

**UConn**  
SCHOOL OF ENGINEERING

# senior design

**THERE'S NO STOPPING YOU!**

DEMONSTRATION DAY APRIL 29, 2016



## **Senior Design Instructors for 2015-2016**

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Steven Demurjian, Ph.D.	Laurent Michel, Ph.D.
Padraic Edgington, Ph.D.	Alexander Russell, Ph.D.
Swapna Gokhale, Ph.D.	Bing Wang, Ph.D.
Song Han, Ph.D.	Fei Wang, Ph.D.
Chun-Hsi Huang, Ph.D.	Yufeng Wu, Ph.D.
Mohammad Khan, Ph.D.	

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## **CSE Senior Design Course**

CSE4939W and CSE4940 are the basis for a yearlong Computer Science & Engineering Design sequence and capstone project required for all CSE and CS majors that began in Fall 2012. In this sequence, the students embark on a realistic project taking it from requirements analysis to design, implementation, testing and production release. Each project is staffed by a team of 3-6 students working under the guidance of a faculty advisor. Projects will employ either waterfall or agile design methodologies and will make use of modern technologies spanning database, real-time operating systems, simulations, optimization, and computer graphics to build software that runs on mobile devices (e.g., iOS, Android), laptops, desktops or client-server architectures via web-based applications.

Students are expected to learn team management skills, project design skills and demonstrate their skills with software authoring. They experience the realities associated with real-life software design and development. Successful teams design, build and deploy software and documentation that is at least of beta-level quality by the completion of the second semester.

### **A special thanks to our sponsors:**

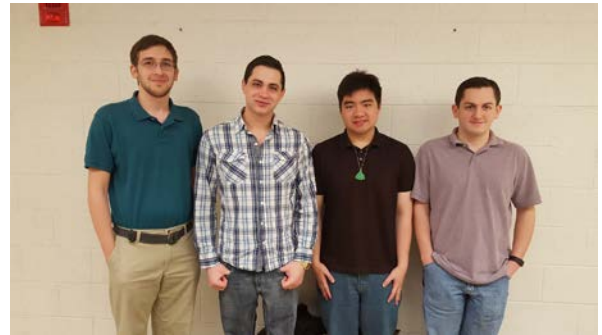
**CS Communication and Systems Canada, Inc, Emerson Process Management, Highper Computing, LLC, IBM, Pitney Bowes, Pratt & Whitney, University of Connecticut's Extension: Connecticut Sea Grant, NEMO & CLEAR Programs, Sustainable Food Systems, Middlesex County Extension Center, Plant Science and Landscape Architecture Departments, Voting Technology Research Center, UConn Health, and UnitedHealth Group.**

# Team 1: Mold Response

Sponsored by: UCHC

Sponsor Advisor: Dr. Mark Buchanan and  
Paula Schenck, M.P.H.

Faculty Advisor: Professor Bing Wang



From left to right: William Lukaszewski,  
Ayham Chalghin, Allen Pham, and Kevin Foley

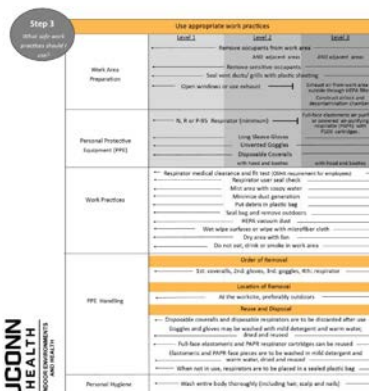
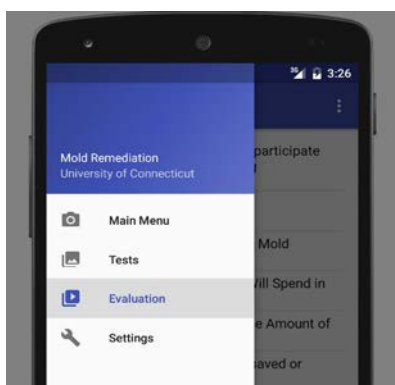
# UConn HEALTH

After storms occur, such as Hurricane Sandy, flooding indoors can affect thousands of people, and the mold that develops can contribute to a very unhealthy environment. There are many different types of mold that thrive on building materials and in temperatures usually found in homes. With moisture present, mold can grow exponentially, becoming a danger to those who clean up after storms. Since mold and other biological materials that grow with the mold in flooded homes can cause severe health issues, such as asthma attacks and lung diseases, it is important to reduce exposures and remove mold safely.

The goal of this project is developing a smartphone app, called *Mold Response*, which assists mold removal and informs the public on mold, particularly after a storm. The app takes a highly complex diagram designed by UConn Health and breaks it down into a simpler form. This simpler form can help people quickly and successfully decide whether they are healthy enough to participate in mold cleanup. If an individual is healthy enough to be around mold, the app then explains how to correctly use safety equipment so the individual can successfully and safely remove mold from a location without causing any harm. The app also informs users certain directions on what they can do if they have a certain health issue.

The application also can be used for testing the individual on their knowledge for mold. The application has numerous quizzes that the individual can take, and each quiz is based on pamphlets also designed by UConn Health. With the application questions being connected to a database, UConn Health can then add and change the quizzes accordingly when they need to either update the information on existing quizzes or add new quizzes entirely.

The application is being designed on an Android environment using Android Studio with the intent to make it portable to Apple IOS in the future. The database uses a MYSQL server with Apache supporting the web interface for the data entry. The whole project's backend is being designed in an orderly fashion so the project can be continued later with a different team if the sponsors wish to expand on the application and its capabilities.





## Team 2: Wireless Electroencephalographic Device Incorporation into Gameplay

*Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Jeffrey Meunier*



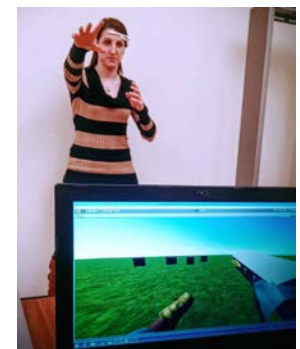
*Back row: Iu-Wei Sze, Patrick Belanger,  
Anthony Barletta  
Front row: Todd Slater, Ashley Dumaine*



Electroencephalographs (EEGs) are input devices available as commercial wireless headsets which are capable of picking up signals associated with facial expressions, emotions, or even focused thoughts. These could be used by physically impaired people (e.g., paraplegics or victims of ALS) to control prostheses or wheelchairs, restore mobility, and increase independence. Alternatively, they can be used by people including the non-disabled to control external devices or software such as video games.

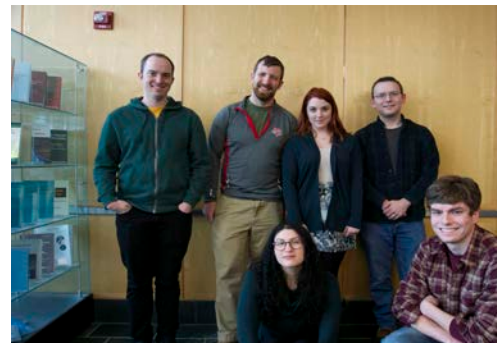
The goal of this project is to create a new paradigm of gaming using EEG input via an Emotiv headset. This makes the game more psychologically involved through the use of mental commands, such as spell-casting, by thinking or concentrating rather than the conventional usage of a keyboard and mouse or console controller. This could make the gaming—or any—experience more intuitive, not requiring the user to click when they want something, but instead just thinking about it. This could also be useful in a psychological sense: it could be used to monitor a person's emotions in a non-intrusive way, and could be used as a therapeutic tool, or simply an interesting way to teach people more about what signals their brains are sending, while providing an entertaining experience in the process.

The game is made in Unity and interacts with the Kinect through RUIS, Reality-based User Interface System. A client-server connection is used to obtain data from the EEG headset which determines the player's actions within the game. Players are able to use their mind with the EEG headset to control certain actions, and move their body in front of a Kinect One to control the character's movements. This provides a more immersive experience where users aren't just pressing buttons to progress through a storyline. EEG gaming is a largely unexplored field of gaming, so much of what this project explores is unprecedented, making it a great problem-solving experience. The main goal is to engineer a more immersive and healthy gaming experience in which the player can interact directly with the environment without the use of traditional inputs.



# Team 3: Real-Time Data Analytics Platform for Industrial Monitoring and Control

*Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Song Han*

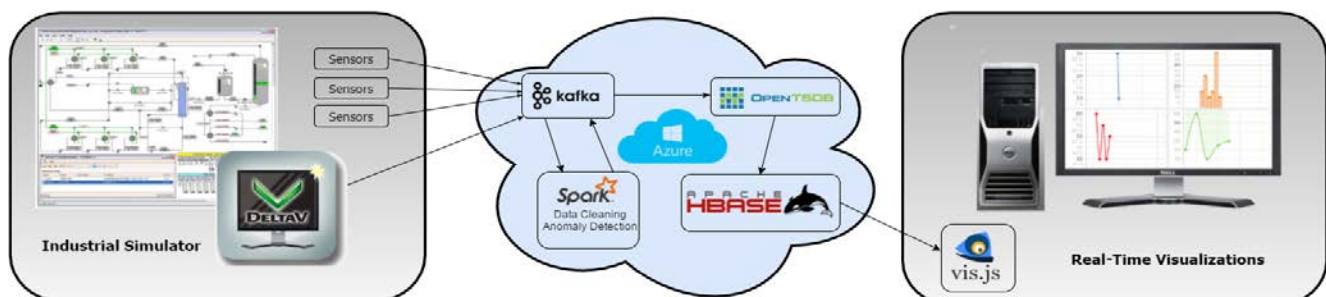


*Top (left to right): Kevin Springsteen, Jeremy Mill, Antonia Lewis, John Butler  
Bottom: Deanna Dziedzak, Matthew Perani*

Manufacturers today face a very real problem: thousands and thousands of industrial sensors are creating millions of data points, with no systems in place to effectively monitor them and indicate possible problems in real time. Solving this big data problem has the potential to save companies tremendous amounts of money, as well as increase their efficiency and reduce waste. Furthermore, companies seek to save even more by running their big data solutions in the cloud, offsetting the cost of expensive hardware and the maintenance costs associated with that hardware, such as electricity and personnel.

Our solution utilizes several technologies to meet those manufacturers' needs. Among them are the Hadoop NoSQL database solution, which can efficiently store and query the millions of data points being sent by sensors throughout the manufacturer's system; PostgreSQL for clustered relational storage of sensor metadata; Apache Spark for advanced, distributed data analytics, and a custom JavaScript web application for data visualization. The data analytics are written in Java, and the framework for storing new data is written in Python, both of which, as languages widely adopted in industry, allow for extreme flexibility and customization to fit the manufacturers' needs with minimal time and expense.

These technologies work together to make a speedy and robust data analytics system, allowing one to monitor an industrial environment from afar, and even be alerted when things go awry. This elegant and versatile solution to data analytics could be applied to just about any modern day industrial environment.

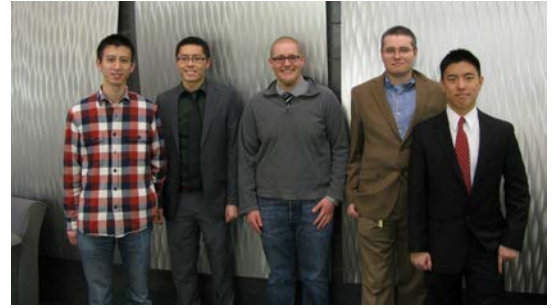


## Team 4: Resource Management and Data Analytics in 6TiSCH Networks

*Sponsored by: Emerson Process Management*

*Sponsor Advisor: Mark Nixon*

*Faculty Advisor: Professor Song Han*



*From left to right: Tao Gong, Henry Lin, Jonathan Roemer, Joshua Gutman, and Jonathan Huang*



With the proliferation of small, low-power, wireless embedded devices, commonly referred to as the "Internet of Things," comes a need for standardized communication protocols. Currently, multiple competing standards are in use around the industry, with two of the most popular being 6TiSCH and WirelessHART. Though the industry is moving towards 6TiSCH, which uses IPv6 on top of the new IEEE 802.15.4e specification, we expect to see many mixed-protocol networks in the future. In this senior design project, we designed a fully-featured network manager for embedded devices that can handle both the 6TiSCH and WirelessHart protocols.

The nodes in an IEEE 802.15.4e 6TiSCH network communicate by following a time Division Multiple Access (TDMA) schedule. A timeslot in this schedule provides a unit of bandwidth that is allocated for communication between neighbor nodes. The allocation can be programmed such that the predictable transmission pattern matches the traffic. This avoids idle listening and extends battery lifetime for constrained nodes. Channel-hopping improves reliability in the presence of narrow-band interference and multi-path fading.

WirelessHART derives its physical layer protocol from the IEEE 802.15.4 standard. Using a subset of the IEEE standard with modifications, it operates only in the 2450MHz ISM band, though the data link layer can employ 15 channels of the band to increase reliability. As in 6TiSCH, the data link layer utilizes superframes and TDMA scheduling.

Our manager provides a GUI representation of the currently running network, in addition to graphical elements to help the user monitor the current network state, monitor traffic patterns, and manage the devices on the network. Link strength, packet loss, and latency information are presented to the user, who can then manage the devices in the active network. Designing for scalability from the beginning, we ensured that our manager could handle hundreds of simultaneously connected devices while still preserving acceptable network performance.

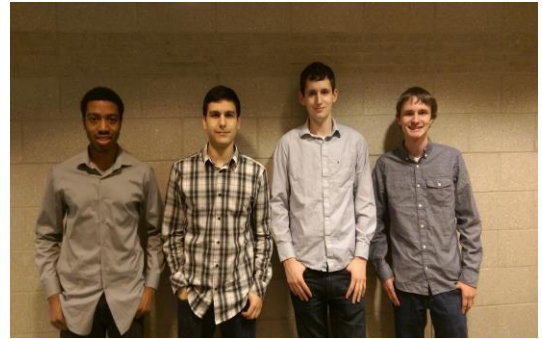
**WirelessHART**





# Team 5: Wi-Fi Connected Chess Board

*Sponsored by: Team Members*  
*Faculty Advisor: Professor Yufeng Wu*



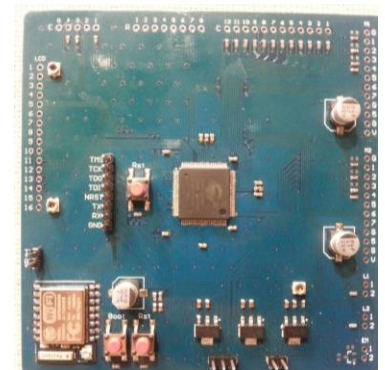
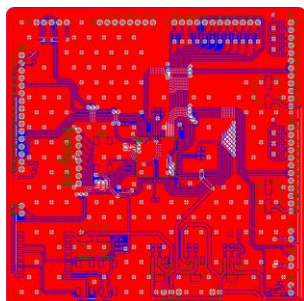
*From left to right: Maurice Wallace, Mark Mauriello, Nicholas Kraus, and Kyle Jameson*



The problem we aimed to solve was simple: how do you play chess online with a friend and still keep the charm and ease-of-use of having a physical chess board in front of you? The result is a physical chess board that can connect to the internet via Wi-Fi. Like a normal game of chess, each player takes turns moving their pieces on the board. Our board then reads the move the player makes, translates the move into an encoded message, and sends the message to the opposing player's board. With that message, the board automatically moves the pieces into place.

Each board consists of a microcontroller, a Wi-Fi module, and an XY gantry underneath the surface of the board. The microcontroller is responsible for driving the motors and gantry that move pieces. Each piece contains a small magnet, which trigger small Reed sensors that reside just underneath every square. Since every game of chess can be defined entirely by its current state, this allows the microcontroller to know where every piece is at any given time.

The two boards both connect to a server, which is in charge of managing the connection, judging the legality of moves, relaying movement messages, and keeping track of the game state. The server was programmed in Python and can run on any modern laptop or desktop computer. This allows one player to use their computer as the host for their game.



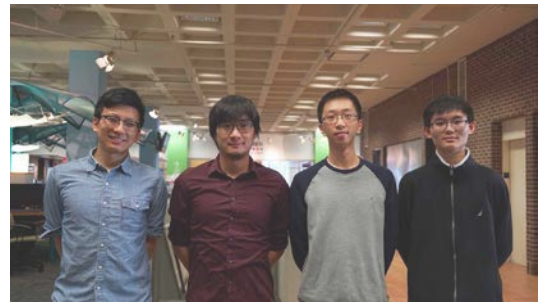


## Team 6: Pins

### - A Society Network on A Map

#### Know Your Surrounding Better

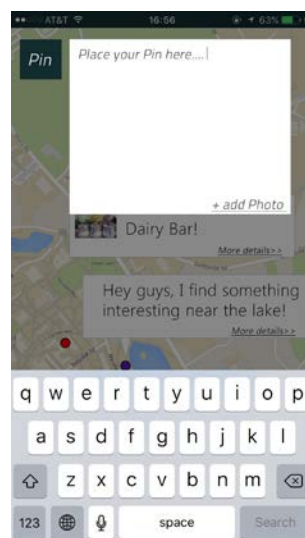
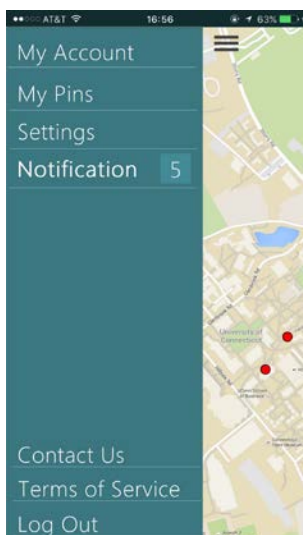
*Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Yufeng Wu*



*From left to right: Qiwei Zheng, Erming Gao,  
Yuchen Jiang, Charles Huang*

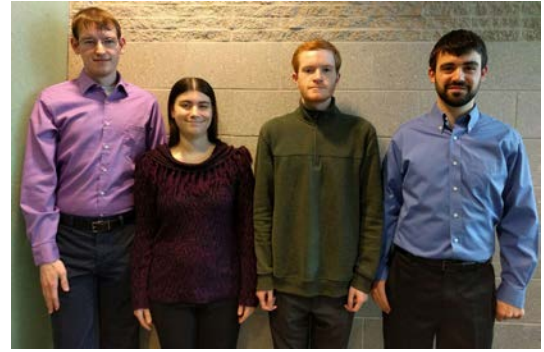
We have built a mobile social network application, called “Pins”, with geolocation features. It allows users to share information in certain categories, events, exploration and deals. This information is in the form of an anonymous post that is pinned to their current spatial location on the map. Users are able to browse the information not only in their surrounding area, but also in other areas that they are interested in. Users are also able to upvote or downvote the pins. Additionally, our application provides filter and search options for users to customize their “map”. One goal of our app is to let people share what they see, discover, and think in a specific location on the map anonymously. The ultimate goal of this application is to let people know their surroundings better by allowing them to quickly get current local news as well as the points of interest in their neighborhood.

Our application was developed for the iPhone and iPad. When the application is initially opened, the user will be prompted to create an account, using their phone number or an email, or to log in to an existing account. A map with multiple pins will be shown after logging in. When a user taps a pin, a bubble will pop out above it showing the post attached to it. Tapping the post will expand the bubble allowing the user to view the full text as well as a larger picture. The popularity level of each post will be determined using an algorithm which will give more weight to earlier votes and less to later votes. The popularity level will also decay with time. The more popular posts will be more visible. Users will also be able to filter what they see using date/time, location, and our three main categories. Furthermore, users will be able to search for posts using keywords. Searching for certain keywords will filter out the pins without those keywords. Users who want to make a post just need to press the pin button. The user will then be allowed to upload a picture as well as write a short text. This post will then be pinned to their current location.



## Team 7: Electronic Pollbook System

*Sponsored by: UConn VoTeR Center  
Sponsor Advisor: Professor Alexander Schwarzmann  
Faculty Advisors: Professor Alexander Russell and  
Professor Laurent Michel*



*From left to right: Michael Motley, Rebecca Davis, Peter Spoldi, and Mark Davis*

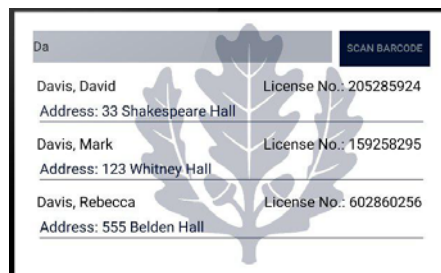
When a voter goes to the polls, a poll worker must check a paper list to see if they are eligible to vote. This simple process is meant to ensure “one voter, one vote,” or the idea that each voter should be able to vote, should have his or her vote count, and he or she can only vote once. Using a paper poll book, while effective, is time consuming and error prone. An electronic system can potentially reduce paperwork, increase the speed of voter check-ins, and reduce errors. It would provide a way to quickly look up a voter’s information and mark them as having voted in the current election.

Yet, an electronic poll book is not as simple to create as it seems. Two critical challenges are security and fault tolerance. The system must prevent attackers from recovering any voter information and cannot violate the “one voter, one vote” policy. It should also be resilient against data losses from a single point of failure, such as a centralized server or a single poll book. In addition, the system should be inexpensive, have a small form factor, and be highly usable.

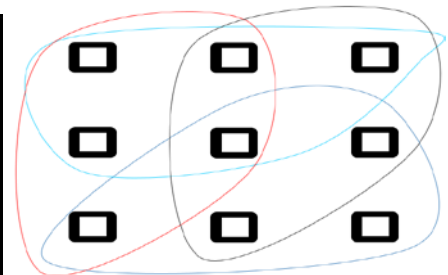
This Senior Design Project addresses all of these concerns with an Electronic ePoll book application for the Android platform. The application can be installed on affordable Android tablets and can be configured as the sole application on the tablet, reducing the risks of attacks. The key insight into a robust solution is the extensive reliance on fault tolerant technologies. Instead of traditional methods of data storage replication, our system uses *distributed shared memory* to reliably and dependably store all necessary data fragments. Transient or even permanent failures of one or more tablets do not jeopardize the ability of the surviving tablets to fulfill their tasks, without any data losses. In addition, the system is very scalable as replacement devices can be safely and easily added during an election to accommodate more concurrent check-in lines and preserve fault tolerance.



*Long Check-In Lines in West Hartford  
Source: NBC Connecticut*



*User Friendly Interface: Looking up a voter is as easy as typing a name or scanning a state ID*



*A sample of a 9 node majority quorum system in DSM. Squares represent tablets (nodes), and colored circles represent quorums.*

## Team 8: \$stockr

Sponsored by: UConn CSE Department  
Faculty Advisors: Professor Bing Wang and  
Professor Mohammad Khan

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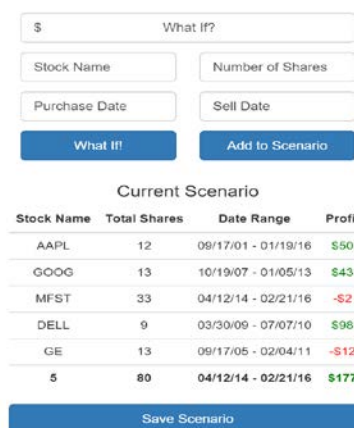
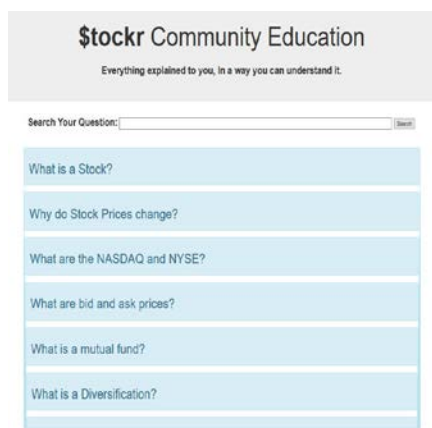


From left to right: Christopher Cyriac, Timothy Black, Sulin Park, and Michael Hart

\$stockr is a mobile-friendly web application that is geared towards newcomers in the business of stock trading, specifically teenagers, and those who are in their 20s. Using our software, users can add stocks to their portfolio, where the details regarding their stocks are updated automatically. Users can also create investment scenarios that enable users to see the return that would have yielded from past investments for different combinations of stocks, depending on their date of purchase, price, and other details.

\$stockr utilizes various techniques to engage users and enhance the user experience with the system. For example, in addition to providing a captivating but simple user interface, the system incorporates a community-powered education platform. In this platform, users can submit content that educates other users regarding various aspects of stock trading. The submitted content is presented in a manner that is easily accessible. Furthermore, submitted content is up-voted or down-voted by the community, therefore identifying the most helpful and informative submissions.

Due to the benefits offered by online platforms, that are accessible to anyone with a modern browser and Internet connection, the system is implemented as a web application using JavaScript. JavaScript is chosen for several reasons. For example, JavaScript runs on all modern browsers, which allows for applications to run in-browser without requiring users to download external programs, such as Java or Silverlight. Furthermore, JavaScript recently earned its popularity from the development of frameworks such as Node.js and MongoDB which provides open-source libraries for server-side implementation and database management functionalities. Alongside front-end frameworks, such as Bootstrap.js and Express.js, full stack web application development is made possible solely with JavaScript as well. Finally, AmCharts.js library is used to display stock information that supports rendering interactive graphs and charts, allowing users to manipulate the views.

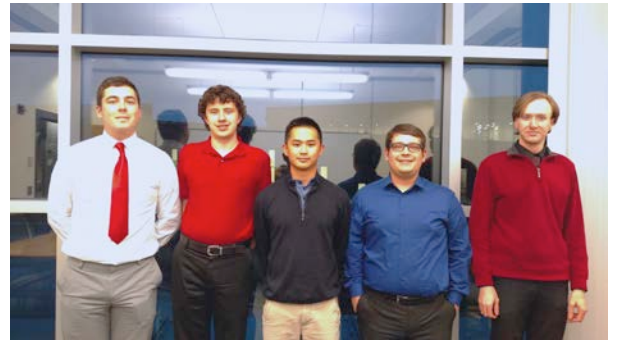


# Team 9: Electronic Engine Control Wireless Test Port

*Sponsored by: Pratt & Whitney*

*Sponsor Advisor: Paul Scheid*

*Faculty Advisor: Professor Padraic Edgington*



*From left to right: Zach Bugge, Ryan Tracey, David Pham, Tom Landry, and Padraic Edgington (Faculty Advisor)*



## Pratt & Whitney

A United Technologies Company

Pratt & Whitney makes jet engines for both commercial and military applications. These engines have an embedded electronic engine control (EEC), which is essentially a computer that controls all the major systems and functions of the engine. The Controls and Diagnostics Systems (CDS) Group at Pratt & Whitney have traditionally used a wired interface during the testing phase in order to monitor and maintain normal operation of the engine and EEC. The current interface allows a connection to be made between the EEC and a testing computer over Ethernet. The data read from the EEC allows the CDS team to find problems that may be occurring within the engine's components.

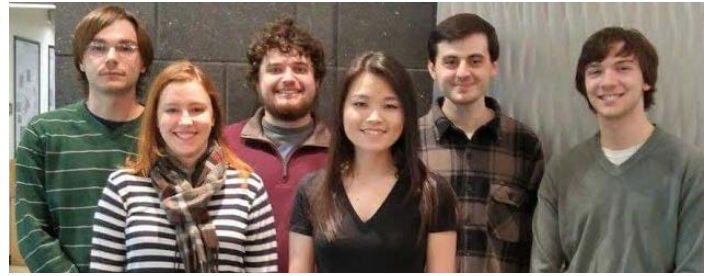
This connection has several limitations, such as being restricted to computers with an Ethernet port, and being near the EEC. Our senior design team was tasked with designing and developing a wireless system to replace the wired system that is currently in place, while still providing all former capabilities and functions. Our wireless interface will be accessed remotely through Wi-Fi, which will support the use of other monitoring devices such as tablets and smartphones.





## Team 10: Rank Management API

Sponsored by: UConn CSE Department  
Faculty Advisors: Professor Bing Wang and  
Professor Mohammad Khan




From left to right: Matthew Martinelli, Brianna Mathiowetz, Jonathan Saleh, Kathy Li, Tyler Southmayd, and Keith Robichaud

# rankMaster

The concept of ranking participants in an activity stems from the inherent human desire to compete. Assigning ranks to participants caters to this innate human desire as top competitors are motivated to maintain their status, while lesser competitors feel a greater sense of involvement and an incentive to improve. This project develops Rank Management APIs that allow users to easily manage and choose from multiple ranking algorithms such as Elo, Microsoft Trueskill, and Glicko, and apply them to create application specific ranking for different types of activities and competitions that result in a win, loss, or draw. For example, competitions can range anywhere from traditional sports such as football and baseball to competitive video games and academic challenges. In addition to enabling ranking and managing events, the API enables presentation of key statistics such as participants' progress over time and analysis of an opponents' performance.

Our developed API can be used by groups of friends as well as groups of competitors to effectively record and update statistics based on the group activity performance. In our developed prototype, users have multiple facets for interacting with the system. For example, developers can install an external library (Node.js module) to communicate with our API from their own application whereas non-technical users can leverage the web and mobile interface support to manage rankings and events.

**rankMaster**

Favorites

☆ Patriots423▶

☆ AFC Wim810▶

+ Add Favorites

My Ladders

◇ Me1321▶

Menu

Search...

Find Favorites3▶

Add Event10▶

Manage Ladder

Create Ladder

Stats

Manage Account1▶

Log out

NFL

Name	Rating	Rank ▾
Steelers	46	1
Giants	44	2
Patriots	42	3
0	0	0
0	0	0
0	0	0

Create Ladder

Stats to track

+ Entries

+ Algorithm

Trueskill ▾

Create

# Team 11: Speakr, or the Pursuit of Audio Synchronization

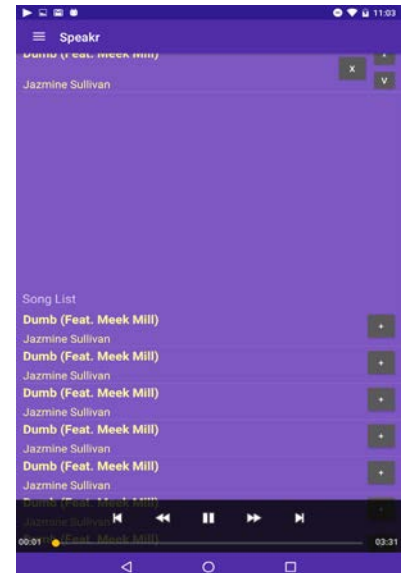
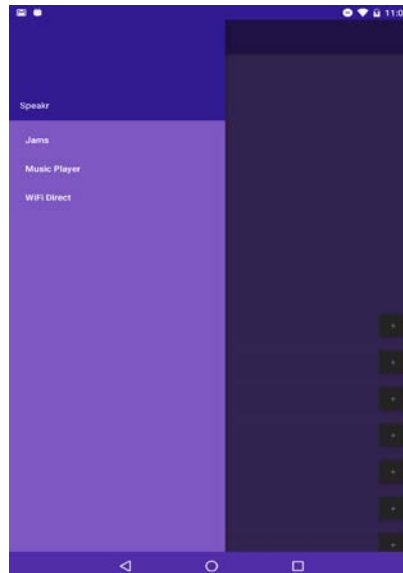
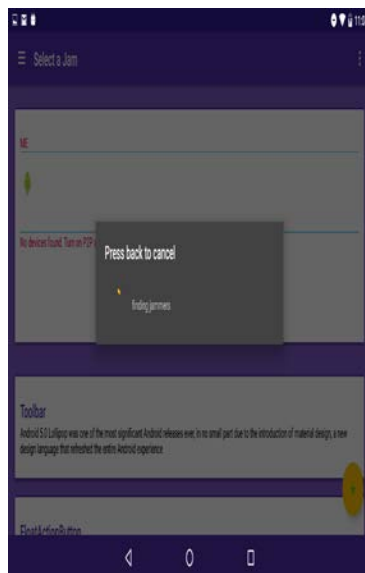
Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Bing Wang



From left to right: Michael Morton, Robert Paganetti, Viren Shinde and Connor Riley

Speakr is an application for Android phones that will allow users to transform multiple phones within a close vicinity into a combined speaker system. The phones will connect through an ad hoc network using either Bluetooth or WiFi. Once connected, all of the phones will be able to stream audio synchronously in real time. Consider a simple use-case: three users want to play music but do not have access to a speaker system. Rather than just play music through only one phone, the users connect all of their phones together through our application. Then, a shared queue will be formed to which any member of the group can contribute. Any music in this queue will be played simultaneously by all phones connected to the ad hoc network. Similar to the functionality of Chromecast, each phone in the network should have control over the audio being played, there is no group leader.

The main purpose of developing Speakr is to provide useful functionality to users and also gain experience developing for Android, using networking technologies, eliminating latency, and implementing material design standards to make an application look professional. The challenges involved in developing this application are many. First, simply learning to understand the Android documentation and use the API's for WiFi direct has been a challenge due to the lack of clear documentation. Second, only one of us actually has Android programming experience and none of us have any experience in using networking technologies. Therefore, our group may have to turn to subject matter experts to assist us in development. Lastly, because the human ear is extremely sensitive to subtitle differences in music, it is crucial to eliminate perceivable offset in the tracks, which is another major challenge. Despite these challenges we hope to have a functional prototype of our application by the end of the year.



# Team 12: The Connecticut Shellfish Harvest Area Mobile Application

Sponsored by: UConn Sea Grant Extension

Sponsor Advisor: Ms. Tessa Getchis

Faculty Advisor: Professor Steven A. Demurjian



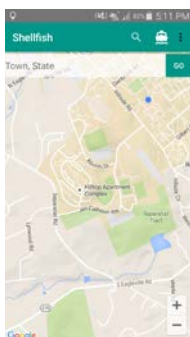
From left to right: Jianxing Ke, Conner Gates, Craig Goyette, Steven Weldon, and Robert Gworek



The goal of the project is to create mobile iOS and Android applications that tracks and provides information on shellfish harvest areas to be used year round in an attempt to protect and preserve their population. The major features of this app are real time harvest area status (depicted on an interactive map interface), tidal information, and harvesting regulatory information. The app has been created to solve the obsolete strategy of posting information related to shellfish harvesting. Currently, users have to call a hotline to retrieve information on whether or not a harvest area is closed due to hazardous conditions (mostly bacteria). This is a hassle for harvesters considering the information may not always be readily available. This app electronically manages all of the information and makes it easily accessible to fishermen.

The map interface utilizes a user's current location or has them input a town they are in or near. Once the user's location is known, a map is displayed showing the area in which they are in and nearby harvest areas. The harvest areas will be distinguished by different shades on the map interface. The harvest areas will be listed below the map, allowing another medium of selecting desired areas. The Connecticut Department of Agriculture's Bureau of Aquaculture's database provides real time harvest area statuses. The frequency at which the data will be updated has yet to be decided. The tide information will be found from the National Oceanic and Atmospheric Administration (NOAA) site. The site has all of the information about tides, and is accessible from the map since some harvest sites are only accessible during certain tides. We have utilized API's to make this data retrieval possible (for example, Java, SOAP, and WSDL implementations at [dap.copos.nos.noaa.gov/axis/](http://dap.copos.nos.noaa.gov/axis/)).

The regulatory information is important as it contains information about how one can go about harvesting shellfish from the designated area. This information is available currently in a PDF/Word doc with all the information. The information includes specifics for each town. The specifics are such as species, shellfish size limits, quantities, seasons, permits and permit costs, and hotline numbers. This information is provided in the app without the need to download the source document.



# Team 13: Hydra – 3D Printed Prosthetic Arm

Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Yufeng Wu



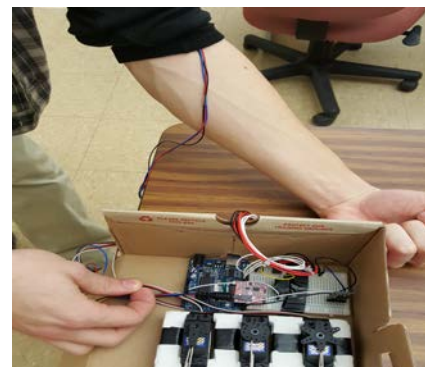
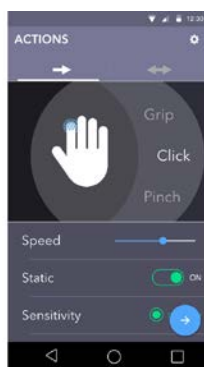
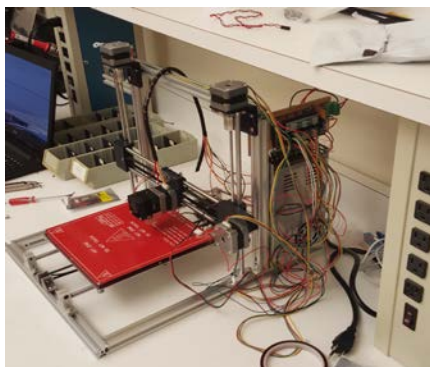
From left to right: Daniel DeMarco, Joey Hanlon, Ted Jensen, and Mike Neas



Hydra is an affordable elbow-down prosthetic that restores dexterity and muscle control for basic hand functionality. At a far lower cost than alternative high-end prosthetics, it allows for dynamic motion and static hand positions essential for daily tasks. The package provides patients with a 3-D-printed forearm and hand, STL's for printing, supplies and directions for installing an Arduino board, Servo's, and a Bluetooth receiver. An Android phone application will give the user control over movement settings and the various functions. The total price is estimated to be under \$300.

The problem we aim to solve is availability and cost of modern prosthetics. The most complicated and expensive part of modern upper body prosthetics is the mechanical control essential for finger movements. Generally, this requires translating the single radial motion of a Servo to a complex jointed bend at the fingertip, which can be done in two ways. The first is purely mechanical finger movement. This has several advantages including exact structured movement for the fingers as well as giving power to flexion and extension equally. However, these designs are complex, heavy, and usually expensive. The second method of finger construction is non-mechanical, where elastics or springs are used in between the joints to return the fingers to an extended position. Flexion of the fingers is achieved by applying a single force pull to the fingertip. This method is lightweight, low cost, and easy to build or fix but is less precise. The strength of the extension is also subject only to the springs in the joints, which must be balanced against the torque of the Servos. Our project aims to find a medium between these two methodologies, allowing the user to specify which type of movement they want at minimal cost. A prosthetic that is capable of emulating multiple gestures would typically require super precise (and expensive) sensors capable of measuring miniscule differences in muscle flexion. By introducing an easy to use phone and smartwatch application, we are able to accurately simulate many common gestures using only two muscle states: flexed and relaxed.

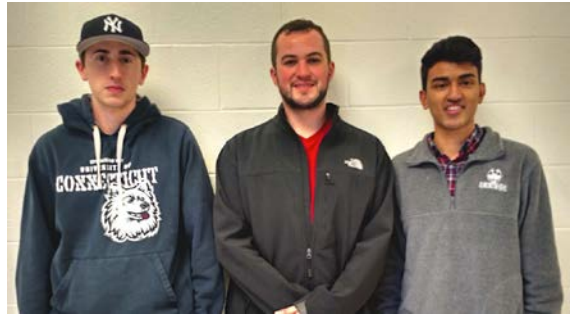
Hydra is scalable, open-source, economically advantageous, and easily reprintable. We want to give the users as much or as little customization as they are comfortable with. Our goal is to merge the various branches of CSE into a unified project that will benefit our education as well as the others in need.





## Team 14: OnIt

Sponsored by: IBM  
Sponsor Advisor: David Leip  
Faculty Advisor: Professor Song Han



From left to right: Taylor Gamache, Luke Belliveau, and Vijay Bala

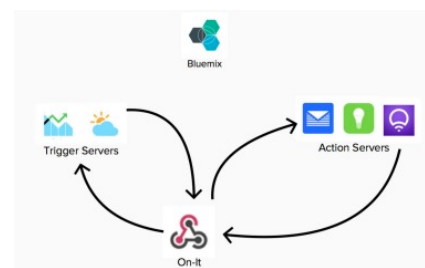
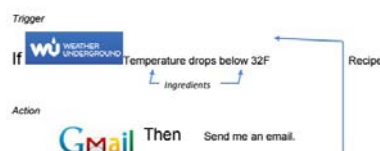


OnIt is a service that adds a new level of interaction to users' favorite applications. OnIt is putting the power of a programmer into the hands of a common user by allowing the user to make applications interact in a manner that previously had to be done manually. Using this service, it is possible to create interactions between two applications that are activated conditionally. These interactions are called recipes. The basic flow of these recipes is as follows; if something occurs in the "trigger" application, then execute something in the "action" application. These somethings are to be set by the user and each application comes with a wide selection of triggers and actions to choose from.

Here is a simple example of a useful recipe. The user can select the weather application from the list of available trigger applications and make a trigger that activates when tomorrow's high rises above 90° F. Then the user can attach this trigger to the email application to send out an email saying, "Soccer training will be cancelled tomorrow due to the heat." This is simple, yet saves the coach some of his time.

Ingredients can also be added to recipes. Ingredients are pieces of information that get passed from the trigger application to the action application. Since this specific trigger action uses location, date, and temperature as pieces of information, they can be passed on to the action as well. A potential email using these ingredients could turn out written like this, "Soccer training will be cancelled tomorrow, 7/16/2015, due to the expected high of 95° F." This recipe is far from the only one that can be created by the user. Due to the large list of available and planned applications, as well as the triggers and actions associated with these applications, users are only limited by their creativity.

Our Senior Design group has been tasked with creating additional channels for the OnIt system to expand the application's capabilities. Our goal is to have five functional channels by the end of the academic year. These include two trigger channels which consist of a Weather Monitor and a Stock Exchange Monitor, and three action channels, consisting of an Email Digest, WeMo Switch, and LIFX.



# Team 15: Software Test Case Automatic Generation

Sponsored by: CS Communication & Systems  
Sponsor Advisor: Emmanuel Delmaere  
Faculty Advisor: Professor Swapna Gokhale



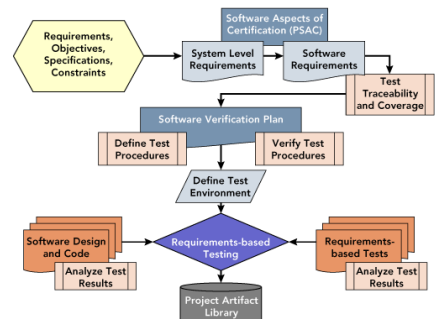
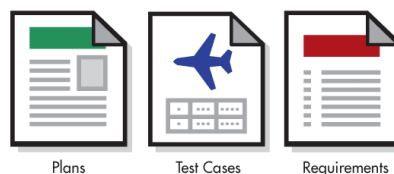
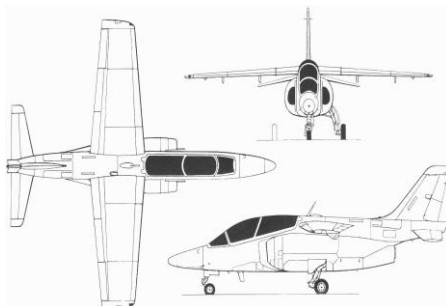
Back row: Austin Deschenes, Tyler Alexander, Toby Mathew  
Front row: Astha Patni, Jessie Ostrander

Aircraft software and systems must adhere to guidelines outlined in the “DO-178 Software Considerations” texts, while also satisfying requirements particular to the manufacturer (or customer) entity, in order to be deemed compliant and eligible for certification by the parenting bodies: Federal Aviation Administration (FAA), European Aviation Safety Agency (EASA), etc.

To achieve these ends this project is focusing on the development of software tools which will allow automation of test case generation and system design verification for aircraft systems. These utilities will reduce the rigorous testing and verification process from a tedious manual endeavor to an efficient, hands off application; this will allow faster product delivery, a higher degree of quality consistency, and higher revenue.

The project software performs several primary functions which are composed of several sub-utilities; these are described as follows:

- 1) Analysis of provided documents via a parsing system
  - Detect and correct variable, function, formatting, and other textual specification irregularities or errors
- 2) Generation of test cases from the software specifications outlined in documents
  - Create complex truth tables for each of the textual cases described
  - Validate all generated and manually composed test cases with each other
  - Verify adherence of total system to DO-178C guidelines.
- 3) Selection and interaction via comprehensive graphical user interface
  - Customize function input and operation
  - Provide feedback via interactive console and generated report

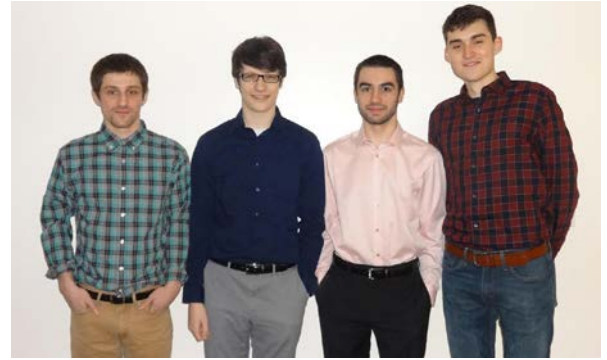


# Team 16: Land Trust Mapping Application

*Sponsored by: UConn Extension*

*Sponsor Advisor: David Dickson*

*Faculty Advisor: Professor Chun-Hsi Huang*



*From left to right: Steven Demurjian, Andrew Schaffer, William Stewart III, and Alex Nicoll*



Land Trusts are nonprofit organizations whose mission is to preserve open space properties. There are 137 land trust organizations in Connecticut that own both properties and easements throughout the state. Monitoring these annually is essential to ensure the properties are neither being encroached on nor violated. This has typically been done on paper, but Land Trusts have been expressing a strong interest to digitize this process. In this senior design project, we developed a cross-platform Android and iOS app for the UConn Extension program that allows Land Trust Volunteers to visit a property and collect information needed to assess the condition of the property, or identify any areas of concern. The application integrates forms stored on a volunteer's Google Drive with an open-source mapping platform to facilitate data collection and sharing.

When using the application, the user first authorizes their Google Drive account and selects a form for use in the monitoring session before opening a map centered on their current GPS location. The map supports the import of overlays from Google Drive or local storage, which will usually be property boundaries in GPX or KML format. This helps users to locate and navigate the property and record information about its condition and any areas of concern. If the user finds an area of concern (point of interest, violation, updated boundaries) they can choose to either create a waypoint or track with details regarding the concern. Additional media such as audio, pictures, or video is able to be attached to the waypoint or track to help detail the issue. Once the user has finished their survey, they have the option to export waypoints and tracks as layers to GPX or KML files and upload the files to Google MyMaps, along with any associated media. The Google Drive MyMaps URL is stored as a field in the form upon export. If the user does not have a wireless connection, the data is saved locally.

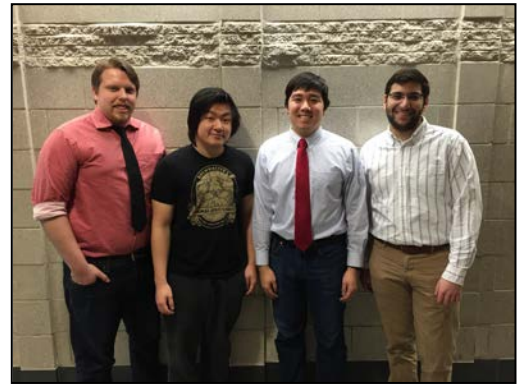
This application was built with the Apache Cordova mobile application development framework, using the open-source Mapbox and Leaflet Javascript mapping libraries and a Model-View-Controller design pattern.



Conservation Parcel Monitoring	
Easement Name	<input type="text"/>
Lot #:	<input type="text"/>
Easement Location	<input type="text"/>
Current owner(s)	<input type="text"/>

# Team 17: On the Quad - Online Classifieds for Students

Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Song Han



From left to right: Derek Rockx, Yao Zhao, William Dickson, and Sam Garfinkel

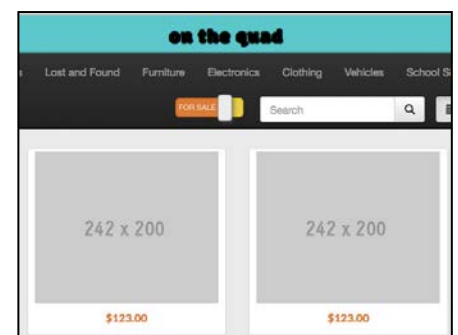
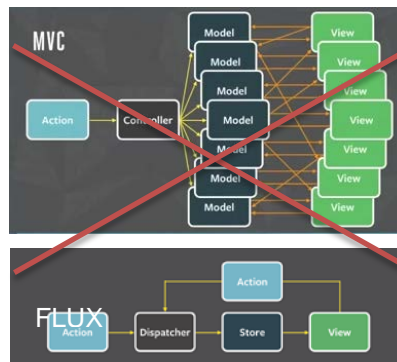
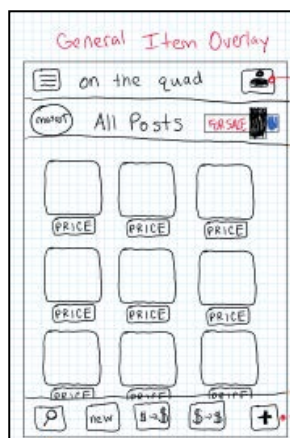
**on the quad**

College is a large financial burden on many students, especially those who live on-campus. Even so, many students moving into new living arrangements will need to purchase furniture, textbooks, and supplies. Additionally, many of the items purchased for dorms or housing near campus is temporary and is not needed after graduation. These conditions lead many students use word of mouth, fliers in their dorm, and even Facebook groups to buy, sell, and trade items with other students. Services such as craigslist create a feeling of insecurity for college students due to the open nature of the platform. Many people would prefer to stay within their on-campus network for their transactions.

We have decided to take this opportunity and create an online classifieds platform targeted at UConn college students. The theme of our site is friendlier than those of other services on the web and to fix the feeling of insecurity, we require login with a valid UConn email address to use the site. We will allow for searching, browsing, and filtering the items posted on the site and we have created a user interface that is both intuitive and easy to use on both mobile and desktop platforms.

From an engineering standpoint, we have made it a goal to use many new technologies in the web development industry. While developing the front-end of the website we have been using many frameworks such as React.js with a Flux architecture, which is Facebook's new variation on the traditional Model-View-Controller (MVC) software design pattern. On the back-end we are using Python with Flask to create a well-structured RESTful API for our front end. For the entire design of the site we are keeping in mind good design practices for a scalable solution that would allow us to expand and add features to the site relatively easily.

Over the course of the semester we have built the site using many developer tools used in industry today such as Webpack, Git, and Heroku. Because we have multiple developers working on the site at the same time, we have multiple development branches set up in Git as well as a full staging site that allows us to check for integration errors before deploying changes to the production server.





# Team 18: UnitedHealth Group

## Mobile Application Store

Sponsored by: UnitedHealth Group  
Sponsor Advisor: Brett Palmer & Kristen Giantonio  
Faculty Advisor: Professor Chun-Hsi Huang



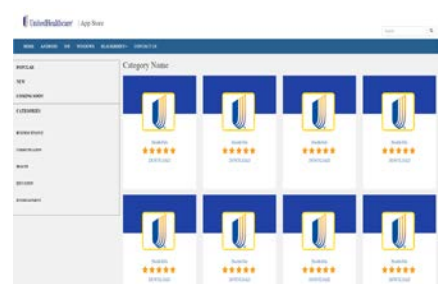
UnitedHealth Group<sup>SM</sup>



From left to right: Besard Gjoni, Jose Tineo, Paul Torres, and Alejandro Meran

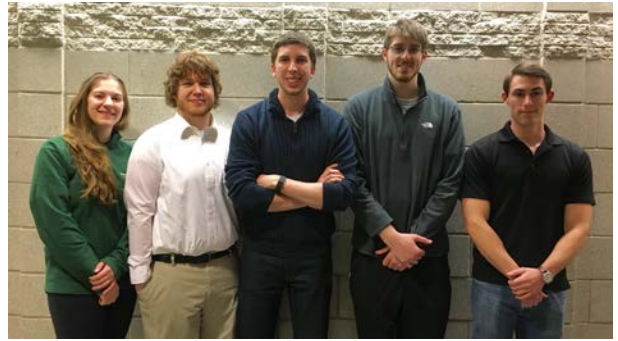
UnitedHealth Group is the most diversified health care company in America that serves its clients and consumers through two distinct platforms: UnitedHealthcare and Optum. UnitedHealthcare provides health care coverage and is the single largest health carrier in America. Optum provides information technology enabled health services. This project focuses on a UnitedHealthcare business called UnitedHealthcare Military & Veterans which proudly serves the health care needs of service members, military veterans, and their families. The company is partnered with the Department of Defense and their TRICARE health care program. Our team has been asked to create a special purpose application store for UnitedHealthcare to allow for the management of multiple (existing and future) apps from multiple sources. Our team has worked with the project leads from Optum to deliver an app store that implements a generic framework, supports flexible branding and multiple channels, supports management of an evolving list of app content, and provides a user interface that is easy to navigate. UnitedHealthcare has existing apps that aim to improve the health of service members and their families. Some of these apps allow users to monitor their emotional health, cope, relax, manage their stress, and browse information on many health topics. One of the reasons the company wants an app store is so they can place all of these existing apps in one location. The ultimate goal of this project is to improve the health and well-being of those who currently serve and have served in the past.

Our team created a static version of the app store website using HTML and CSS. We implemented a framework called bootstrap to make the pages for the site responsive so that they could be scaled for different devices including phones, tablets, and desktops. We used a content management system (CMS) application to maintain the websites content from a central interface. UnitedHealthcare wanted an app store with many of the technical features that existing app stores have. Some features required include, but are not limited to, the ability to add/remove/edit apps within the mobile store, flexible branding, ability to display in mobile and desktop browsers, ability to search for applications within the store, ability to gather user feedback, ability for users to download and share applications, and ability for users to preview applications.



# Team 19: Population and Occupancy Tracking System (P.O.T.S.)

*Sponsored by: UConn CSE Department  
Faculty Advisor: Professor Yufeng Wu*

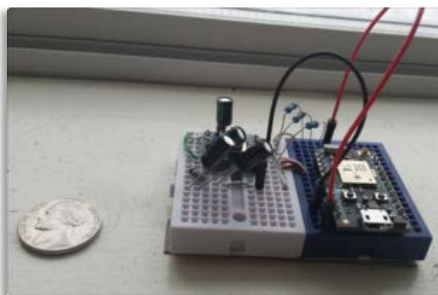


*From left to right: Erica Ballas, William Taylor, Jason Levine, Andrew DaRin, and Ryan Zuklie*



The Population and Occupancy Tracking System (abbreviated P.O.T.S.) is designed to easily track either a single person, or multiple people entering or exiting an area. The system is composed of three major components; a sensor module (for every entrance and exit of a building or area), a central server, and a web server. The first component is the sensor module, which contains an array of sensors attached to a microcontroller. These sensors detect people entering and exiting the designated facility, logs the detection, and sends the data to the central server. Once it has arrived at the central server, the data is aggregated and displayed via the web client to any users who wish to view it, either by live occupancy, or recorded and predicted occupancies stored on the server. Through this flow, the system is able to accurately and reliably report real-time data to the user base.

The ultimate goal of P.O.T.S. is to be able to analyze a facility's capacity at certain times of the day, and to provide this data in a clear interface to anyone who wishes to find the least populated times to visit a certain location. By doing this, we predict that informed people will visit the location at low-traffic times which will eventually lead to a similar capacity level for all times of the day. An endless number of facilities can make use of this technology: restaurants, movie theaters, grocery stores, parking garages, just to name a few.

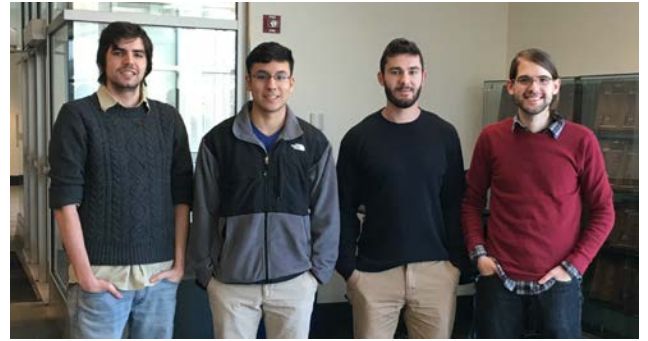


# Team 20: The Integrated Pest Management (IPM) Mobile Application

*Sponsored by: UConn Plant Science & Landscape Architecture*

*Sponsor Advisor: Ms. Donna Ellis*

*Faculty Advisor: Professor Steven A. Demurjian*

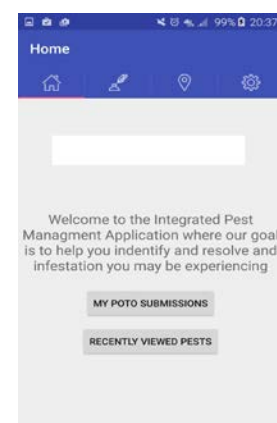
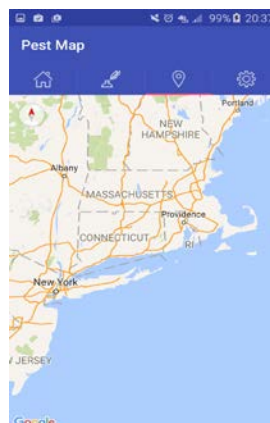
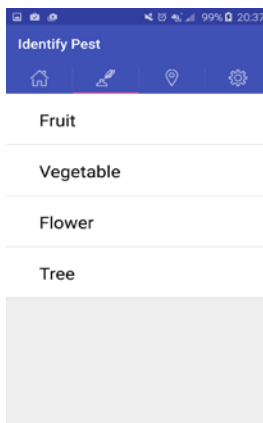


From left to right: Kevin Loureiro, Thomas Charles, Patrick McGarity, and Andre Tremblay



The IPM mobile app (iOS and Android versions) supports the work performed by the UConn Integrated Pest Management (IPM) Program (<http://ipm.uconn.edu/root/>) which provides training and outreach education on managing plant pests for commercial producers of diverse agricultural cropping systems - fruits, vegetables, ornamentals (nursery and greenhouse), and landscapes. There are many pests that attack agricultural crops, including insects, mites, diseases, weeds, and invasive plants. The IPM app provides direct access in the field to a database of information on plant pests, help the user identify the plant pest by comparing photos of the pest itself and damage caused by the pest on the crop, and resources about the pest and how to manage it using photos, videos, text, and links to online resources. The IPM provides capabilities that include: pests that are found in Connecticut, with applicability to New England and the Northeastern US; pests that are found on vegetables (sweet corn, tomatoes, peppers, etc.), fruits (apples, peaches, blueberries, strawberries, etc.), and ornamentals (greenhouse crops: poinsettias, herbs, and annuals; and nursery and garden center crops: trees, shrubs, and perennials); and damage on plants caused by specific pests.

Using the IPM app, a grower takes a photo of a plant pest or crop damage caused by the pest. They select a crop grouping (vegetables, fruits, or ornamentals) and then a particular plant species within the crop grouping. They further select where the pest and/or damage is found on the plant, such as leaves, stems, flowers, fruits, or roots and match the pest and/or damage to images in the database to help identify what is causing the problem. The images in the app database include possible pests that may cause the damage and various types of damage that can occur on the crop. The causal factors include biotic (cause by living organisms) or abiotic (caused by other factors such as weather, nutritional disorders, pollution, or pesticide toxicity). Once the identification of the pest is determined, the user is linked to additional information on the pest and the damage it can cause to the crop (photos, videos, text, and online resources) to learn about the pest and its life cycle, along with control recommendations, such as the UConn IPM website, the New England Vegetable Management Guide, etc.





## Team 21: Big Data Analytics

*Sponsored by: Pitney Bowes*

*Sponsor Advisors: Qianlong (QB) Bian, Vic Dimenna*

*Faculty Advisor: Professor Fei Wang*

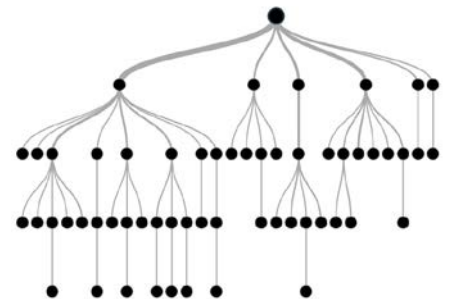


*From left to right: Jackson Kringle, Cory Wang, Connor Ginley, Jared McFarlane, and Joey Muller*

Pitney Bowes is a global technology company that powers billions of physical and digital transactions in the world of commerce. The current focus at Pitney Bowes is enabling data-driven marketing, parcel shipping and logistics, and statements, invoices, and payments. The shipping of items sold on eBay is powered by tools built by Pitney Bowes. Of the many tools Pitney Bowes provides, they have a Global Shipping Program that companies use to effortlessly ship their products all over the world. All international packages that are shipped from the United States through the Global Shipping Program are first sent to Pitney Bowes's hub in Kentucky. While at the hub, all the necessary work is done on the package to prepare it to be shipped internationally. Once the appropriate steps are taken for the country it is being sent to, Pitney Bowes ships the package out to its designated destination. Our group will be working with Pitney Bowes and the data they provide us to tackle two use cases that address the complicated process of mass shipping both domestically and internationally.

The first project given to us by Pitney Bowes to tackle has been that of carrier performance analysis. Pitney Bowes uses its Instant Online Postage tool to provide domestic shipping and tracking to eBay sellers. Our goal is to create a model that chooses the optimal carrier for a given package by training this model with 12 months of Pitney Bowes shipping data and the major US carriers. The features used to select the optimal carrier include parcel destination, origin, physical dimensions, and weight.

The second project concerns selecting an optimal "hub" location. Currently, all parcels are shipped to the Kentucky Hub before they are sent overseas. It may be beneficial to expand this process by adding one or more hubs within the United States. We will study 12 months of shipping data to select a new location for an additional hub to be built. Factors that will be considered include physical location within the US, labor and shipping costs from that location and state-by-state shipping routes.





## Team 22: Fite-Bit “Exercise Videogame App”

Sponsored by: Team Members

Faculty Advisor: Professor Chun-Hsi Huang



From left to right: Jinesh Mehta, Yilun Chen, Erik Green, Benjamin Keen, Santiago Galarza, and Jezreel Jardeleza

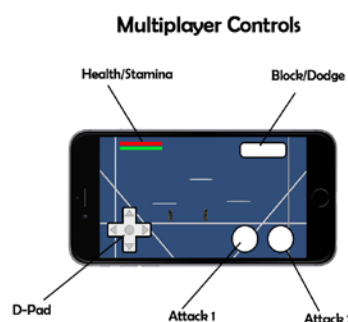
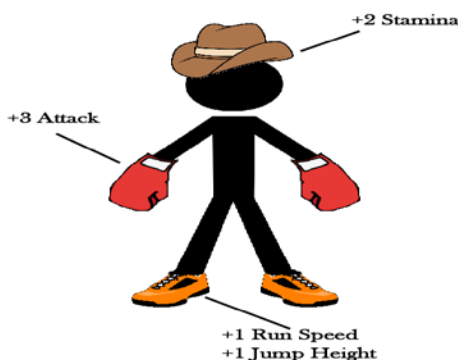


Our Mission Statement: *“Provide motivation and encourage a healthy lifestyle through a competitive and entertaining mobile video game application.”*

Information technology undoubtedly has an enormous impact in our daily lives. Over the past few decades, it has enabled us to gain access to massive amounts of data and information from all over the world, created countless new businesses, and even brought a new breed of millionaires along the way. In general, such advances in technology have allowed us to become more productive and efficient, leading to many breakthroughs in business, medicine, science, and various other fields. However, as the inevitable growth of technology continues, we are now starting to see a new emerging trend in technology and it is no surprise that most of us, if not all, have already experienced it one way or another. Although some may say it's well overdue, technology has finally begun to target our quality of life rather than just our productivity in the workplace. Motivated by the development of the internet and fueled by introduction of cellular phones, we have seen applications that help us cope with depression, applications that allow us to keep in touch with loved ones half across the world, and now even applications that with the integration of wearable technology, like the Fitbit® for example, can help us monitor our own body and ultimately our well being.

Observing these current trends in technology and the direction that we are headed, our team's project will be to develop a mobile application, in particular a video game, whose main objectives are to entertain users while promoting a healthy lifestyle. Our team goal is simple. We will work with these new technologies, exploit their capabilities, and present a product that will not only bring a new flavor to the way people play video games, but will also have a significant and positive impact for today's technologically inclined society.

The idea of the game is simple, yet addictive. While the user exercises, information will be collected and seamlessly sent to our servers for analysis and interpretation. Once data has been processed, and the user opens our App, an addictive game will be presented and your character strength will be a measure of how much exercise has been done.



# Team 23: The Stormwise Mobile App

Sponsored by: UConn Middlesex County  
Extension Center  
Sponsor Advisor: Mr. Thomas E. Worthley  
Faculty Advisor: Professor Steven A. Demurjian



From left to right: Steven Smith, Steven Cranston, Nicholas Rose, and Sean Bridges



The STORMWISE program at UConn (<http://www.stormwise.org>) is intended to mitigate damage associated with power outages caused by large storms (hurricanes, snow, etc.). The Stormwise mobile app with iOS and Android versions provides the ability for an expert professional (arborist, utility worker, etc.) and layperson (homeowner, concerned citizen, etc.) to assist in this process by supporting three capabilities: failed/broken tree data collection, tree risk assessment, and communication of the broader STORMWISE program.

The tree risk assessment and damage report components of the Stormwise mobile app allow a user to submit a detailed self-assessment of potentially problematic and failed trees. The assessment of tree risk has become more precise, but it is largely unknown how accurate the assessments are. Tracking the fate of assessed trees through follow-up damage reports can reveal the accuracy of assessments. The Stormwise app engages the lay person in the process of looking at their trees as something that could fail, and the dangers therein. It provides a vital educational tool, giving agency to the layperson in recognizing tree safety. To accompany this, a primer in tree risk assessment including documentation and photographs curated by professionals will be included. This widespread awareness of tree-related risk will also be valuable to the broader implementation of the STORMWISE program. As a crowd sourced activity, contributed data of tree hazard and risk can be georeferenced on a map visible to the user. This would provide a powerful perspective on the level of tree health in the neighborhood, town, state or even country. Users of the app can register, or sign in as guests. Those with accounts will see more interactive features such as ticket history, and verified expert users will have access to more precise reporting criteria.

A web app will also be included for the town services managing STORMWISE services. This will provide a complete view of all tickets submitted, with options to sort, produce info graphics, and comment on reports.

A screenshot of the Stormwise login screen. It features the Stormwise logo at the top. Below the logo are input fields for "Username" and "Password", followed by a "Login" button. There are links for "Forgot Password?", "Sign Up", and "Login with Facebook" (with a Facebook icon). At the bottom, there is an "Or" separator and a link "Be Our Guest".A screenshot of the Stormwise main menu screen. It features the Stormwise logo at the top. Below the logo are five buttons: "Risk Assessment", "Damage Report", "Your Tickets", "View Area (Map)", and "Sign out".A screenshot of the Stormwise tree risk assessment screen. It features the Stormwise logo at the top. Below the logo is the title "Tree Risk Assessment". There are input fields for "Species" (with a dropdown menu showing "Unknown"), "Height" (with a unit of "feet"), and "Diameter" (with a unit of "feet"). There are "Back" and "Next" buttons, and a "Cancel" button at the bottom.

## Team 24: Backpack

### Electronic Guidance and Informational Application

*Sponsored by: Hyper Computing, LLC*  
*Sponsor Advisor: Professor Sanguthevar Rajasekaran*  
*Faculty Advisor: Professor Reda Ammar*

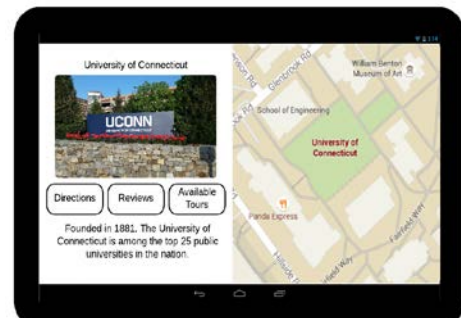


*From left to right: Ivan Peng, Nicole D'Arco, Wesley Garcia, Madhumita Das, Joseph Smith, and Nupur Jain*

Backpack is an informational mobile application that offers a menu of options and features to optimize any travel experience. The purpose of Backpack is to guide users in a new environment by providing access to an extensive library of electronic tours and multimedia information. The portability and user-friendly interface increases the efficiency of traveling to locations that may be unfamiliar. Backpack can eliminate the inconvenience and expenditures associated with a physical tour guide, as well as the hassle of carrying paper maps and brochures. The tours consist of verified user-generated content that provides users with a uniquely designed and detailed description of any facility. The main advantage is the application's access to local insights on locations, which may not be available on the web or other resources. Local business owners and managers can increase revenue by focusing on immediate consumers. Backpack is an invaluable asset for local business owners and managers since it is a more cost effective approach to marketing than most other methods of advertisement.

The application's home screen consists of a Place Search Box with the default input set to the current location of the user. Upon entering a location, existing tours are displayed on the screen for selection. Each tour is separated into pages with left and right arrows, allowing the user to easily traverse through the sites. Each tour includes text descriptions as well as optional multimedia. When progressing to each site, the user is prompted with a "Start Route" option. This feature implements the Google Places API and provides directions to the next location in the tour.

Tours can be generated and viewed on a corresponding website implemented using the Bootstrap web framework. The website is synchronized with the same database used for the mobile application. Backpack's data are stored on a cloud database, which is hosted on DigitalOcean's cloud servers. The Django framework was used to develop back-end server operations used for both the application and the website. The Google Identity Toolkit API gives users of Backpack with existing Google accounts a convenient way to gain login access. Although the current version of Backpack supports most Android phones, any device with web access capabilities can use the application. The Google Places API also gives Backpack the capability to provide basic information on nearby points of interest such as restaurants, metro stations, airports, hospitals, fire and police stations, retail stores, art galleries, museums and more.

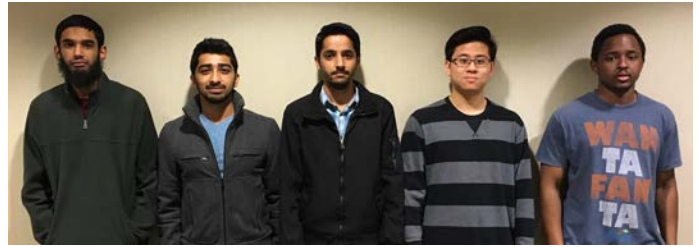


## Team 25: The Food Systems: CT 10% Mobile App

*Sponsored by: UConn Sustainable Food  
Systems*

*Sponsor Advisor: Ms. Jiff Martin*

*Faculty Advisor: Professor Steven A. Demurjian*



*From left to right: Salman Kaleem, Azm Siddiqui, Sufian Nazim, Eric Tran and Nnamdi Egzebo.*



The Live Local Mobile App for UConn Extension is both an iOS and Android mobile application used to engage local residents and business to support local farms and working landscapes. UConn Extension is a department within the College of Agriculture, Health, and Natural Resources devoted to connecting the power of UConn research to solve local problems. One of our growing projects is engaging residents to support local farms and working landscapes. Through the CT 10% Campaign, residents and businesses are invited to take a pledge to spend 10% of their food and gardening dollars on locally grown products. The 10% Campaign is an online tool of agriculture service providers that are working together to help consumers discover local Agriculture, based at [www.buyctgrown.com](http://www.buyctgrown.com).

In August 2014, the CT 10% Campaign recruited 400+ people and 115 businesses to take the pledge with cumulative tracking of over \$700,000 spent on locally grown products. As of August 2015, the commitment has increased to 1000+ people and 220 businesses taking the pledge, spending over \$2,200,000 on locally grown products and these numbers continue to grow. The development of a Live Local Mobile App for the Android platform will further momentum for the campaign. The Live Local app allows users to: Discover information with users about opportunities to discover and experience local agriculture (calendar, season's top ten, featured trails (e.g. beer trail); Track and share their progress toward their 10% pledge; and, Maximize social media opportunities for users, such as sharing pictures, sharing progress toward the pledge, joining a Facebook group of mobile app users, etc.

The Live Local Mobile App has been designed for CT residents as well as tourists/visitors to CT who want to discover CT-grown food and experience local agriculture (calendar, seasons top ten, featured trail). The app lets users browse upcoming events to find an activity that will be fun for the family. Users take a pledge to spend 10% of their food and gardening dollars on locally grown products and then may use the app to track and share their progress with friends on Facebook. The Live Local Mobile App also helps to build an online community of local food and farm enthusiasm through Facebook.



**1,133** PEOPLE  
and **239** BUSINESSES  
SPENT **\$2,967,325**  
LOCALLY SINCE AUGUST 2013

