MICHIGAN STATE
UNIVERSITY

The Capstone Experience

From Students...to Professionals

COMPUTER SCIENCE AND ENGINEERING 2014-2015

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 Amazon, Auto-Owners Insurance, Boeing, Bosch, Chrysler, Dow Chemical, Electronic Arts, Ford, GE Aviation, GM, Google, IBM, Meijer, Microsoft, Mozilla, MSU Federal Credit Union, Quicken Loans, Spectrum Health, 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 throughout the Engineering Building.

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, 2014-2015

Department of Computer Science and Engineering

Michigan State University

Corporate Sponsors

Peter Faricy

Vice President
Amazon Marketplace

Amazon
Seattle, Washington

amazon.com

"Capstone courses provide students with real-world experiences within the global online retail industry. Students get to apply what they've learned in the classroom to actual business problems. The most recent Amazon student capstone team produced a software system that is designed to improve and optimize the experience of Amazon's third–party sellers."

Jim Schumacher

Senior Vice President ,
Information Systems
and Technology

Auto-Owners Insurance
Lansing, Michigan

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

"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 Michigan State University graduates."

Randy Mott

Senior Vice President and
Chief Information Officer

General Motors
Detroit, Michigan

GM

"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."

Linglong He

Chief Information Officer

Quicken Loans
Detroit, Michigan

Quicken Loans
Engineered to Amaze

"Michigan State's Capstone project plays a vital role in ensuring our young, talented men and women receive the hands-on experience and contacts needed to lay the foundation for a great career in technology. We've hired several students that have participated in the Capstone program that now work on critical projects at Quicken Loans and take part in Detroit's technology-driven revival."

Capstone Alumni

Mairin Chesney

Data Analysis
Software Engineer

Google
Mountain View, California

"The capstone experience at MSU was invaluable on multiple fronts. From a technical perspective, we learned about the software design process from conception to completion. From an interpersonal perspective, we learned about the trials and joys of working on a team. On all fronts, this experience was phenomenal preparation for my job as a Google software engineer."

BS, CSE: May 2015
Hometown: Brighton, 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

Justin Fila

Software Engineer

TechSmith
Okemos, Michigan

"As a Michigan native, I wanted to pursue my career within the state. I was thrilled to discover my company, TechSmith, near MSU in Okemos, Michigan. TechSmith is one of many capstone course project sponsors located within Michigan. I am very grateful for the exposure I received and the experience I gained from it."

BS, CSE: December 2014
Hometown: Norway, Michigan

Austin Huynh

Associate 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: May 2015
Hometown: Jackson, Michigan

Fall 2014

Project Sponsors

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

Amazon
Seattle, Washington & Detroit, Michigan

Auto-Owners Insurance
Lansing, Michigan

Bosch
Farmington Hills, Michigan

Ford Motor Company
Dearborn, Michigan

General Motors
Detroit, Michigan

Meijer
Grand Rapids, Michigan

MSU Federal Credit Union
East Lansing, Michigan

Quicken Loans
Detroit, Michigan

Spectrum Health
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Whirlpool Corporation
Benton Harbor, Michigan

Amazon
Twitter Trending Effects on Amazon Sellers

Amazon Marketplace provides a platform for individuals and businesses to sell products to hundreds of millions of online customers. Since more than 40% of Amazon unit sales now result from third-party sellers, Amazon is committed to improving and optimizing their experiences.

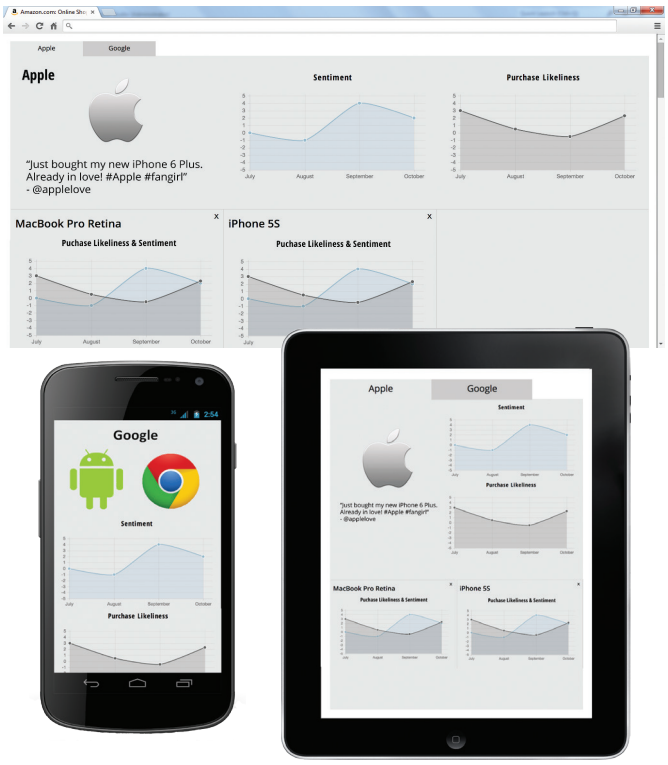
One of the main challenges faced by Amazon sellers is that of determining what products to stock and in what quantities. To assist them, the Amazon Seller Services team would like to provide its sellers with a free and fast alternative to traditional market studies, which are expensive and time-consuming.

Our Twitter Trending Effects on Amazon Sellers system analyzes Twitter tweets to determine what Amazon products consumers are talking about, what they think of them, and what products Amazon customers are buying.

These Twitter trends are displayed in a responsive, real-time dashboard that Amazon sellers customize for their specific needs, adjusting timeframes and overlaying data sets for comparison. Information about a particular brand or product includes the volume of tweets, the overall positive or negative sentiment and the sentiment of tweeters who mention owning it or purchasing it.

Using our dashboard to forecast the popularity of brands and products, Amazon sellers can make better-informed decisions for the types and quantities of products they stock.

Our system is written in Java using the Kinesis, Redshift, and Elastic Compute Cloud (EC2) Amazon Web Services with a cloud-hosted Ruby on Rails web interface.



amazon

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Amazon
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Auto-Owners Insurance
Navigation Assistant and Accident History App

Auto-Owners Insurance is a Fortune 500 company working with more than 6,200 independent agencies in 26 states. Founded in 1916, Auto-Owners continually improves their products and services for their policyholders.

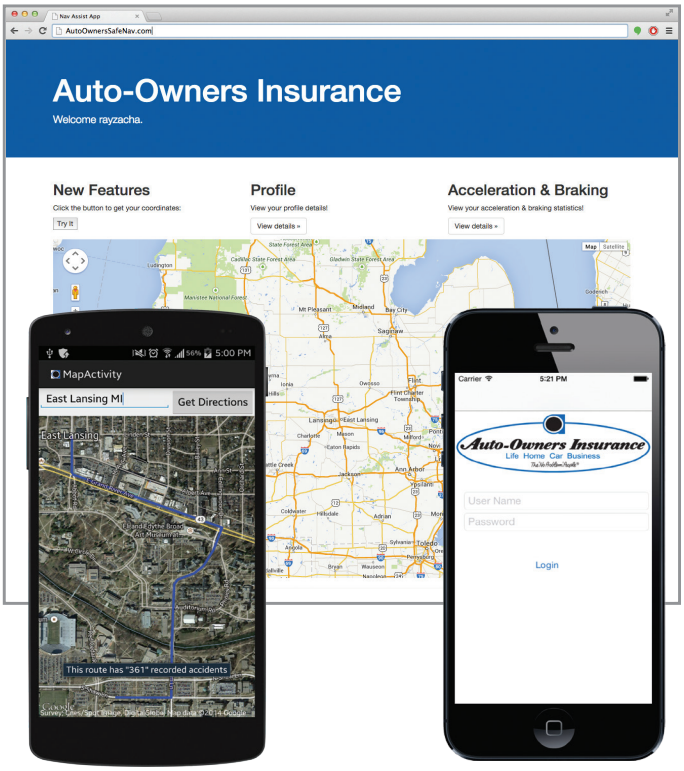
Our Navigation Assistant and Accident History App gives customers tools to help them practice safer driving habits. By learning and suggesting safer driving routes, as well as tracking and displaying basic driving statistics, it helps users reduce the likelihood of getting into accidents.

In order to do this, the mobile app keeps track of a user's frequently visited locations via GPS. Once the app learns a user's frequent locations, the app analyzes the routes between them. After the safest option is found, the user is sent a notification before departing to their next location. This notice provides the user with new directions to their destination.

Each customer has a profile that includes information about their driving habits. They can view how often they take safer routes, maps of frequently visited locations, as well as their acceleration and deceleration patterns. This information is available using either the mobile app or the online web app.

The web app gives Auto-Owners administrators an overview of general driving statistics, which enables them to gauge the effectiveness that the mobile app has on creating and encouraging safer driving habits.

The Android and web apps are written in Java; the iOS app is written in objective-C. Customer data is stored using SQL Server and accessed through a web service written in C#.



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The No Problem People®

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Bosch
Mobile App for XCP Measurement and Calibration

Bosch is a global engineering and electronics company with products sold in 150 countries worldwide. In addition to its industrial and building lines of products, Bosch is the world's leading supplier of automotive components.

Today's cars and trucks include up to 50 computers which monitor, control and regulate many things such as fuel efficiency, emissions and braking.

Our Mobile App for XCP Measurement and Calibration gives automotive engineers a quick and easy way to interact with a vehicle's computers wirelessly using any Android device.

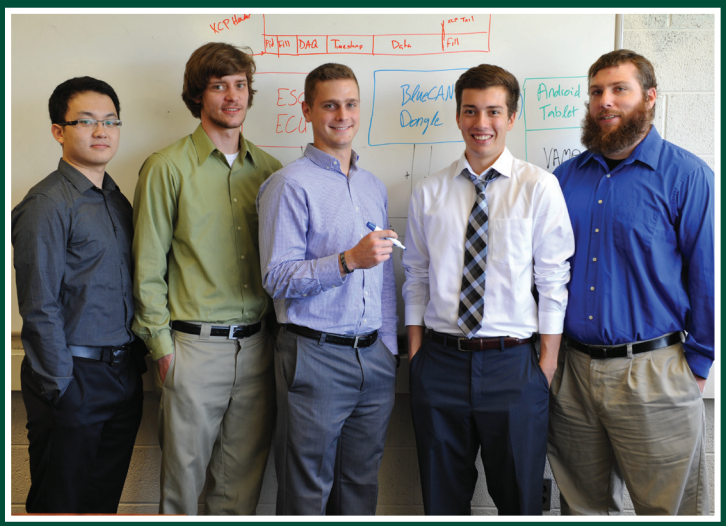
A vehicle's computers provide a wide variety of measurements about performance such as the wheel speed or the steering angle. Using our app, these values can be viewed in real-time or stored for analysis later.

Our mobile Android app gives users the ability to identify problems quickly. The measurement and calibration features of our app can be used to adjust settings to improve a vehicle's overall performance.

The computers in cars and trucks communicate with each other using a network protocol called the Universal Measurement and Calibration Protocol or XCP. Our Android app abstracts the details of this protocol, making access to the computers transparent and easy for the user.

Our Mobile App for XCP Measurement and Calibration is written in Java for the Android platform. The primary component of our project is a standalone Java library with an Android application used as a control interface.

BOSCH
Invented for life



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Ford Motor Company
Vehicle Audit Analytics

Ford Motor Company manufactures and sells Ford and Lincoln cars and trucks across six continents with 181,000 employees and 70 plants worldwide.

Ford takes a data driven approach to all aspects of designing, developing and manufacturing vehicles by critically evaluating Ford and Lincoln products against their global competitors to ensure that Ford designs are the very best.

Called "vehicle audits," this evaluative process is currently done manually by designers using spreadsheets and, in some instances, even paper forms.

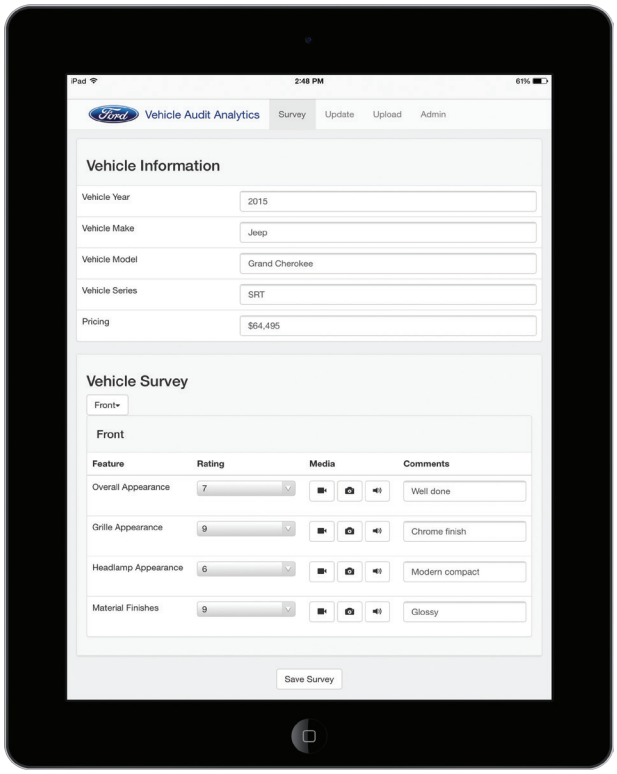
Our Vehicle Audit Analytics software automates and simplifies the vehicle audit process with an easy-to-use mobile web app. Ford designers compare Ford and Lincoln products against those of their competitors using their mobile devices.

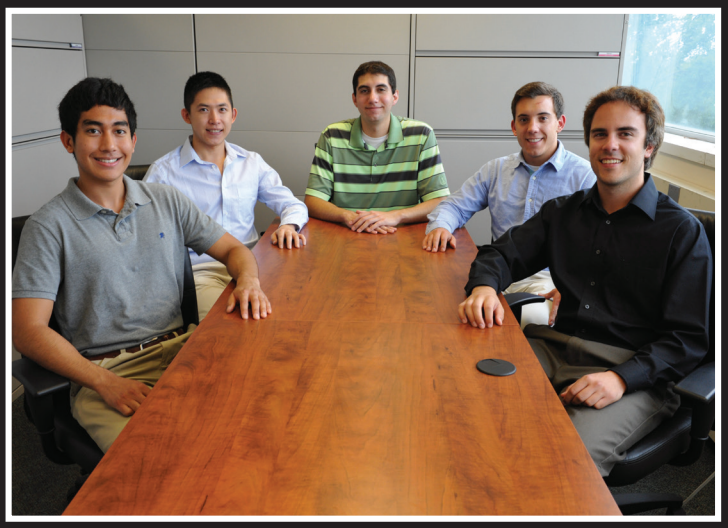
Vehicle audit analytic data is generated by responding to survey questions simply with the touch of a finger. Users can augment responses by adding video, photos and audio.

By automating and simplifying the audit process, our Vehicle Audit Analytics application decreases audit and analysis time. All of the audit data is consolidated into a central location, which results in better data and faster audits.

Our web app works seamlessly both with and without an Internet connection.

Our Vehicle Audit Analytics software uses HTML5, Bootstrap, AngularJS, and Java, SQL Server 2012 and Apache Tomcat.





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General Motors
Productivity Toolbar (aka Fast App Launcher)

General Motors is one of the world's foremost designers and manufacturers of cars and trucks sold in more than 120 countries. Headquartered in Detroit, Michigan, GM's 212,000-plus employees work in 396 facilities spanning six continents.

GM employees depend heavily on desktop and web applications including hundreds developed by GM. With so many applications, finding and launching those most important to a particular person's work is challenging.

Our Productivity Toolbar, also known as Fast App Launcher, enables GM employees to find and launch the computer applications most important to their work quickly and easily.

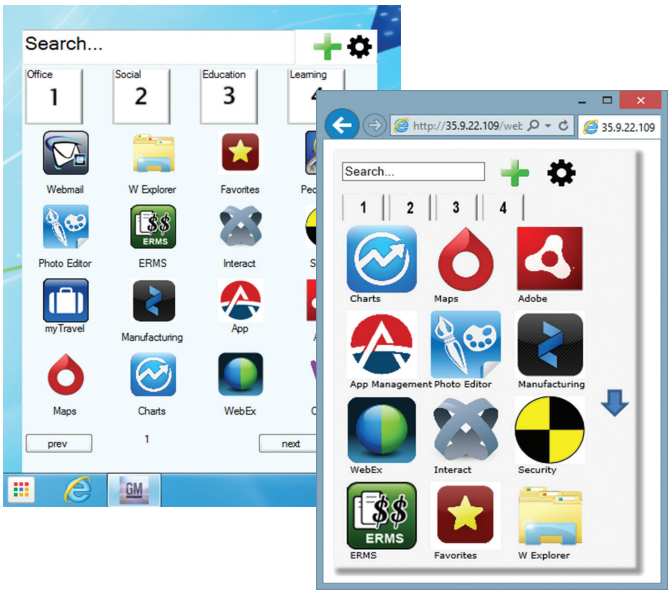
Using the Productivity Toolbar, employees create personalized pages displaying icons of their most used apps. The toolbar is used to launch both desktop apps and web apps.

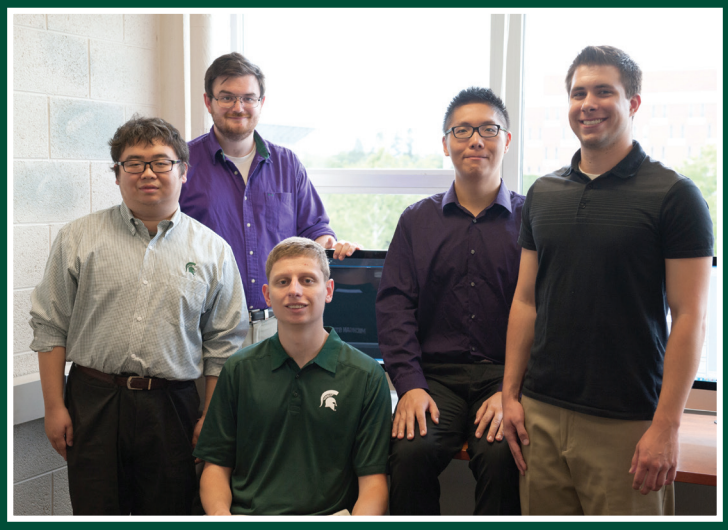
In addition to launching apps, the Productivity Toolbar can be used to personalize the location and appearance of the apps.

Applications written by GM are added to the Productivity Toolbar from the General Motors Application Store. Employees use the toolbar to search for apps by name, category and tags, and then add them to their personalized launcher.

Our Productivity Toolbar runs both as a native desktop app on Windows 7 and as a web app in Internet Explorer.

Application information is maintained in a MySQL database. The desktop app is scripted in C#; the web app is written in JavaScript with AJAX.





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Meijer
Mobile Location-Based Product Promotion

With over 200 stores, Meijer serves the Midwest as one of the largest supermarket chains in the country. Having created the first modern supercenter in 1963, Meijer is known for customer service and continual innovation.

Meijer is revolutionizing today's shopping experience in many ways including the way that product promotions are delivered to its customers.

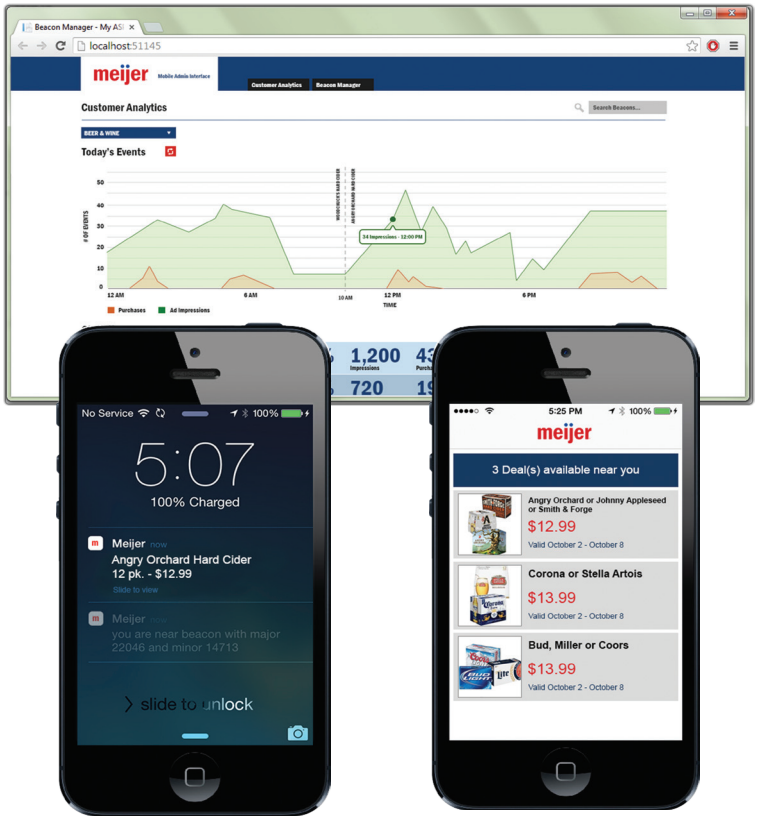
Our Mobile Location-Based Product Promotion system features an iPhone app that shows product promotions based on a customer's location within any Meijer store. For example, when walking down the cereal aisle, a customer may be alerted that their favorite cereal is on sale.

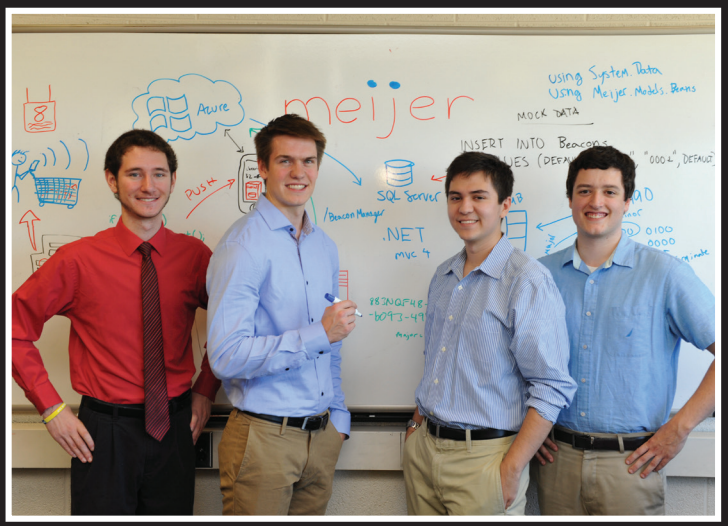
Our iPhone app determines a customer's location in a store using strategically placed devices called iBeacons, which communicate with iPhones using Bluetooth. When a customer walks within range of an iBeacon, a notification appears on their phone showing all nearby product promotions and sales.

In addition to our iPhone app, our system includes a web app with which Meijer team members create, edit and delete iBeacon product promotions and sales.

Our web app also displays customer analytics enabling Meijer and its vendor partners to evaluate the impact of location-based promotions on buying decisions.

Our iPhone app is written in C# while our administrator interface is built with HTML, CSS and AngularJS. Microsoft Azure hosts the administrator website and database which uses SQL Server 2012.





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MSU Federal Credit Union
Refer A Friend Website and Mobile App

Michigan State University Federal Credit Union (MSUFCU) is the world's largest university-based credit union, offering a full range of personal and business related financial services to Michigan State University and Oakland University faculty, staff, students, alumni association members, and their families worldwide.

Maintaining and growing membership is a priority for MSUFCU. Our Refer a Friend Website provides a means to keep current members happy while also growing the MSUFCU family by encouraging new individuals to join.

Our Refer a Friend Website assigns each existing MSUFCU member a unique referral code, which they can share quickly and easily through Facebook, Twitter and email.

When the referrer's friends or family members click through the shared link, they are presented with the choice either to print out the referral code to bring into a local credit union branch or to begin the process of opening an account online.

After a referred account is created, both the existing member and the new member are given their reward.

Referring members are able to track how many of their referrals result in new accounts and the reward they receive on the main page of the referral website.

Our Refer a Friend Website is responsive and works well on both mobile and desktop browsers. It is written in PHP, HTML, JavaScript, and uses the Bootstrap framework. It runs on an Apache webserver and uses MySQL database.

MICHIGAN STATE UNIVERSITY
FEDERAL CREDIT UNION
Building Dreams Together

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Quicken Loans
Enterprise Architecture Visualizer

Quicken Loans, headquartered in Detroit, Michigan, is the largest online retail mortgage lender and the second largest overall retail lender in the US. With almost 30 years of experience, their customers include over 2 million American families.

The term "enterprise architecture" refers to the components that make up an enterprise's information technology (IT) system, and the relationships and dependencies between those components. For large organizations, enterprise architectures are very complex and often difficult to grasp.

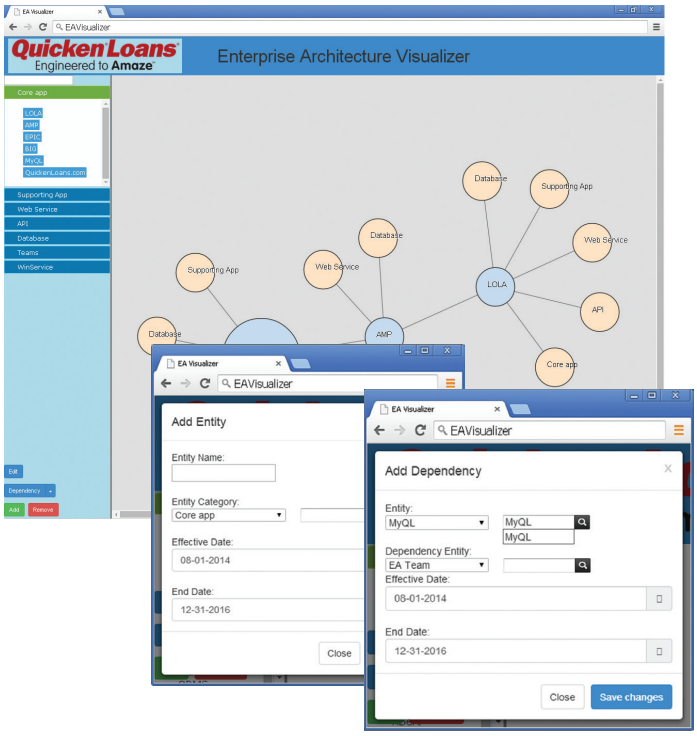
Our Enterprise Architecture Visualizer displays the enterprise architecture of Quicken Loans using an intuitive graphical user interface, making it easier to understand, maintain and grow.

Each IT component, such as a server or an app, is represented by a graphical icon. Once selected, a component is centered in the window and displayed with its dependencies, showing its place within the overall IT system.

Administrative users can add, remove and edit components along with their dependencies as changes are made or planned. Snapshots of the entire enterprise architecture can be saved and retrieved by date including future dates for envisioned plans.

Our Enterprise Architecture Visualizer is a web app targeted for Google Chrome on desktops and laptops.

Our system is written using Visual Studio 2012. The backend database is Microsoft SQL Server 2008 R2. The website is hosted using Microsoft Internet Information Services.



Quicken Loans®
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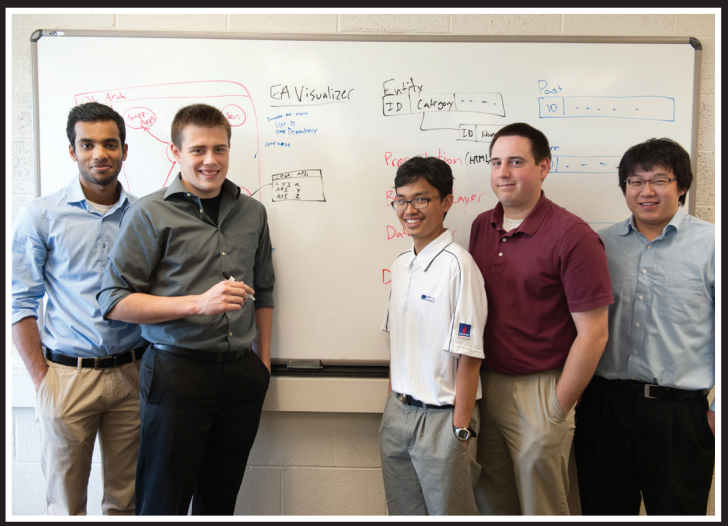

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Spectrum Health
Employee Discount Mobile App

Spectrum Health is a not-for-profit health system, based in Grand Rapids Michigan, offering a full range of care throughout the Spectrum Health Hospital Group, which is comprised of 11 hospitals, 170 ambulatory service sites, and over 1080 employed physicians.

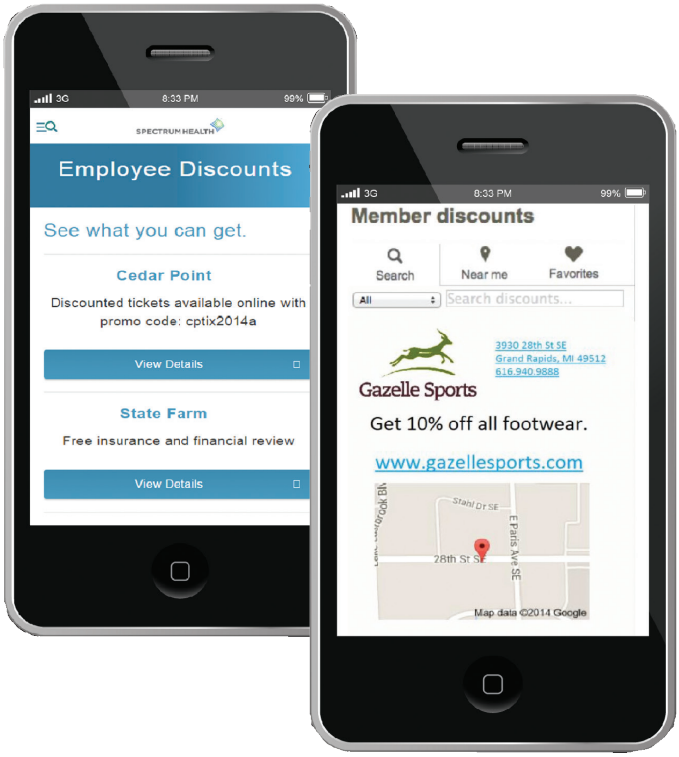
Spectrum Health employees enjoy discounts on goods and services from a variety of vendors. While previously only accessible using a website at work, our Employee Discount Mobile App now gives Spectrum Health employees access to these discounts from anywhere using their mobile devices.

Spectrum Health employees start at the Employee Discounts landing page shown in the left iPhone image. A task bar allows a user to search through all the discounts either by name or by category.

After selecting a particular discount, a user is given more information than the original snippet found on the landing page. This additional information, shown in the right iPhone image, may include the address of the location offering the discount and sometimes a special discount code.

By providing a mobile way of searching and viewing discounts, Spectrum Health employees can now take better advantage of the employee discount system.

Our Employee Discount Mobile App runs on all phones and tablets of varying sizes. The back end of our system is written in C#, with ASP.net MVC 4.0. The front end uses AngularJS, HTML and CSS.



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TechSmith
GroupWork for Google Chrome

Based in Okemos, Michigan, TechSmith provides over 180 countries around the world with computer screen capture and recording software. TechSmith's tools are designed to work across multiple devices and locations.

GroupWork for Google Chrome provides a quick and seamless way for groups of people to work collaboratively using TechSmith software, most notably Snagit and Camtasia.

GroupWork users create groups of workers and projects on which to collaborate. Groups are assigned to projects and tasks are assigned to group members.

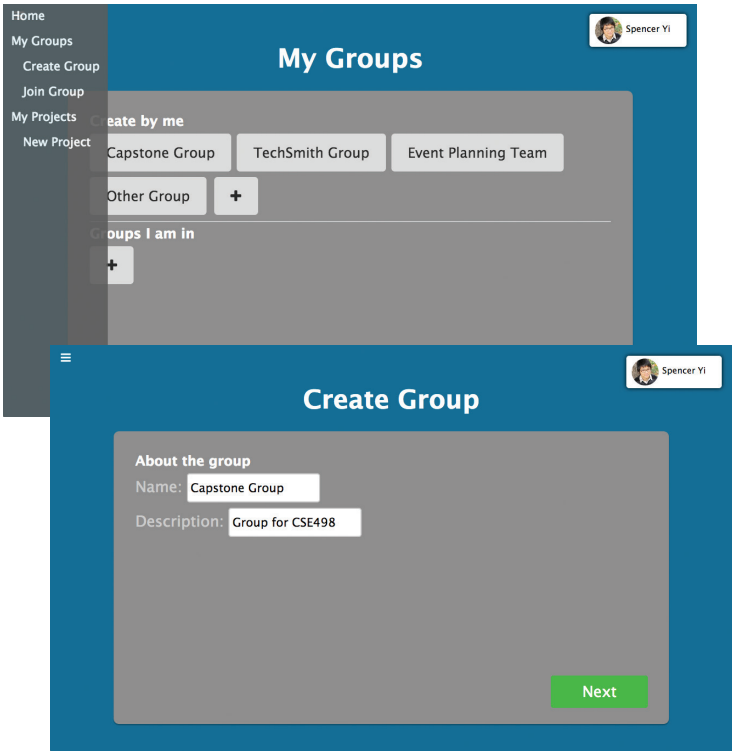
Group members communicate by posting comments and receiving notifications within the group. GroupWork tracks upcoming deadlines by placing events on group members' calendars.

Tracking progress is essential for any group effort. Group members can peruse through all of the tasks within a project, checking which tasks are complete and which are pending including an estimate of the time required to complete them.

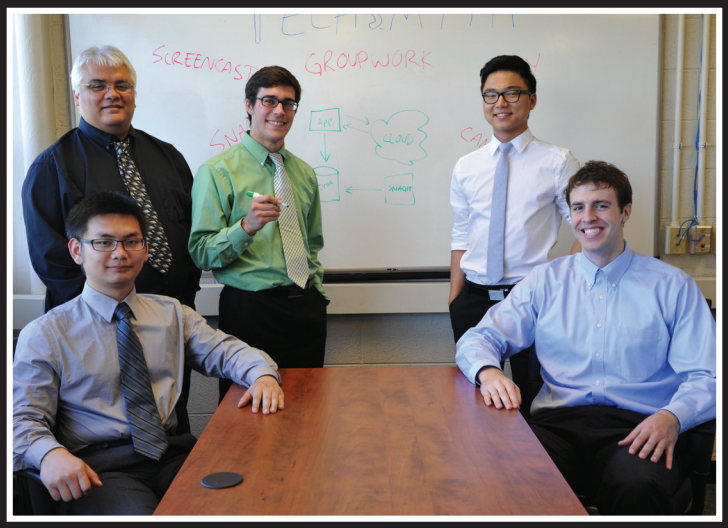
GroupWork is integrated with Snagit for Chrome, a TechSmith tool used for capturing and sharing content within the Chrome web browser. GroupWork, together with Snagit for Chrome, creates an easy way to share feedback quickly and effectively.

Since GroupWork is a Chrome app, it runs on any computer that supports the Chrome web browser.

GroupWork is written in JavaScript, HTML and CSS, and utilizes AngularJS. Google Drive provides the backend.



TechSmith®



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Urban Science
HR Matters

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.

Employees at automobile dealerships fill many roles such as salesperson or service advisor. People successful in a particular role often share a similar set of behavioral competencies such as having self-confidence or being a good communicator.

HR Matters is a software tool that enables dealers to assess the behavioral competencies of their employees. Managers rate each behavioral competency on a scale from one to five. To assist managers in this process, HR Matters displays a standard list of key behavioral indicators for each competency that corresponds to each of the possible ratings from one to five.

By knowing which behavioral competencies are shared by successful people in particular roles, automobile dealerships use these key behavioral competencies in a variety of ways.

For example, a behavioral area of weakness of an existing employee may be identified for improvement. HR Matters includes historical records of each employee's behavioral evaluations for tracking progress over time.

In addition, HR Matters can be used to screen potential dealership employees for their suitability for particular roles.

HR Matters is a web-based application that is optimized for both tablets and desktops. It is written in C# using ASP.NET MVC and Bootstrap with a Microsoft SQL back-end database.

URBAN SCIENCE™

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Whirlpool Corporation
Windows 8 Apps for Smart Appliances

Whirlpool Corporation is the world's leading manufacturer and marketer of home appliances. Headquartered in Benton Harbor, Michigan and operating in more than 130 countries, Whirlpool has over 69,000 employees worldwide.

Connected to the Internet, Whirlpool's line of Smart Appliances can be monitored and controlled by customers from anywhere using mobile devices. Currently, Whirlpool provides Smart Appliance apps for Android devices and iOS devices, which include iPhones and iPads.

Our Windows 8 Apps for Smart Appliances complete the suite of apps by enabling customers to monitor and control their Smart Appliances using any Microsoft Windows 8 device, from phones to desktops. Sharing a common look-and-feel, the mobile and desktop versions provide customers with a seamless experience across multiple devices.

Our Windows Live Tiles, which are pinned to the start screen of Windows 8 devices, provide dynamic, at-a-glance information about connected Smart Appliances without requiring the apps to be open.

Cortana, the speech synthesis and recognition software for Windows Phones, is integrated with our Windows Phone app, allowing for hands-free commands and notifications.

Our Windows 8 Apps for Smart Appliances use the Windows Universal Applications framework provided by Microsoft and is written in C# and XAML.

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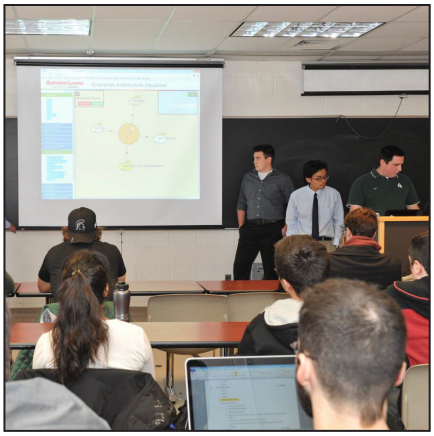
All-Hands Meetings

Fall 2014







Corporate Sponsors

Elizabeth Klee

Chief Information Officer

Urban Science
Detroit Michigan

URBAN SCIENCE

"Our mission at Urban Science can only be accomplished with the best and brightest problem solvers, innovators and analytical thinkers, which is why we partner with The Capstone Experience at Michigan State University. We've sponsored fifteen projects in the past six years and have hired thirty-six MSU graduates."

Jeremy Briggs

University Staffing Manager

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 26 permanent hires and 28 summer interns in just the last seven years."

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."

MICHIGAN STATE UNIVERSITY FEDERAL CREDIT UNION
Building Dreams Together

April Clobes

President and
Chief Executive Officer

MSU Federal Credit Union
East Lansing, 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. Our latest Capstone project, Financial 4.0 Interactive Budgeting Tool, will be deployed as part of MSUFCU's suite of mobile financial apps ."

Capstone Alumni

Mike Quiroga

Software Engineer

Quicken Loans
Detroit, Michigan

Quicken Loans
Engineered to Amaze

"In the capstone course at Michigan State University, I worked on a four-person student team to design, develop and deliver a technically challenging software system for TechSmith. The experience gained and the lessons learned jumpstarted my career at Quicken Loans. "

BS, CSE: Fall 2013
Hometown: Mason, Michigan

Luke Pritchett

Software Development Engineer

Amazon
Seattle, Washington

amazon.com

"The MSU Capstone Experience took the strong foundation I had gained as a computer science student of MSU and applied it to a real-world business problem. By being able to work on the entirety of the design and development process, and by focusing on issues such as scalability, modularity and reusability, I am much more prepared for my work at Amazon."

BS, CSE: May 2015
Hometown: Midland, Michigan

Jourdan West

Software Developer

General Motors
Warren, Michigan

GM

"I gained two essential skills from the Capstone Experience. First, I learned how to explain and defend technical decisions to teammates, peers and corporate clients. Second, I learned how to use my technical skills to convert my client's needs to functional and intuitive software. In addition, I was able to connect with contacts from many large companies and jump-start my own career at GM."

BS, CSE: May, 2015
Hometown: Detroit, Michigan

Samantha Bentzel

Analyst

Urban Science
Detroit, Michigan

URBAN SCIENCE

"The Capstone Experience gave me the opportunity to work on developing a software solution for a large company, which helped me to understand what it means to build software while also being business-minded. It was great preparation for my job at Urban Science."

BS, CSE: May 2015
Hometown: Atlanta, Georgia

Spring 2015

Project Sponsors

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

Amazon
Seattle, Washington & Detroit, Michigan

Auto-Owners Insurance
Lansing, Michigan

The Boeing Company
St. Louis, Missouri

Ford Motor Company
Dearborn, Michigan

General Motors
Detroit, Michigan

Meijer
Grand Rapids, Michigan

MSU Federal Credit Union
East Lansing, Michigan

Quicken Loans
Detroit, Michigan

Spectrum Health
Grand Rapids, Michigan

TechSmith
Okemos, Michigan

Urban Science
Detroit, Michigan

Whirlpool Corporation
Benton Harbor, Michigan

Amazon
SIFT: Seller-Forums Information Filtering Tool

Amazon Marketplace provides a platform for individuals and businesses to sell products to hundreds of millions of online customers. Currently, more than 40% of Amazon sales result from third-party sellers.

In order to improve and optimize the experiences of their third-party sellers, Amazon provides Seller Forums on which sellers can post questions and answers to questions.

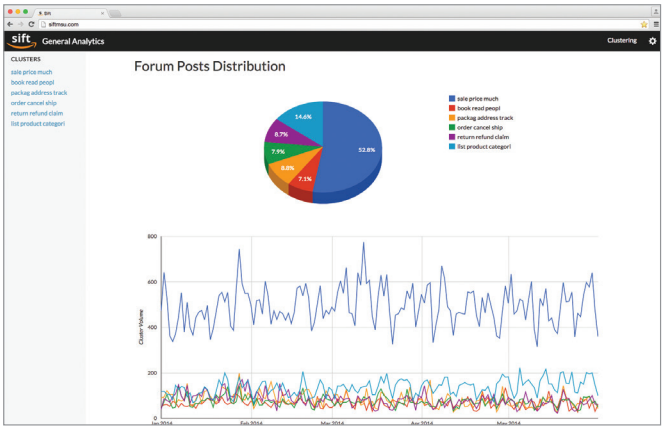
Worldwide, Amazon sellers post about 65,000 questions and 2,100,000 answers per year. Without an automated way to analyze these posts, it is very difficult for Amazon to get a sense of trending topics, pain points and areas to be improved.

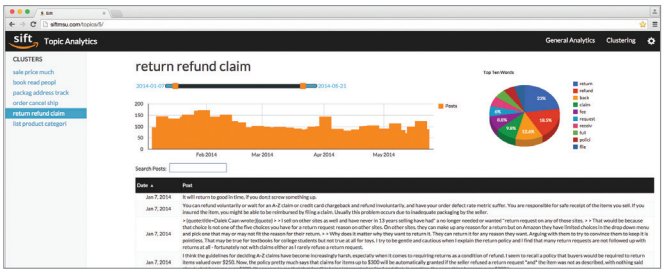
SIFT, *Seller-Forums Information Filtering Tool*, analyzes the Seller Forums using natural language processing to classify the posts into groups clustered around common themes. These clusters identify currently trending topics within the seller forums, thereby helping the Amazon Seller Services team to resolve potential issues for their sellers.

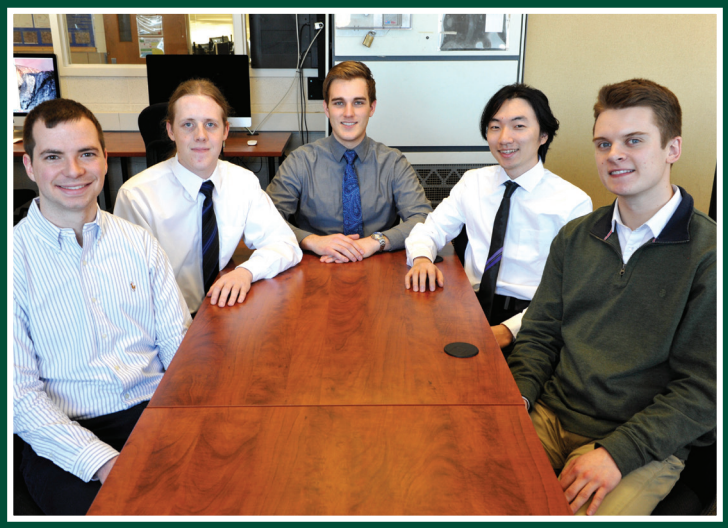
The clustering of posts into topics can be refined by specifying the number of clusters to be created, a date range and other cluster-specific settings.

SIFT's dashboard displays the current state of trending topics on the Seller Forums. Amazon Seller Services team members can view, search and filter posts related to each cluster.

SIFT is written in Python using the Django web framework. A MySQL database is hosted on Amazon's Relational Database Service, which is hosted on Amazon's Elastic Cloud Computing through Amazon Web Services.







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Auto-Owners Insurance
Claims First Notice of Loss Application

Auto-Owners Insurance, a Fortune 500 company founded in 1916, is the 15th largest insurer in the country. Auto-Owners is known for its exceptional financial strength and customer service among the nation's largest insurers.

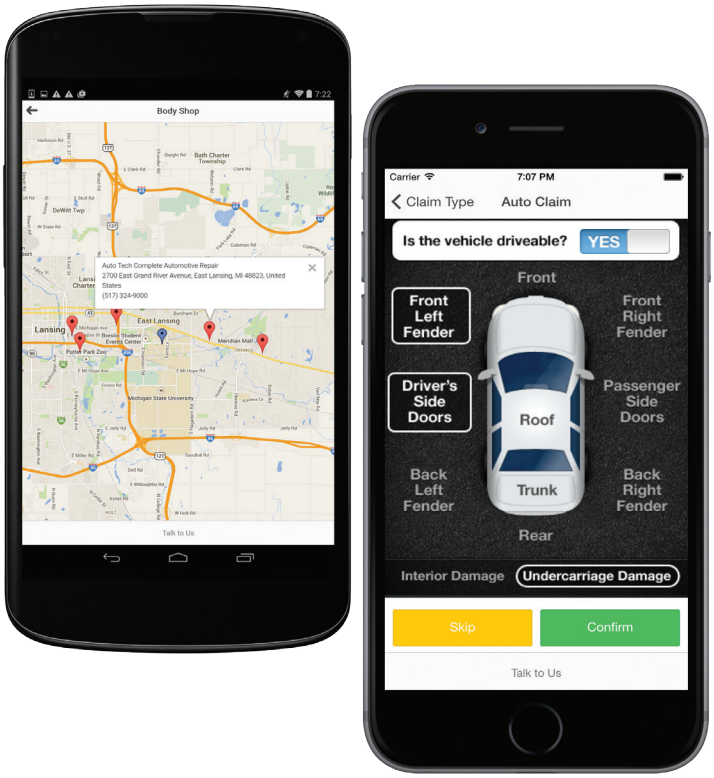
The experience of a loss of any kind can be a very difficult time. Auto-Owners is committed to providing its policyholders with claim service that is as simple and as stress free as possible during these difficult times.

Using our *Claims First Notice of Loss Application* Auto-Owners' policyholders can submit their initial claim information, called their "first notice of loss," using their mobile phones at any time and from anywhere.

Our application supports both home and automotive claims. Policyholders can attach photos, location data, damage descriptions and audio. Nearby emergency services can be located and contacted. Policyholders can communicate directly with Auto-Owners customer service representatives.

Our software system includes a separate web application that independent Auto-Owners agents use to view claims submitted through the mobile application. Agents set notification preferences specifying how they would like to be notified about claims. The agents can choose between email, text message and automated voicemail notifications.

Our *Claims First Notice of Loss Application* is a cross-platform CSS, HTML and JavaScript mobile application that submits data to a Django web service. The claim data is stored in a MySQL database.



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

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The Boeing Company
Business Developer's Electronic Sales Bag

Boeing is the world's largest aerospace company and leading manufacturer of commercial and military aircraft, spacecraft, defense systems and missiles. This wide array of products and services is marketed at customer meetings, trade shows and other forums by Boeing business developers.

Today pilots no longer carry heavy "flight bags" full of printed maps. Instead, small tablet computers serve as "electronic flight bags" providing pilots with hundreds of maps on a single mobile device.

Similarly, our *Business Developer's Electronic Sales Bag* provides Boeing business developers with access to all of their sales tools using a single tablet computer, replacing "sales bags" full of printed materials with electronic versions.

In addition to providing electronic versions of marketing materials, our electronic sales bag enables Boeing business developers to manage all aspects of the business development process including scheduling meetings, organizing materials for specific customers, and documenting meetings.

Everything within our *Business Developer's Electronic Sales Bag* is available to Boeing business developers regardless of Internet connectivity. Business developers no longer need to worry about forgetting any marketing materials because the entire collection is available at anytime from anywhere.

Our *Business Developer's Electronic Sales Bag* is a native Windows Surface Pro 3 app. It is written in C# and uses an underlying SQLite database.

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Ford Motor Company
Electric Vehicle Charging Station App

Ford Motor Company manufactures and sells Ford and Lincoln cars and trucks across six continents with 224,000 employees and 90 plants worldwide.

Ford has begun producing and selling electric vehicles like the Ford Focus Electric. As the popularity of electric vehicles increases, so does the need for charging stations.

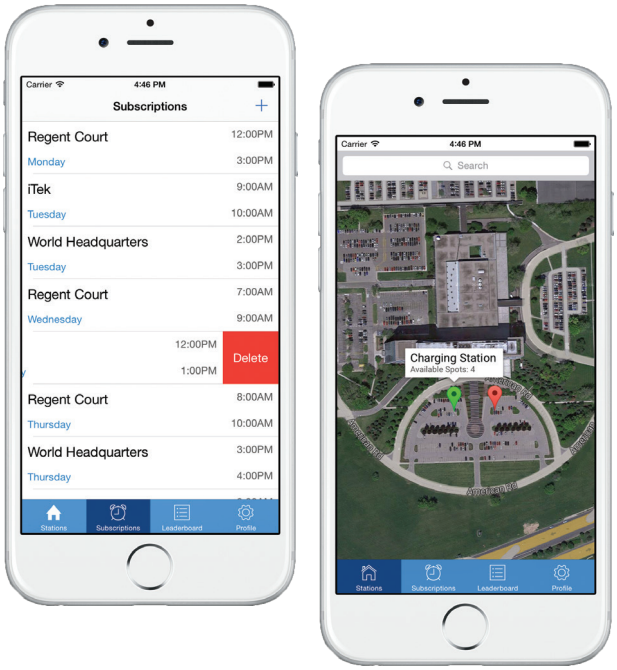
To meet the increased demand at their headquarters, Ford provides numerous charging stations throughout their Dearborn campus.

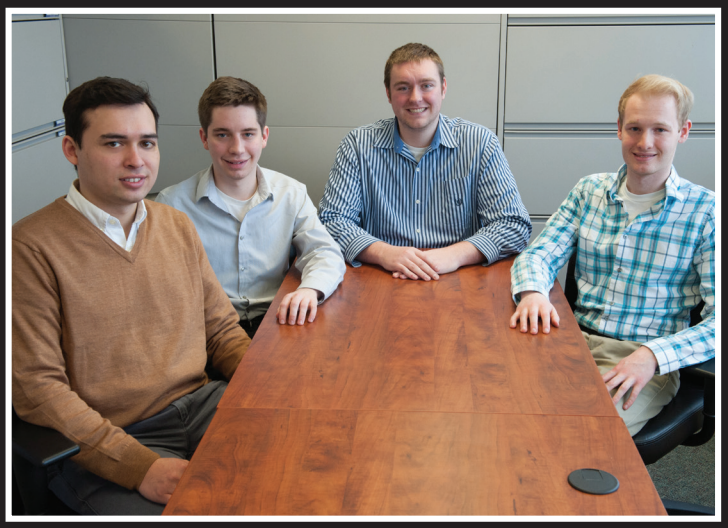
Our *Electric Vehicle Charging Station App* enables Ford employees to locate unoccupied charging stations on their Dearborn campus via a map and set notifications for when a charging station becomes available, all using their iPhone.

In addition to finding charging stations, our app reminds employees to move their car after it has been parked at a station for more than four hours. A leaderboard keeps track of who follows this recommendation and displays it in the app.

Our system uses Bluetooth devices called Estimote Beacons. Employees obtain and register a Beacon, which they place in their car. The charging station senses the presence of their Beacon and marks the station as occupied by that employee, which updates the employee's iPhone app.

Our *Electric Vehicle Charging Station App* is written in Objective-C. The web services backend is written in Java using the Spring framework. An OpenLDAP server handles our user authentication and storage. A Microsoft SQL Server database stores all other relevant data.





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General Motors
Employee Companion Mobile Application

With over 100 years of experience in developing and manufacturing innovative vehicles, General Motors is a global leader in the automotive industry.

GM provides convenient Information Technology (IT) Service Centers where employees can go for help with their computers and mobile devices. With over 212,000 employees worldwide, GM supports many IT Service Centers across the globe.

Our *Employee Companion Mobile Application* provides GM employees with quick and easy access to information about IT Service Centers.

After using our app to locate the nearest IT Service Center, GM employees can schedule an appointment by selecting a desired date and time. In addition, they can provide reasons for the appointment along with attached screen-capture images that show examples of their problem.

Once an appointment is scheduled, users can view appointment details including directions to the IT Service Center, building layouts and contact information.

In addition to its scheduling features, our app includes a "Frequently Asked Questions" (FAQ) section where GM employees can post questions as well as view answers to previously posted questions.

Our *Employee Companion Mobile Application* runs on iPhones, iPads and in web browsers. The iOS app is built using Xcode with the Swift programming language. The web app is written using CSS, HTML, JavaScript and PHP. Both use the same MySQL database backend.

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Meijer
Product Availability Check using Glassware

Meijer is one of the country's largest supercenters that provides high quality food and merchandise to several states across the Midwestern United States. With their headquarters located in Grand Rapids, Michigan, Meijer has over 200 stores, 60,000 team members, and is continually revolutionizing today's shopping experience by utilizing cutting-edge technology.

Our *Product Availability Check using Glassware* system enables Meijer team members to check the availability of products for Meijer customers. Our application supports searching via barcode scanning or voice input and it provides visual feedback regarding availability, quickly and hands-free.

In addition to the Glassware, our system includes a native Android application that also provides barcode scanning capabilities and the ability to view previously scanned products to reduce duplicate scans. While the Glassware screen is only visible to Meijer team members, customers can view product information using this Android application.

The third component of our product availability system is a web application that displays analytics showing the usage of the Glassware and Android apps. Meijer team members can look up products to see how many times they are searched for, including how many times the scans are successful.

The Glassware and Android applications are written in Java with the open source ZBar scanning library. The web application is written using CSS, HTML and JavaScript. Our backend services are hosted on Microsoft Azure, which includes a SQL server and mobile services features.

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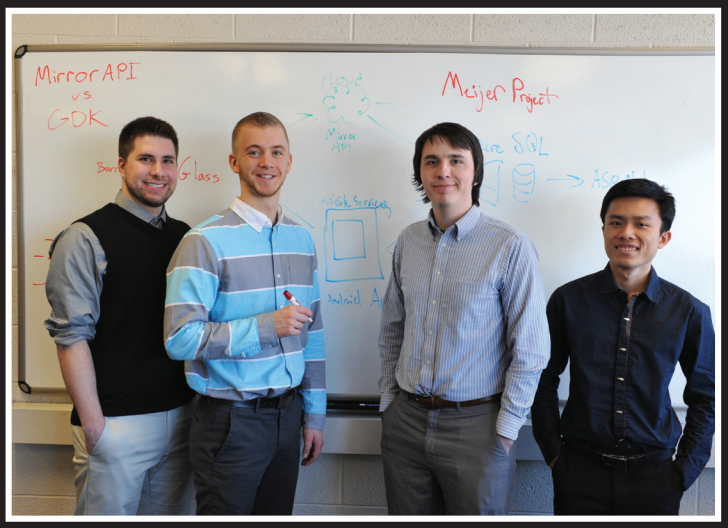

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MSU Federal Credit Union
Financial 4.0 Interactive Budgeting Tool

Michigan State University Federal Credit Union (MSUFCU) is the largest university-based credit union in the world, serving Michigan State University, Oakland University and their surrounding communities.

As a university-based credit union, MSUFCU is committed to educating students about their finances. To this end, MSUFCU is building a suite of apps called *Financial 4.0* designed to teach students about a variety of important economic topics.

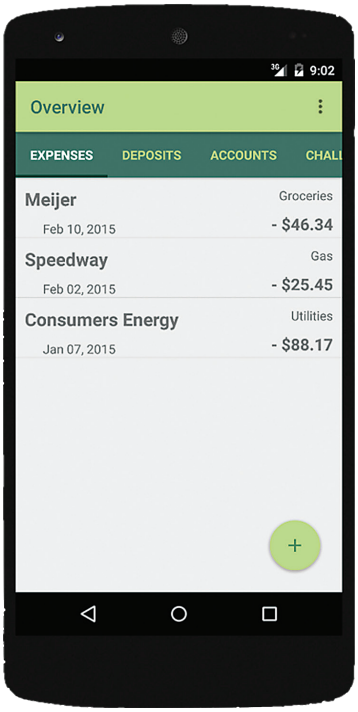
As part of the suite, our *Financial 4.0 Interactive Budgeting Tool* enables students to create and manage personal budgets. In order to make this more appealing and more fun for students, our app includes game-like features.

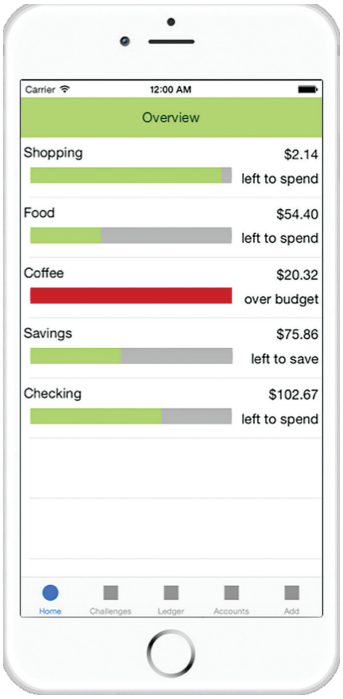
Students can compete in a variety of financial games such as the "52-Week Money Challenge" and the "Shopping Spree on a Budget." Winners are awarded points that determine a player's rank. Future versions of these challenges may include prizes provided by MSUFCU.

In addition to budgeting and gaming, our app provides students with a financial "Tip of the Week."

This version of *Financial 4.0 Interactive Budgeting Tool* is styled after MSUFCU apps. Our system is designed to be adapted easily to produce a future version styled for Oakland University Credit Union as well.

Our *Financial 4.0 Interactive Budgeting Tool* runs on iPhones, Android devices and within any web browser. It uses HTTP requests to communicate with our server, which in turn are handled using our PHP-based back end.





MICHIGAN STATE UNIVERSITY®
FEDERAL CREDIT UNION
Building Dreams Together

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Quicken Loans
Parking Allocation and Expense Reconciliation

Quicken Loans, headquartered in downtown Detroit, Michigan, is the largest online retail mortgage lender in the US. With almost 30 years of experience, their customers include over 2 million American families.

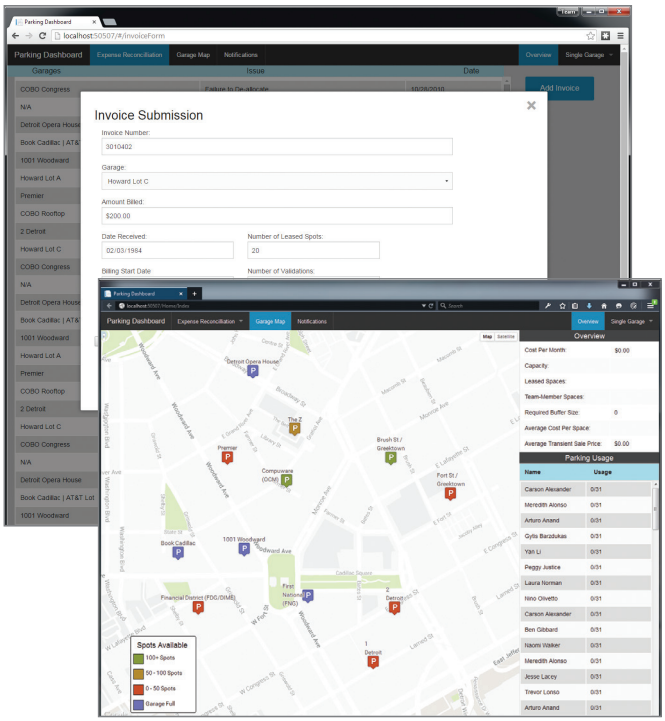
As it rapidly expands its workforce, Quicken Loans faces the continual challenge of meeting the parking needs of its team members, many of whom commute by car.

Quicken Loans is frequently overbilled due to discrepancies between garage managers' invoices and Quicken Loans' records. These discrepancies are reconciled manually by the Quicken Loans Parking Team through a number of processes including spreadsheets and emails to garage managers.

Our *Parking Allocation and Expense Reconciliation* dashboard automates this process by ingesting data from each garage and identifying points of contention. Our system also provides an easy way to communicate problems to garage managers by generating and sending issue reports.

The dashboard manages invoices and visualizes numerical data such as the number of spots billed each month, which are used to track and monitor parking expenses. It also includes the ability to monitor team member parking by communicating with badge scan readers located in several garages and displaying parking activity, thereby enabling the Parking Team to optimize usage and allocate spots as needed.

Our dashboard is written in C# using the .NET Framework. The underlying database is Microsoft SQL Server 2012. The front end uses Google Maps, AngularJS and jQuery.



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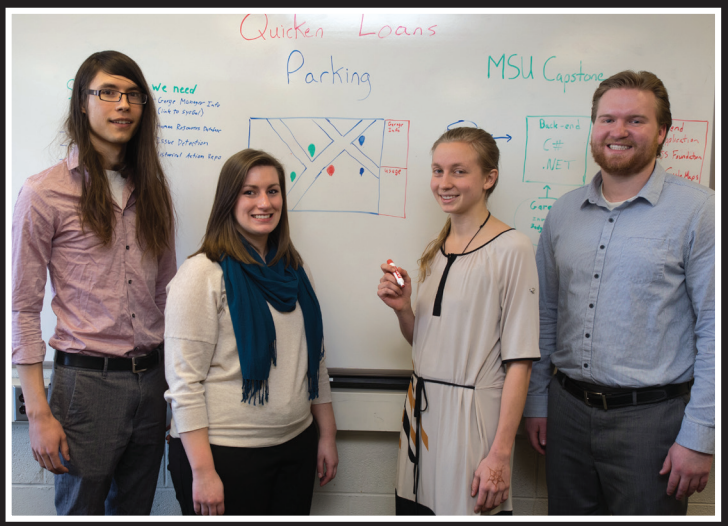

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Spectrum Health
Mobile Appointment Check-In and Payment

Based in Grand Rapids, Michigan, Spectrum Health is a not-for-profit health care system serving more than one million patients every year. Spectrum Health offers a variety of services that involve hospitals, treatment facilities and physician practices.

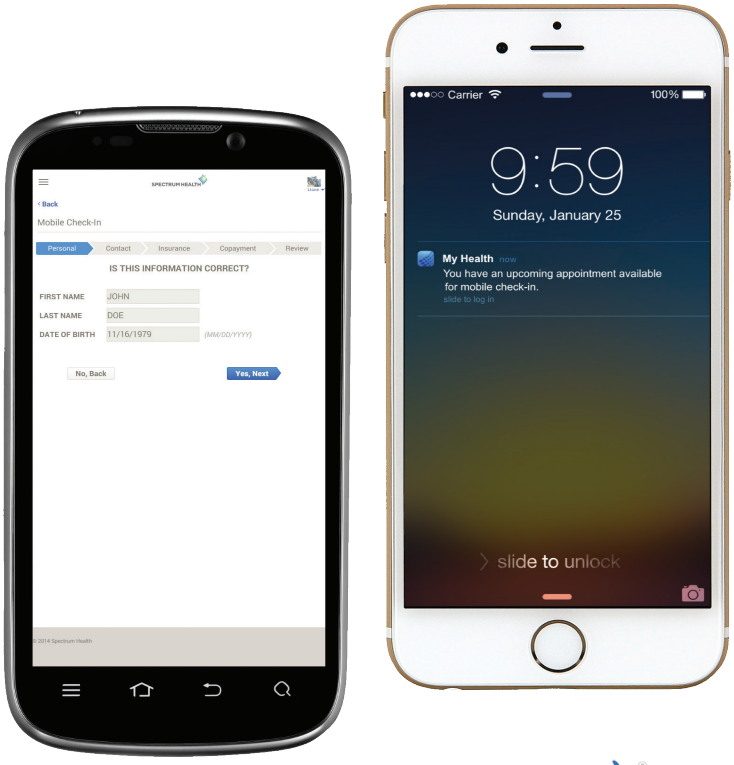
Spectrum Health is working to become the national leader in health care by the year 2020. One component of their strategy to improve the patient experience is the use of innovative mobile technologies.

Our *Mobile Appointment Check-In and Payment* system revolutionizes the check-in process by allowing patients to check in for appointments and make payments using their personal mobile devices.

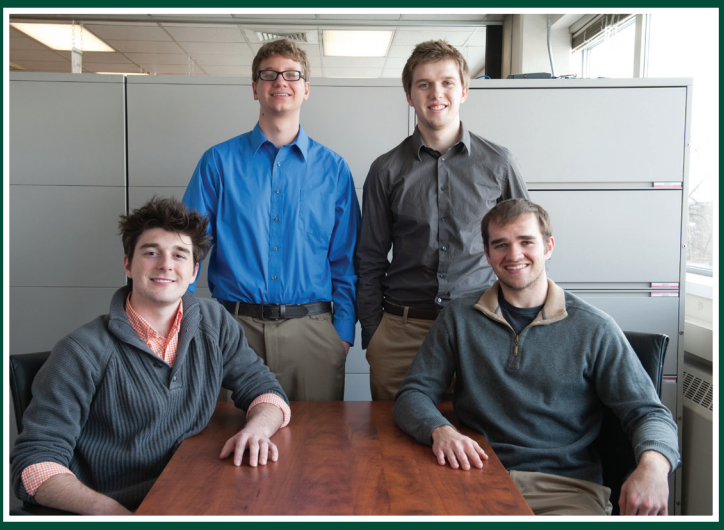
Upon arrival at a Spectrum Health facility, our system sends patients a notification informing them that they have an appointment available for mobile check-in. Once signed into the app, patients verify their personal and insurance information making any corrections directly from their mobile device. Patients can also sign any waivers or compliance agreements that may have changed since their last visit.

After the check-in process is complete, patients can process their copayment along with any other balance on their account using PayPal. A floor map of the facility guides patients to their appointment.

Our app is written using Angular JS, HTML and C# using Apache Cordova to produce versions for iPhones, iPads and Android phones and tablets.



SPECTRUM HEALTH



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TechSmith
Enterprise Learning Activity Capture

TechSmith is a leading software developer of screen and video capture and editing software including the very popular Snagit and Camtasia Studio, which are used by companies and educational institutions around the world.

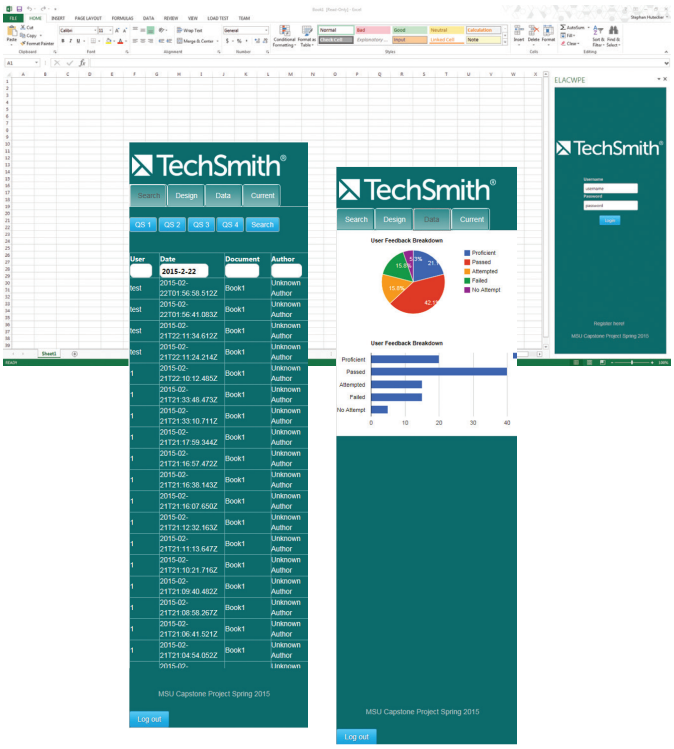
Creating such a wide variety of software requires TechSmith software developers to use an equally wide variety of technologies. When faced with the challenge of learning a new technology, it is helpful to find a colleague who already knows it. Yet finding the right person "in the know" is hard to do.

Our *Enterprise Learning Activity Capture* system captures the learning activities, and hence the skillsets, of TechSmith developers and records these activities in a special database called a Learning Record Store.

Implemented as a Microsoft Office application, our system runs seamlessly within the entire Microsoft Office suite, appearing as a task pane within Office. Users only need to log into our system once, after which it runs unobtrusively in the background.

While looking through Office documents, TechSmith software developers can search for other developers who already know particular technologies and have the skillset of interest. After a user enters a search topic, our system points developers to their colleagues who can help them the most.

Our *Enterprise Learning Activity Capture* system uses the Advanced Distributed Learning's Learning Record Store, the TinCan API, CSS, HTML5, JavaScript and Bootstrap.



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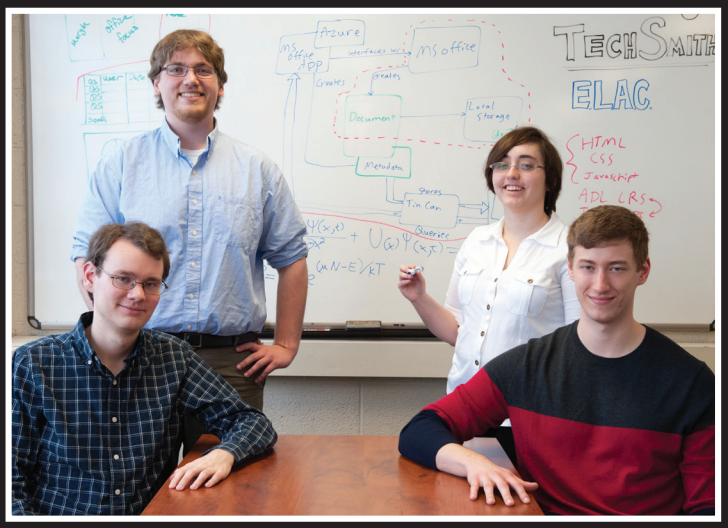

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Urban Science
Global Dealer Census and Market Share Viewer

Urban Science delivers consulting and software solutions that help automotive clients increase market share and boost profitability through high performing retail networks.

At each of Urban Science's automotive partners, the global marketing managers are responsible for understanding what cars are selling where and how these sales relate to their competition.

These automotive marketing managers review market statistics through a variety of metrics, providing their assessments to executives who use them to make strategic investments in new products and dealerships. Currently, this information is obtained using multiple disparate systems.

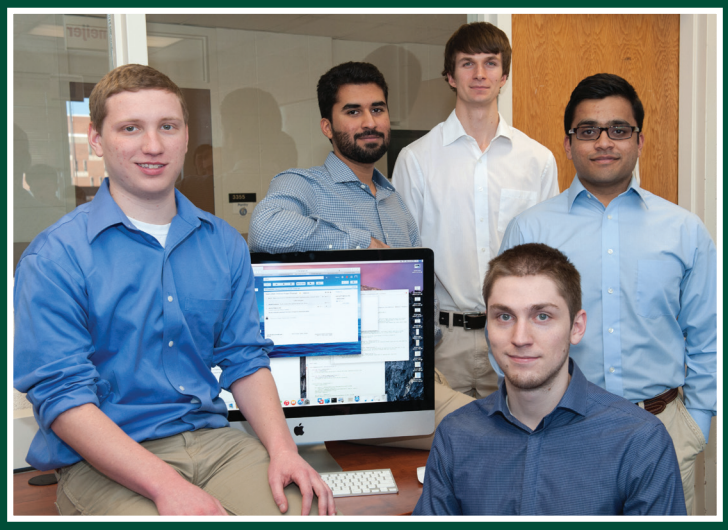
Our *Global Dealer Census and Market Share Viewer* system is a robust multi-platform application that consolidates and visualizes global market share data in one convenient place.

Using a map interface, managers can drill down to region and country level statistics, and analyze the data using a variety of metrics. Graphs and charts provide helpful visualizations. Managers can receive push notifications when updated market share data become available.

The CEO view shows a high-level summary report of a company's market and franchise share versus its competitors.

Our system includes a web app along with native apps for iPad and Android tablets. The web app is written in JavaScript using ASP.NET MVC with a Microsoft SQL backend database. The iPad application is written using Swift and Objective C. The Android application is written in Java.

URBAN SCIENCE™



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Whirlpool Corporation

Launder: Laundry Room Tablet Payment System

Whirlpool is a global leader in the design and manufacture of appliances including an innovative line of Smart Appliances, which are Wi-Fi enabled and connected to the Internet.

Whirlpool's commercial washers and dryers are widely used in public laundry facilities such as college dorms and apartment complexes. Using their Internet connectivity, these machines can provide lots of useful information, such as the price of a wash or the time when a load in a washer or dryer is done.

Launder, our *Laundry Room Tablet Payment System*, is a payment and information terminal for Whirlpool washers and dryers. It runs on dedicated tablet computers in unattended public laundry facilities. Launder is simple and easy to use, even by customers with no experience using mobile apps.

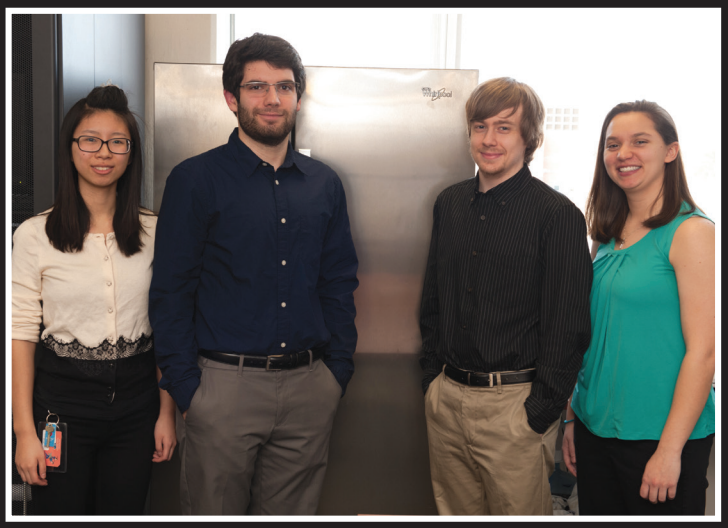
Launder enhances customers' laundry room experiences in a variety of novel ways. Customers receive text messages when a machine becomes available or when their wash or dry is done, reducing the hassle of waiting in the laundry room.

Customers can send feedback to their laundry room manager, say to report broken machines, and they can gain rewards for consistent use of Whirlpool machines.

Launder centralizes payment by allowing customers to pay with their credit cards instead of coins, tokens or other payment methods. Launder optionally emails receipts to users.

Launder is written in C# and XAML, and runs on Windows 8 and Android tablets.

Whirlpool CORPORATION



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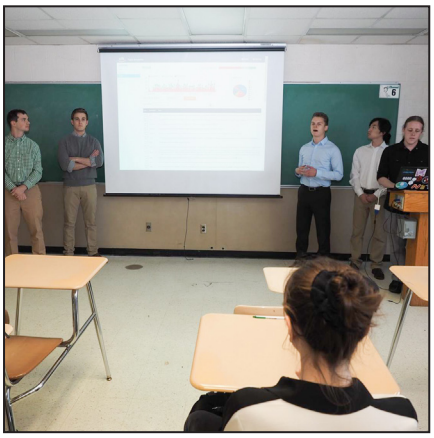
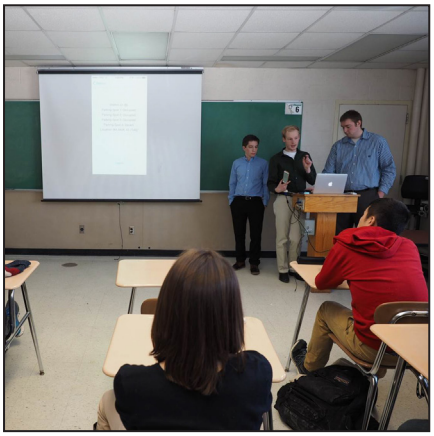
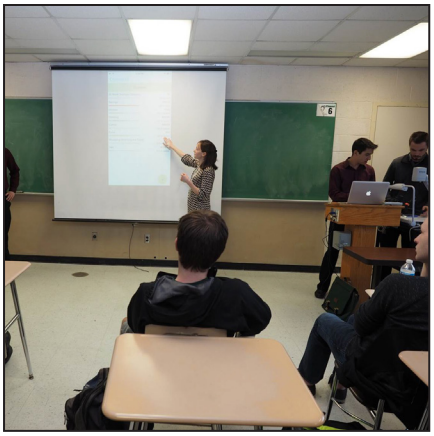
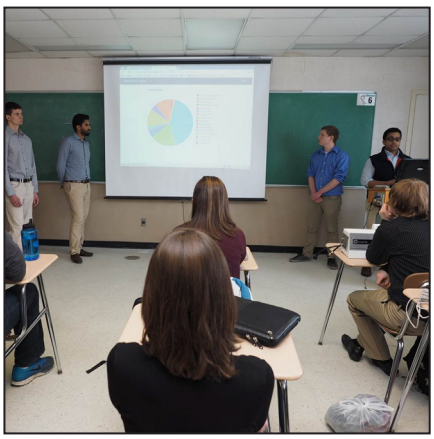
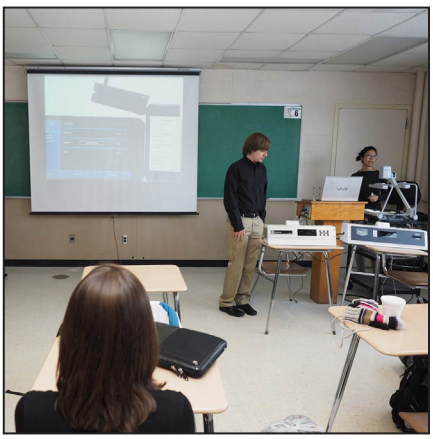
Spring 2015







The Capstone Experience

Design Day

Fall 2014

Design Day

Spring 2015

Design Day Award Winners

Fall 2014

Spring 2015

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