video Player, a user can gesture to add a bookmark, an on-screen comment about the content, or a SmartFocus zooming or panning point.

Every user-generated tag is added to a database to which tags from users worldwide are constantly being added. The most commonly-placed tags are pulled from this crowd-sourced collection onto all users' iPhones and iPads. Each individual user has the option of viewing their own data alone or the most popular crowd-sourced data from around the world.

Our Mobile Smart Video Player is written in Objective-C. Video content comes from Camtasia Studio. The XML metadata is parsed using Google libraries and is stored in a Microsoft SQL Server database. Our player communicates with the server via the RESTful Open Data Protocol.

TechSmith



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Urban Science
Infographics Generator

Urban Science serves the automotive industry by improving the sales and services of its customers using comprehensive data driven analysis of key performance indicators. The results produce higher sales and better services at lower costs.

Our Infographics Generator provides an innovative way to visualize these key performance indicators, helping teams track effectiveness in their primary market areas. Our visualizations serve as a bridge, transporting users from a confusing table of numbers to a vibrant display of relevant information.

The key performance indicators are divided into three main categories: sales, lead management and service. Each category represents a major slice of business. Our drill down display provides a more in-depth explanation of the information shown on the infographic.

An infographic element, a subsection of an entire infographic, can be selected to display a trend chart covering the last six months of data along with a more detailed description of that element.

Our Infographics Generator is a web application designed for use on the iPad. Our web application supports typical touch gestures such as swipe gestures that one would expect on a tablet, thereby giving users the feel of a native application.

Our Infographics Generator is written using HTML5 and JavaScript. Data for the infographics generator is stored using a SQL Server 2008 database then sent in JSON format to the iPad's local storage for fast retrieval.

URBAN SCIENCE

Michigan State University
Team Members (left to right)

Lok Cheung
Hong Kong, China

Kevin Shreve
Brighton, Michigan

Peter Chen
Taipei, Taiwan

Louis Bodnar
Livonia, Michigan

Urban Science
Project Sponsors

Matt Bejin
Detroit, Michigan

Greg Davidson
Detroit, Michigan

Ryan Hespenheide
Detroit, Michigan

Shannon Muldowney
Detroit, Michigan


System Architecture


Design, Fly and Compete
Choose a Level
Choose an Aircraft


Dow


Preferences Page Architecture


Image Edit


Screen Mockup: VoIP Call


Aggregation

Design Day Awards

CSE 498, Collaborative Design, is the senior capstone course for students majoring in computer science. Teams of students design, develop, and deliver a significant software system for corporate clients. The CSE capstone teams compete for four prestigious awards. The winners are selected on Design Day by a panel of distinguished judges.

Auto-Owners Exposition Award

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

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

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

Team Mozilla
In-Content Preferences for Firefox

Joe Chen, Jon Rietveld, Owen Carpenter, Devan Sayles
Presented by Scott Lake of Auto-Owners Insurance

Chrysler Praxis Award

CHRYSLER

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

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

Team Boeing
Design, Fly and Compete Flight Simulator

David Cornelius, Jon Moore, Brandon Overall
Presented by Karen Wrobel of Chrysler

Spring 2012

Design Day Judges

Greg Davidson
Urban Science

Rich Enbody
Michigan State University

Adam Haas
Ford

Louise Hemond-Wilson
IBM

Brian Loomis
Microsoft

Patrick O'Hare
Spectrum Health

Kevin Ohl
Michigan State University

Marty Strickler
Rose Packing Company

Karen Wrobel
Chrysler

TechSmith Screencast Award

Each CSE 498 capstone team produces a video that describes and demonstrates their software product. Starting with a storyboard and a script, teams use Camtasia Studio 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 Plex Systems
HTML5-Based WYSIWYG Label Designer

Andrew Melfi, Michele Winsky, Matt Duffy
Presented by Dean Craven of TechSmith

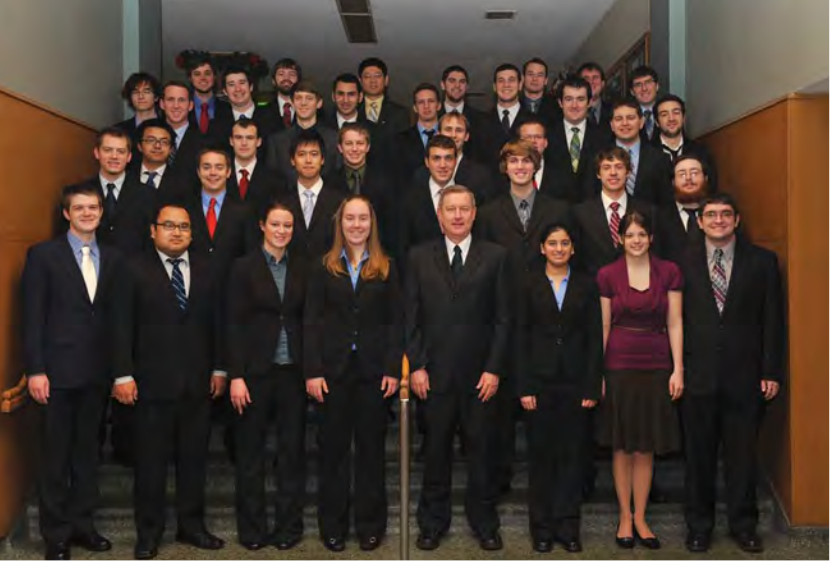
Urban Science Sigma Award

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

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

Team GE Aviation
Mobile Avionics Weather

Drew Space, Mike Dunn, Eric Cook
Presented by Matt Bejin and Greg Davidson of Urban Science




WILDCATS


URBAN SCIENCE


FIRE EXTINGUISHER


MSU
UNION

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

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