UCONN
SCHOOL OF ENGINEERING

seniordesign.engr.uconn.edu

Senior Design

DEMONSTRATION DAY

GAMPEL PAVILION, STORRS, CONNECTICUT APRIL 28, 2017

COMPUTER SCIENCE AND ENGINEERING

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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 the Fall of 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:

Auerfarm, Cigna, Pitney Bowes, Pratt & Whitney, Synchrony Financial, UConn Health Family Medicine, University of Connecticut's Center for Open Research Resources and Equipment, Center of Voting Technology Research, Natural Resources and the Environment, Student Affairs Information Technology, Extension, University Information Technology Services, and Zlotnick Construction, Inc.

Team 1:
Device Security System

From left to right: Adrian Anthony II, Tsan Lee, Alan Peng, Xiguang Liu and Tianyi Wang

Sponsored by: Synchrony Financial
Sponsor Advisors: Daniel Murphy & Jake Miller
Faculty Advisor: Dr. Chun-Hsi Huang

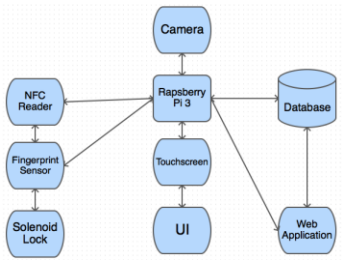
synchrony FINANCIAL

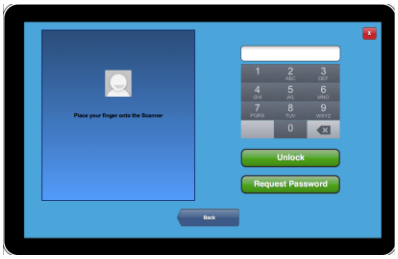
COMPUTER SCIENCE & ENGINEERING

Synchrony Financial is an 84-year-old consumer financing company with the heart of a startup. Synchrony is pioneering the future of financing which now includes products across many devices and digital mediums. In order to equip their employees with all the latest technology used by customers, Synchrony allows employees to check out mobile devices such as laptops, phones, and tablets, to test their products.

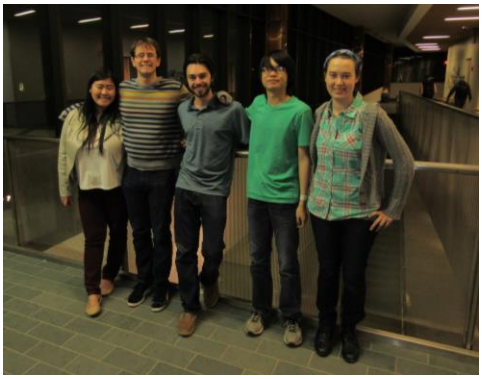
Synchrony Financial wanted an upgrade to its device security storage. The requirements for the new security system were as follows: physically securing the devices from unauthorized actors, identifying employees as authorized users, allowing authorized users to access the devices, and keeping track of the devices' statuses as they are removed from storage. The physical security is done via an electronic lock connected to an authentication system. The identification of employees is done via the same authentication system, which uses biometrics and passwords. The authorization of access to the devices is controlled by the system interacting with the lock. The verification of the devices' presences in the secure storage is made possible by way of an NFC scanner and a database. The database also interacts with another senior design team's device request system. The interaction of the two systems is kept consistent by giving priority to device requests over those taken out on-site. The system also allows administrative overrides and access to a log of operations it has performed.

The security system is made up of an electronic lock, a fingerprint scanner, an NFC scanner, a camera, a Raspberry Pi, a touch screen, and a database. The lock secures the door of the storage. The fingerprint scanner is used to register and test biometric data from the authorized users. The NFC (near-field communication) scanner is used to identify particular devices and change their states in the database. The camera is used to record the user that made use of the storage and to enable administrative override of the security system. The Raspberry Pi is the processor driving all the devices and the user interface, and the touch screen is what enables the user interface. The user interface, as well as all of the code for the system is written in Python, using the Tkinter library. The database is written via MySQL and is used to hold both the device data and the data of the authorized users.





Team 2: Synchrony Financial Mobile Device Tracking System



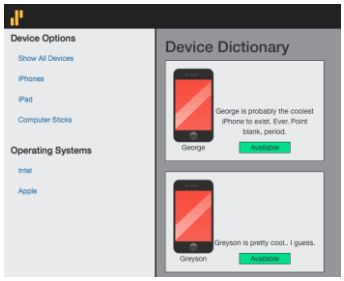
From left to right: Maegan Dyakiw, Connor Jackson, Adam Claxton, John Costa III, and Brianna Boyce

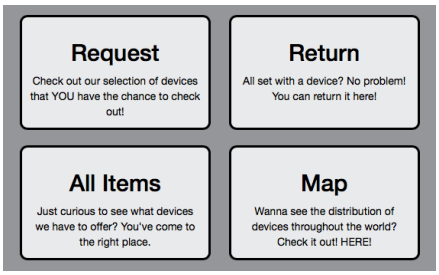
Sponsored by: Synchrony Financial
Sponsor Advisor: Daniel Murphy
Faculty Advisor: Dr. Yufeng Wu

COMPUTER SCIENCE & ENGINEERING

Synchrony Financial is an 84 year old consumer financing company with the heart of a startup. Synchrony is pioneering the future of financing which now includes products across many devices and digital mediums. In order to equip their employees with all the latest technology used by customers, Synchrony allows employees to check out mobile devices such as laptops, phones, and tablets to test their products. Synchrony currently tracks their mobile devices manually in an Excel spreadsheet, and this process can be tedious. With a new system, the process of requesting, ordering and approving mobile devices will become easier, quicker and more efficient. Our Java web application will use a MySQL database for backend, a Java application layer, and HTML, JavaScript and CSS with Bootstrap as the framework. The Pivotal Cloud Foundry service is used to host the website in a more agile fashion. The system would be very similar to a library, where a patron can see the library's inventory, request a book for some amount of time, and then return the book to the library. The user may request additional time with their product, return it early, and receive reminders on due dates.

With this new system, requests, approvals, status updates, reminders, and printing labels could all be handled by this application. This system will be simpler for employees to request devices and for administrators to approve or reject device requests or add them to a waitlist. The administrator can query the database and check the status of devices. If a device is checked out, they may be added to a waitlist, or choose a different device to request. There will also be a feature to track where devices are on a map of the world. This can be a useful visual to show where the devices are going in an international corporation. Overall, this system will make all steps of device tracking easier and more efficient.





Team 3: Insight

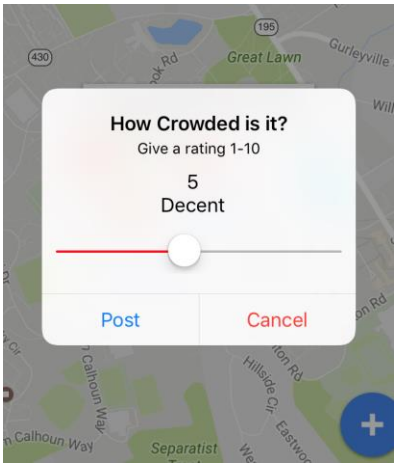
Sponsored by: Team Members
Faculty Advisor: Dr. Yufeng Wu

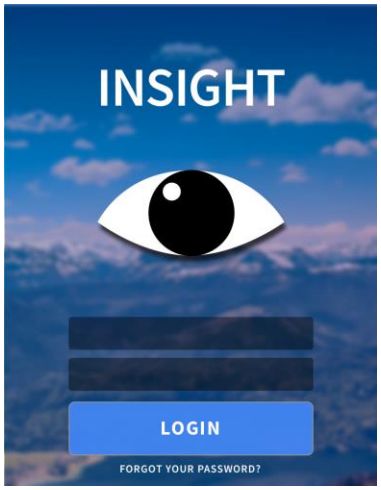
Left to right: Ryan Arnold, Blake Apatow, Mike Lento, Tom Smith-LaFemina, and Karl Lassy

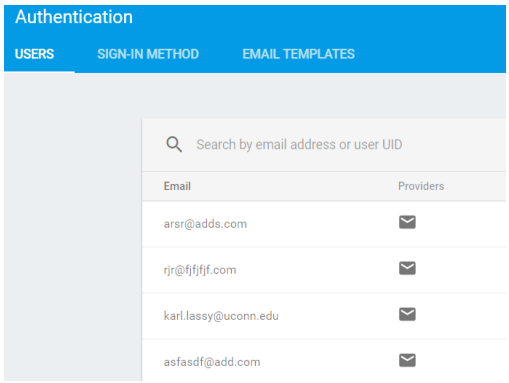
Over the course of our undergraduate experience, students consistently complain about the inconveniences they face by not knowing the current crowd conditions of locations on and around campus. We recently saw two students walk into the gym and find the bottom floor weight room completely packed and a line of several students to use any of the machines. They left the gym in frustration. Walking circles around the floors of the library in search of an open table is a common occurrence during mid-semester peak periods and finals week. Restaurants and bars on campus fluctuate in popularity in a seemingly random schedule. Certain times or days are fun and interesting but then boring at the same time the next week. The unifying problem in each of these situations is that there is currently no way to know what is going on in an area unless you have direct communication with someone physically there or you are there yourself. This pain point for people on campus can be mitigated by creating a service that allows users to add feedback on the current conditions of a location and for other users to see that information and use it to their advantage in planning their activities.

Our solution is Insight. Upon opening Insight, a user is directed to a map view of their current location where they are able to input information about their current location, confirm information about their current location, or check the current condition of locations near or far. The app's focus is on creating an interconnected real-time 'view' of different locations in the area. Our initial launch area is UConn but this idea can be applied to other campuses or urban areas.

There is currently no popular or effective means to check the current crowd conditions of a location in your area. Conditions can and do surprise, inconvenience and frustrate students frequently. We provide an easily accessible, user-friendly mobile application that allows users to check the conditions of a location without having to physically visit or know someone attending.







Team 4: Transactional Document Pattern Matching

Sponsored by: Pitney Bowes
Sponsor Advisors: Paul Mayer and Bob Laprade
Faculty Advisor: Dr. Swapna Gokhale

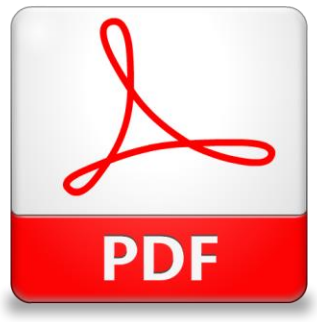
From left to right: Max Wright, Jack Bonadies, Daniel Turgeon, Joshua Eller and Alan Bergquist

COMPUTER SCIENCE & ENGINEERING

Pitney Bowes is a company dedicated to finding commerce solutions. For this reason the company often receives massive sets of mail with extraneous information. Thus, a solution needed to be developed in order to automatically find key information from the mail including addresses and names as well as finding a place to put a barcode. Given PDF files of all of the documents the company receives, a program would need to be developed that can recognize names and addresses, find whitespace, and split up documents in a logical way.

Research was performed leading to finding an open source program that could find the locations of text in the pdf file, help with optical character recognition, and find whitespace. From this and our knowledge of regular expressions, special strings of text that can be used to define a search pattern, we could more easily and reliably find the key information we were looking for. Developing a proof-of-concept using these methods, we were able to extract relevant information from sample documents provided by Pitney Bowes and we were satisfied. To further improve our delivery we looked into a database in order to match documents previously used for input. This involved using software to match key text and logo coordinates from the input to a small database.

This project spanned many areas in computer science and computer engineering including deterministic finite automata, application programing interfaces, and optical character recognition. Deterministic finite automata were defined to implement regular expressions to match a defined language of text and phrases, in this case customer accounts, names, and addresses. An application programming interface to communicate with PDF documents was developed in order to extract coordinates of text and whitespace. Optical character recognition is a field within artificial intelligence to extract text from images so that they can later be searched or manipulated. This was essential as the files given to us were not plain text, they were scans of mail.



Team 5: Cyber Security and Integrity with Embedded Systems

Sponsored by: Pratt & Whitney
Sponsor Advisors: David Howland, Scott Beecher, Jason Posniak
Faculty Advisor: Dr. Bing Wang

From left to right: James Park, Ryan Mack, Matt Arnold, Ryan Carmellini and Dylan Mousch

COMPUTER SCIENCE & ENGINEERING

Pratt & Whitney
A United Technologies Company

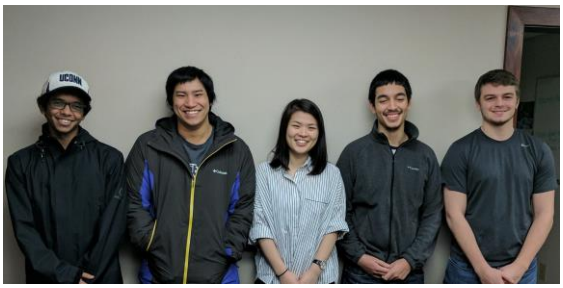
Pratt & Whitney is an aerospace manufacturer with operations worldwide. They create state-of-the-art engines and turbines for civil and military applications. The premise of our Senior Design Project is to evaluate a loadable software delivery process, research cutting edge technologies related to the process and then design a robust end-to-end delivery method for sensitive software to be installed on embedded systems in the field. We have worked closely with Pratt & Whitney to replicate their environment and assess vulnerabilities in the process and have applied industry standard solutions to counter these risks.

The key challenges in designing a secure end-to-end delivery system came from the variety and scale of end-points that needed to be secured. Our solution must support large-scale distribution to field devices that may be located at many geographic locations. In addition, our solution needs to retrofit legacy field devices that may not have high computation capabilities. We have used state-of-the-art security techniques to ensure that our secure delivery system meets these requirements. Specifically, the solution uses a combination of symmetric and asymmetric cryptography techniques as well as digital signatures to provide confidentiality, data integrity, and authentication. Using these techniques we have been able to design a secure and scalable end-to-end delivery system.

We have built a prototype using off-the-shelf devices to demonstrate and evaluate the performance of our solution. We use OpenSSL, an open source encryption system to encrypt and authenticate files. Open Source software allows us to verify the security claims because the source code is readily available. Our prototype uses Amazon AWS as a storage server for encrypted keys and software files. Using a custom Python-based protocol we are able to communicate between a field-deployable tablet loader and an embedded system for software delivery. We used a microcontroller to simulate the embedded systems located in the field and a Linux-based tablet, which is consistent with what is currently used by P&W.

Team 6: Zlotnick1

Sponsored by: Zlotnick Construction, Inc.
Sponsor Advisor: Gregory Zlotnick
Faculty Advisor: Dr. Song Han



From left to right: Ektedar Alam, Steven Tang, Cindy Lin, Sebastian Colorado and Ryan O'Conner

ZLOTNICK CONSTRUCTION INC.
GENERAL CONTRACTORS • CONSTRUCTION MANAGERS
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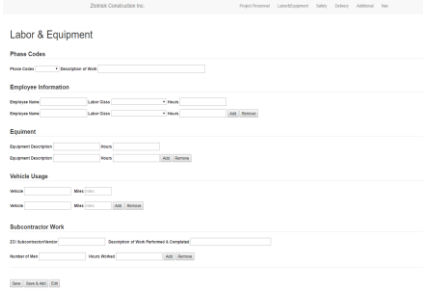
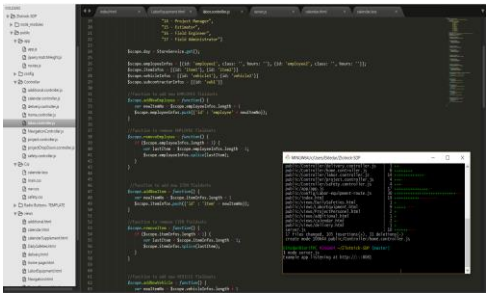
COMPUTER SCIENCE & ENGINEERING

Zlotnick Construction is one of the foremost contractors in New England. They have a vast number of projects for the private as well as public sectors. Throughout the years, processing data records have become significantly difficult with numerous ongoing projects. The majority of the information and data are currently processed and handled through paper, however, Zlotnick Construction has been expressing an interest to digitize this process. For our senior design project, we are implementing and deploying a front-end data acquisition app for teams working in-the-field. Specifically, on constructions that need to be reported on a daily basis. Some examples would include, the work description, usage of equipment, consumables, materials and human labor as it relates to specific activities on the site.

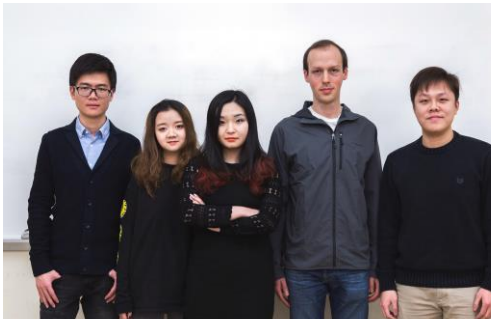
Our project integrates with the database (SQL Server) of the existing commercial tool Viewpoint for acquiring basic data as well as store the information entered through our developed system in a separate database. The viewpoint database consists of important information such as equipment related phase codes, payroll and employee information. The application must give the administrators capabilities of accessing and modifying existing database so that information on the front-end is consistent. When using our application, the user must first login with their credentials. Depending on administrative permission of the account, they will have access to certain projects, limited information, and depending on their role, they will be given different responsibilities to handle. The administrators will have the responsibility of assigning new accounts with permissions and projects.

This project is paired with Team 7 (Zlotnick Data Analysis and Results Visualization) who are developing a data analysis tool. Their application will use information acquired from the front-end to compare real time data to detect inconsistencies, budget overrun/underrun, profit/loss or any other anomalies.





Team 7: Zlotnick Data Analysis and Results Visualization



From left to right: Linfei Xie, Yan Zhu, Qiyu Li, Tsz Yan Wong and Nick Barber

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Sponsor Advisor: Gregory Zlotnick
Faculty Advisor: Dr. Song Han

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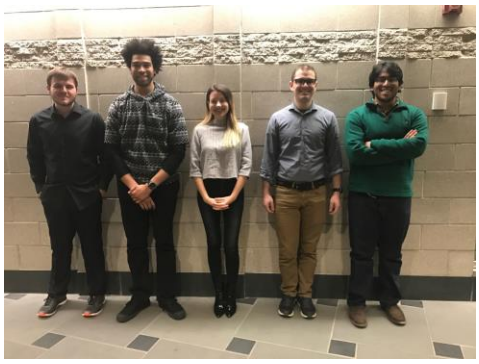
Our Sponsor, Zlotnick Construction, is a company that has sustained their reputation as being one of the foremost contractors in the New England region. Through slow and strategic growth, the company has grown to service regions from New Jersey to Maine and completes projects ranging in size from $1,000 to $20,000,000. They work in fields such as retail, commercial, medical, and industrial, and have partners such as PriceRite, Costco, PriceChopper, Staples, Walmart, as well as others.

Zlotnick has a system with defined rules and procedures for construction projects. For each project, the company's estimators will generate an estimation based on the requirements and costs such as equipment, labor, and materials. After these estimations are entered in an Excel file, the project will begin as planned and the company's accounting department will have to manually enter them in a construction software called Vista by ViewPoint to generate financial reports. In addition, throughout the course of a project, accounting will also manually enter detailed information about many of real costs corresponding to those described in the estimate. Prior to our involvement, it was not possible to match estimated and real costs for a given project, not only across broad domains such as equipment, labor, and materials, but also across more refined fields, known as opcodes, referring to specific tasks such as concrete and electrical wiring. Without these capabilities, it was difficult if not impossible for managers working on the site to have a sense of whether or not they were on schedule. Not being able to anticipate difficulties in advance was one of the main obstacles for Zlotnick in remaining under budget and ahead of schedule across many of their construction projects.

Specifically, the goal of our project has been to work with another front-end development team to build a system capable of monitoring the progress of the projects that the company is currently working on. Our task was to augment the capabilities of the other team and employ their collected data through data analysis and reporting tools which could compare and contrast forecasted project estimates, both in time and financial terms, with completion estimates, progress-cost tracking, and actual resource usage to detect anomalies, deviations or surprises that may arise within a large-scale construction project. Our intent has been to provide the management level of the company techniques including differential analysis, time-based analysis, and progress rate, to name a few. Our final product will provide both textual and visual results to our client.

Team 8: Geographical Representation of Network Usage at UConn

Sponsored by: University Information Technology Services (UITS)
Sponsor Advisor: Lara Juenger
Faculty Advisor: Dr. Chun-Hsi Huang



From left to right: Patryk Rus, Christopher Byars, Alexandra Augustak, Asher Solomon and Abel Matthews

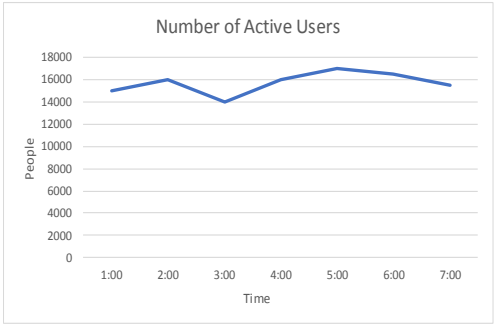
UCONN
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

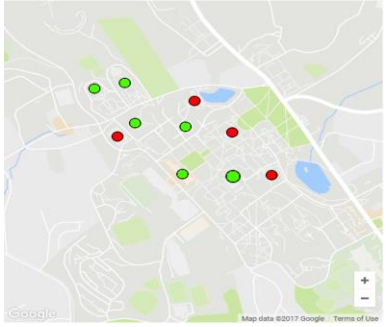
COMPUTER SCIENCE & ENGINEERING

As the University of Connecticut expands and enrolls more students each year, it is important that the infrastructure of the network at UConn is able to adequately meet the demands and needs of the student and faculty body across its campus. Currently, the university's network consists of approximately 100,000 data access switch ports and only utilizes about 25% of them. This shows that the capacity of the network greatly exceeds demand, and reconstructuring is possible to achieve a higher level of efficiency.

Before trying to re-structure or change the network infrastructure, it is important that data is first collected and analyzed to better understand how and what should be done. While a lot of basic information is readily available (number of ports, physical locations of ports) there is a lot more information that is required to make an informed decision. Things like the demographics of the users as well as the types of space that the network infrastructure is supporting are valuable assets in deciding where to focus efforts and developments.

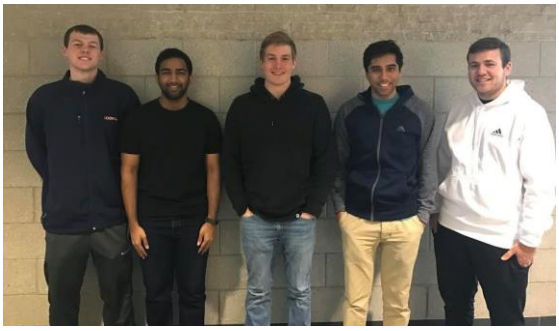
Our Senior Design Project addresses these issues with a web application. Our web application will allow UITS staff and other authorized users to be able to see network traffic trends on an easy to read graphical image. By collecting data regarding the number of users at wireless access points, as well as demographics regarding users at both wireless points and wired ports, UITS will be able to better understand where they should focus their efforts and how to better use space so that departments and faculty who have greater network demands can be better outfitted. Our web application will provide multiple services. These include things such as a graph showing the total number of active users on the network, a geographical map of the Storrs campus outlining where the largest number of users are located, and a detailed view of the floor plans of the buildings themselves. The floor plans will be a critical part of the application as they will allow UITS to see wired port usage in a building with filters that highlight faculty and their respective departments to better understand who is using these networks. The web application will be collecting data at certain time intervals, and will be logged to allow discoveries of trends in network usage. With all these tools at their disposal, UITS will be able to make informed decisions on future network infrastructure changes.





Team 9: SAIT Student Affairs Case Management System

Sponsored by: UConn Student Affairs Information Technology
Sponsor Advisor: Valerie Puffet-Michel
Faculty Advisor: Dr. Swapna Gokhale



From left to right: Bryant Molloy, Nihar Devineni, Kyle Gain, Daljit Sharma and Roberto Gentile

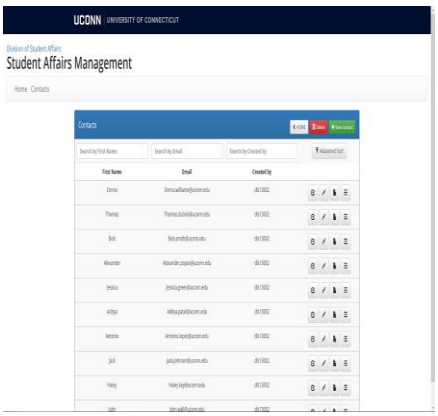
S.A.M.
Student Affairs Management

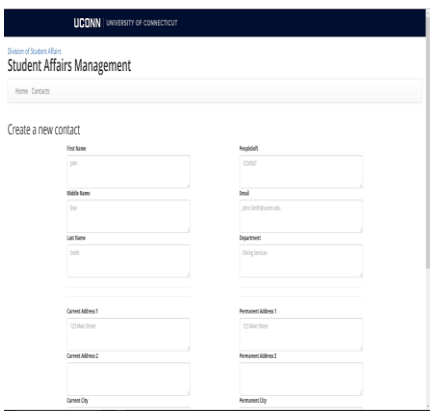
COMPUTER SCIENCE & ENGINEERING

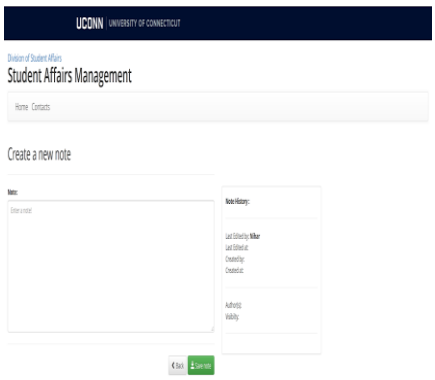
The University of Connecticut Student Affairs division encompasses most of the non-academic branches of the University. These branches regularly communicate with students, faculty, and staff on a daily basis. Currently, each branch keeps track of their contacts either on paper or using their own case management software. This is an inefficient system for such a large division of the University, and makes interdepartmental case work more difficult.

Because of this, the goal of this project is to create a division wide case management system to simplify communication. Through this software, faculty and staff will be able to create contacts and notes to communicate and record information as needed for case work. These contacts can include other faculty, students, staff, and can even be extended to include people outside of the university such as police officers, landlords, etc. Notes can include information about meetings, uploaded files, and various contact information. Contacts and notes within the system can be kept private to a specific user or department(s) in the case of personal information. Students, as well, will be able to access the system to communicate to specific departments as needed. As an example, a student in need of additional time on a test will be able to submit a doctor's note to the Center for Students with Disabilities via S.A.M.

In order to implement this project, the Student Affairs Information Technology department provided a collection of tools that they currently use to facilitate future maintenance and improvements. Technologies such as Python, SQLServer, Linux, Pyramid as a web framework, jQuery, and others were used in conjunction with the Agile work format to make a project similar to those found in the industry today.







Team: 10
Modular Security Framework

Sponsored by: University Information Technology Services (UITS)
Sponsor Advisors: Jason Pufahl, Stephen Lincoln
Faculty Advisor: Dr. Chun-Hsi Huang

From left to right: David Engel, Nathan Ramdial, Gavin Li, Kyle Heitman, and Tony Pham

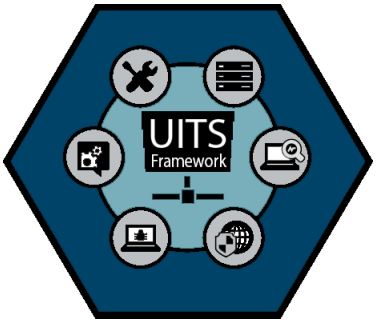
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

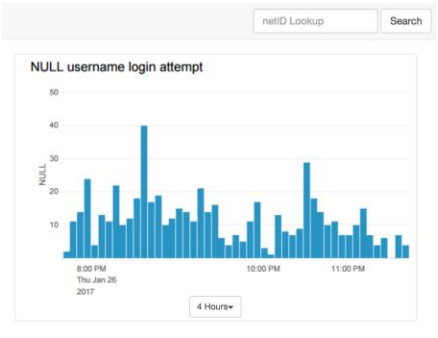
COMPUTER SCIENCE & ENGINEERING

The UITS workflow currently requires manual log file lookup, analysis, and action for any potential security threats concerning University ID's. The goal of the project is to automate this workflow by implementing a framework that establishes a central multi-processing controller. This controller will monitor and regulate all running security applications, provide an API to extend upon UITS' ability to modify and create new functionality for their applications, and implement a front-end web client that delivers notifications, visualization of data, and control over all applications. The framework is written in Python 2.7.1 and the webpage is implemented in HTML with most of its functionality written in PHP.

The webpage is the front-end of our project and is how most users will interact with the application. The webpage uses PHP to access the framework's API functions, allowing users to search student and faculty via ID or email, access logs from databases, and resolve any issues found by security applications. The webpage also has real time notifications of any issues found by the applications. The page centralizes all processes and notifications from several different UITS databases to one location for easier access.

The API has functions useful for security applications that are built in. This supports modifications to existing processes and creation of new procedures. Applications that identify fraudulent use of University ID's are built using the framework API. These applications take user access and locational data and predict the likelihood of a security breach based on frequency of logins and change in geographical coordinates over time. The central controller runs each security application listed in its script as its own process and monitors the status of the process. This isolates each application and allows them to run independently of each other, providing modularity. Both applications act as a proof of concept for the use of the API's functions and are also working additions to UITS' security arsenal.





Team 11: Healthcare Data Mobile App via Fast Healthcare Interoperability Resources

Sponsored by: UConn Health Family Medicine and CSE
Sponsor Advisor: Dr. Thomas Agresta
Faculty Advisor: Dr. Steven A. Demurjian

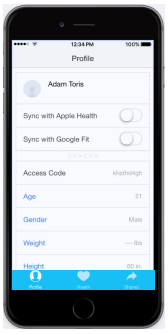
From left to right: Geoffrey Cheng, Amy Franzis, Angela Onofrio and Adam Toris

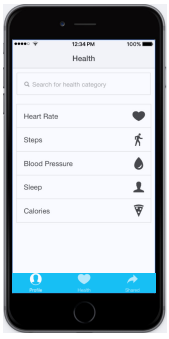
The purpose of the SDP is to explore all of these different issues utilizing a variety of health information technology standards, frameworks, and systems in order to develop a healthcare data mobile health (mHealth) app that is able to gather information from multiple sources utilizing FHIR, Fast Healthcare Interoperability Resources. FHIR provide a RESTful Application Program Interface (API) to share data in a common format. FHIR conceptualizes and abstracts information for HL7 into Resources that effectively decompose HL7 into logical components for information usage and exchange. This will provide patients with the ability to: manage health/medical/fitness/chronic disease data across a wide range of applications (may be both mobile and web-based) that involve separate and independent repositories; and, share information with family members (child care, elder care, spousal care), nutritionists, personal trainers, therapists (physical, occupational, pulmonary), home health care aides, internist, family medicine MD, nurse practitioner, physician assistants, pediatricians, cardiologists, ENTs, orthopedic surgeons, physiatrist, phycologist, therapist, etc.

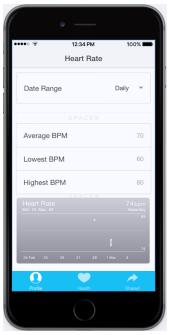
The project developed a healthcare data mobile app that is able to interact with Google Fit, Apple Healthkit, the OpenEMR electronic medical record, and the Microsoft HealthVault Personal Health Record. This was accomplished by:

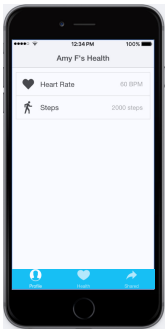
- Designed and developed a FHIR RESTful API that is able to load/store data into Google Fit. This will require utilizing the Google Fit API.
- Designed and developed a FHIR RESTful API that is able to load/store data into Apple Healthkit. This will require utilizing the Apple Healthkit API. Note there is a FHIR effort ongoing in Objective-C.
- Designed and developed a FHIR RESTful API that is able to load/store data into OpenEMR via the OpenEMR API.
- Designed and developed a FHIR RESTful API that is able to load/store data into Microsoft HealthVault via a C# API.

The mobile app utilizes an API UI framework that leverages HTML5, CSS, and JavaScript to generate iOS and Android apps from one code-based.



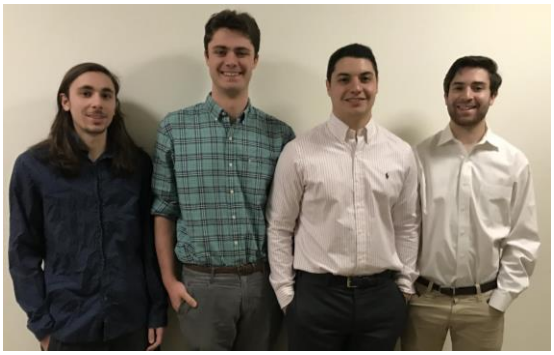






Team 12: Auerfarm Mobile App for the 4-H Education Center at Auerfarm

Sponsored by: UConn Extension & Auerfarm
Sponsor Advisors: Jen Cushman and Beth Bye
Faculty Advisor: Dr. Steven A. Demurjian



From left to right: Anders Fogelberg, Mike Donohue, Emilio Volpe and David Dardik

COMPUTER SCIENCE & ENGINEERING

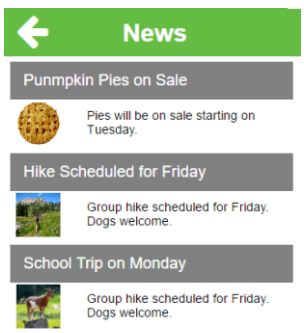
The 4-H Education Center at Auerfarm is a 120-acre farm that provides valuable hands-on experiences to more than 12,000 children throughout the year. Seasonal programs are offered to school classes, community groups, and the public in the Center's animal barn, gardens, farmland and orchards. The campus is open to the public year round allowing the farm to fulfill its mission to connect people, agriculture and the environment through education and recreation. The farm is also the home to multiple 4-H Clubs. The farm has various facilities that provide educational opportunities in the areas of animals, wildlife, plants and farm production.

The Mobile Application for the 4-H Education Center at Auerfarm is an application for both Android and iOS whose main purpose is to enhance the educational experience of visitors of the 4-H Education Center at Auerfarm as well as contribute to the farm's mission: to connect people, agriculture, and the environment through education and recreation. The application does this through several different features:

- An interactive map of the property including trails, gardens, animals, etc. where users can select landmarks, plants, animals, and facilities to display more information (pictures, identification, origin, description, fun facts, etc.).
- Ability for visitors to submit questions, comments, or request more information through the app interface.
- Interaction of the mobile app with Instagram and Facebook.
- Ability for staff to post news and upcoming events.

Users of the app include: members of the community using the application while visiting the farm who would like to know more about the plants, animals, or landmarks around them, see cool locations to check out during their visit, or submit questions/comments relating to the farm; members of the community using the application outside of the property to view any updates or upcoming events, see information about the different plants, animals, landmarks on the farm, or contact the staff to request more information; and
Auerfarm staff using the application to provide the community with any Auerfarm news/information/updates, answer visitor's questions, and add/update descriptions of the different aspects of the farm.

The application was developed using web based technologies like HTML, CSS, JS, and APIs for Google Maps (for the interactive map), Facebook, and Instagram (to help contribute to Auerfarm's presence on Facebook/Instagram). Apache Cordova is used for mobile deployment on both iOS and Android.



Team 13: Flow Mobile App for Groundwater Flow Modeling

Sponsored by: UConn Natural Resources and the Environment
Sponsor Advisor: Dr. Gary A. Robbins
Faculty Advisor: Dr. Steven A. Demurjian

From left to right: Zachary Alberts, John Scipion, Mahir Rana and Gustavo Evangelista

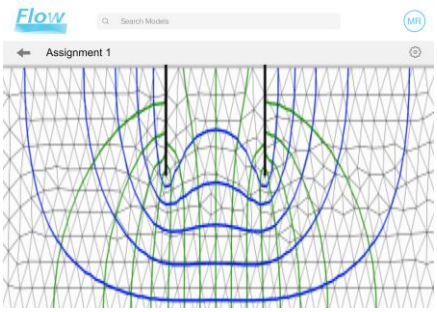
COMPUTER SCIENCE & ENGINEERING

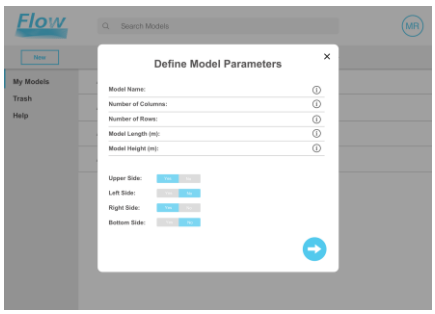
Groundwater flow modeling is an important tool in hydrogeology that is utilized to predict how groundwater flows (the direction, rate and quantity) and also used to establish water well protection zones and to clean up groundwater contamination. The use of such models typically has a long curve. Some years ago, Prof. Robbins found a model that was very easy to use and for students to learn. The model is a finite difference model. Version 5.1 was published in 1983 and developed by H. Van Elburg, G.B. Engelen and C.J. Hemker in cooperation with the Institute of Earth Sciences at the Free University of Amsterdam, the Netherlands (address: C.J. Hemker, Elandsgracht 83, 1016 TR Amsterdam, Netherlands). The model is a 2D finite difference code with input grid and output contour graphics. The original app runs on DOS and written in Fortran so the app is very outdated. The Finite Difference Model uses a combination of different groundwater laws such as Darcy's Law and the Continuity Formula. One of the main efforts in this work was to reengineer and recode the Finite Difference Model so that it would be accessible by mobile Flow app.

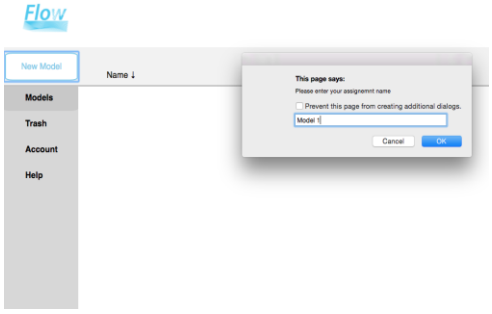
The project developed, Flow is an application that builds on the model created by Robbins, but creates a better aesthetic look and feel, improving the user interface (UI) design. The Flow applications market demographics is for students in college courses all over the world, who will use this tool for training.

The Flow app has an input interface for inputting boundary head conditions, a grid that measures 20 horizontal by 10 vertical, a graphic map of the grid for inputting horizontal and vertical hydraulic conductivity values and porosity values. The output would be a graph of contour lines and flow lines. The flow lines would also show distance traveled given a set time of interest. Using the Finite Difference Model, a combination of groundwater and mathematical laws, we can create realistic models on screen that represent what would occur in the real world.

The technologies that we used for the app include HTML, CSS, and AngularJS to create the basic functionality and aesthetics of the application. We also implemented Bootstrap and Ionic to make a responsive webpage, capable of adapting depending on screen size. For the server side of our application we used MySQL database.

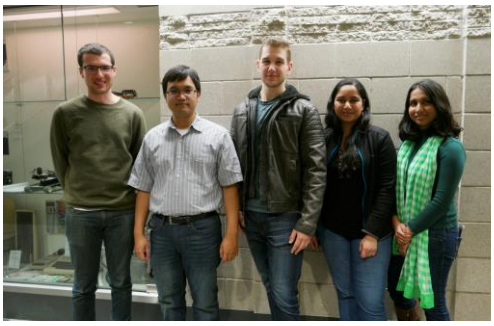






Team 14: Wello Mobile App for Connecticut Well Completion Reports

Sponsored by: UConn Natural Resources and the Environment
Sponsor Advisor: Dr. Gary A. Robbins
Faculty Advisor: Dr. Steven A. Demurjian



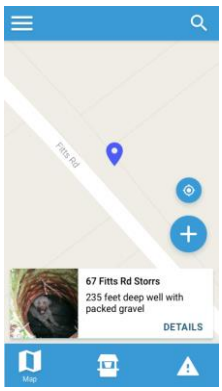
From left to right: Erik Lindsay, Arif Prabawa, Mathew Fox, Shivani Dandekar and Juhi Nadella

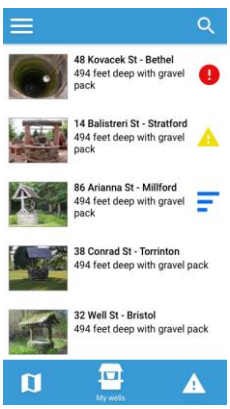
COMPUTER SCIENCE & ENGINEERING

The Wello mobile app is designed for the user to enter and view Well Completion reports. For background, when a contractor drills a well, they enter well details into a completion report that describes the characteristics of the well, which include; location, depth to rock, depth of well, etc. Unlike many other states, the completion reports for Connecticut are in paper copies or tiff files and no statewide digital database exists to easily access well information. There are likely more than 400,000 wells in the state. A current Access database developed by Prof. Robbins and assistant Meredith Metcalf at ECSU, has approximately 4000 wells in the Coventry Quadrangle. There are also separate databases for wells in Stamford and Lebanon. The Wello mobile app allows users to view the location and characteristics of a well, which can be used by drillers, homeowners and environmental regulators. With respect to the latter, imagine a truck carrying gasoline turns over and spills its contents into the ground. If the regulators had such an app, they would know where the nearest affected wells were. We would like to develop a prototype that can be used to approach the state to get funding for a statewide effort.

When a user signs into Wello they are immediately brought to google maps. They can search for different wells in the area or search for a specific well. The wells can be searched using longitude/latitude points or through their physical addresses based on their town or street address. This app supports use from administrators, well owners or contractors. Contractors and administrators have the special option to add a well by clicking on the plus sign. This will take them to the well completion reports screen that allows them to add information into the different fields provided and will then send them through the server into the database. This information will then be accessible to all of the users to view. Some other features also provided in the application is the ability to take photographs and to send out alerts to certain well users.

The phone application will be created using the PhoneGap as the framework. This allows it to be made in both iOS and Android. HTML and CSS was used to create the application along with PHP and AJAX. The database was created by taking the Access database and transferring it to MySQL and tweaking it by adding more queries.





Team 15: Citizen Science Bat Mobile App

Sponsored by: UConn Natural Resources and the Environment
Sponsor Advisor: Dr. Laura Cisneros
Faculty Advisor: Dr. Steven A. Demurjian

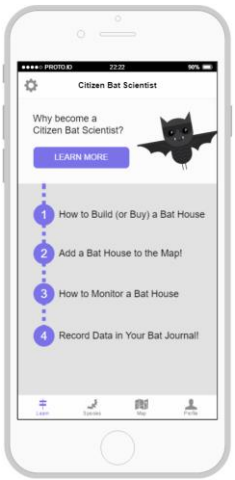
From left to right: Anthony Parziale, Rhyza Velasco, Elizabeth Pelletier, Kyle Robertson, Lindsay Reindl and Nick Monteleone

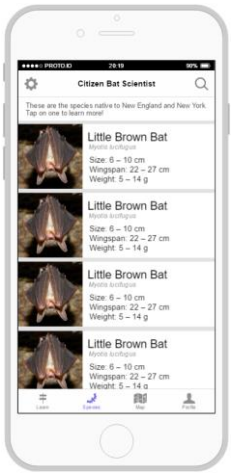
COMPUTER SCIENCE & ENGINEERING

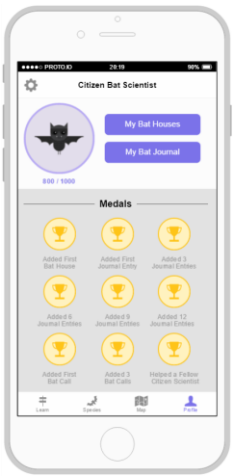
The Citizen Science Bat Mobile Application aids citizen scientists in becoming bat biologists and contributing to the Connecticut bat house monitoring program. The goal of the citizen science bat house monitoring project is to learn how different environments and landscapes influence the occupancy of bat boxes by different bat species. The mobile application will also contribute to statewide monitoring efforts. The app provides citizen scientists with the following capabilities:

- Description on the importance and motivation of the project background on bat species
- Instructions on how to build and install a bat house
- Instructions on the bat house monitoring process
- Capability to collect initial information on a bat house including: GPS location, environmental variables, unique identifiers, and a photo of the bat house
- Capability to collect continuous data where the citizen scientists visit the bat house once a month from May to September to survey the bats using Echo Meter Touch units. They can record ultrasonic calls of bats as they leave the bat house

The Citizen Science Mobile Bat Application needs to be compatible with both Android and iOS devices. We will be developing it in a studio that allows for cross platform development and coding. This ensures our application will be easy to maintain and there will be lots of overlap between the Android and iOS versions. The data collected will be organized into a relational data model that is suitable for a Mongo Database. This database will be secured and only accessible with proper credentials. Data will be ensured for accuracy before entering, and therefore be regarded as clean. Access to this database will be through a created RESTful API. An integral aspect of the Bat Mobile Application is the account creation and login process. To securely allow users access to account creation, we will utilize OpenID as the authentication protocol using pre-existing accounts the users may have (Google, Facebook, etc.). User information must also be protected confidentially. Personal information is necessary for account creation and authentication and must be secured.







Team 16: Hospital Monitoring & Tracking System

Sponsored by: UConn CSE Department
Faculty Advisor: Dr. Dong-Guk Shin

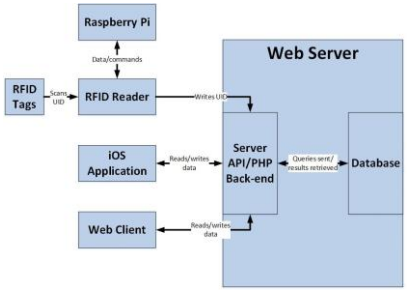
From left to right: Connor Leeman, Andras Palfi, Andrew Tran and Brandon Haas

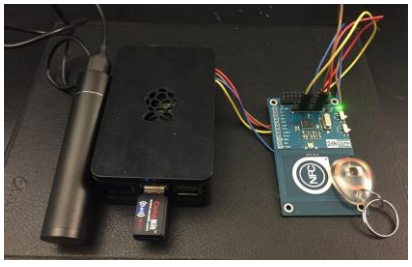
HMTS

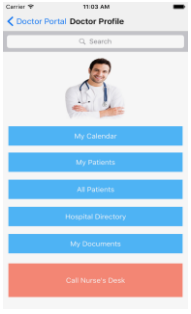
COMPUTER SCIENCE & ENGINEERING

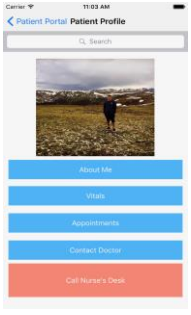
This project utilizes radio frequency identification (RFID) technology to create a cyber-physical system (CPS) which aims to improve the way hospitals track and maintain patient data. In many hospitals, doctors and nurses still use clipboards, paper, and pen to track and record their patient information. Although this system has been in place for a long time, there are clearly many flaws with its functionality. The degree of human error is uncontrollable and can potentially have life threatening effects if not carefully reviewed. This project is an attempt to create a new system to replace and improve the current operational procedures carried out in today's hospitals. The idea is to create a scanner that has the ability to scan wristbands that are worn by the patients. Upon scanning the wristband, doctors and nurses will be able to retrieve patient information, as well as update that information via a mobile application or web client. Patients will also have access to a mobile user interface where they can enter their login information, retrieve test results, and track their progress.

There are three core sections to the project. First, a Raspberry Pi is being used to create the RFID scanner that will scan patient wristbands. The Raspberry Pi utilizes an ITEAD PN 532 NFC module via UART configuration. The low level SDK "libnfc" is used to program and connect the scanner to the other core components of the CPS. The scanner has the ability to read all RFID/NFC tags and has a maximum range of approximately 3 centimeters. Second, a server with a MySQL database is being used to store all patient and doctor information utilized by the CPS. The database along with a REST API implemented on the server's back-end will be responsible for handling all data requests and responses between the scanner, applications, and database. Third, a user interface in terms of an iOS mobile application and a web client is being used to view and update the retrieved patient information. The iOS application is the main user interface for dealing with the CPS and will work on both iPhones and iPads. The web client has full functionality as well, similar to the iOS application, and will be accessible with any web browser.









Team #17: PlantPal – Plant Recognition Mobile Application

Sponsored by: UCONN CSE Department
Faculty Advisor: Dr. Dong-Guk Shin

UCONN
SCHOOL OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING

From left to right: Quincy Chapman, Alexander Raffone, Efrain Goyzueta, Patrick Korianski and Gabriel Borges

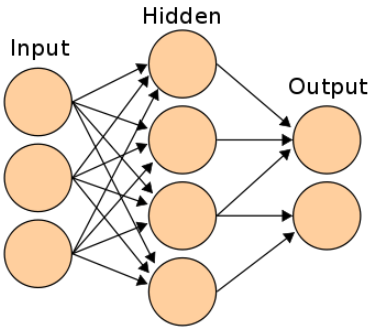
COMPUTER SCIENCE & ENGINEERING

PlantPal is a mobile application that can instantly recognize and classify a wide variety of plants, as well as provide extensive information and a clear description about them. All of this can be done by simply taking a picture of the plant in question and hitting submit. The seamless interface provides a simple solution to an otherwise complex problem. If you have ever struggled to recognize poison ivy while on a hike, noticed a strange flower in a garden or just want to pursue knowledge of the plant kingdom, PlantPal is the perfect solution.

PlantPal tackles the problem of object recognition with application to plants. While it might be easy for a human to tell the difference between a tulip and a sunflower, the problem is non-trivial when applied to computing. To solve this, our group applied a very deep convolutional neural network. With training, the network can accurately recognize a wide scope of different types of plants.

The backend for the mobile application works as follows. Once a picture is submitted, it is sent to a server where the image is submitted to the network for analysis. The network returns several top results, along with a probability (i.e. 76% chance of being a sunflower). The relevant results are sent back to the user (along with a couple stock images for identification) to allow them to select which plant is probably theirs. Once selected, the submitted image is stored in our database for two purposes. One is to be tied to the user, so they can look up their history of plants they've submitted. The second purpose is to continually collect more training data for the network. This will allow the network to become more accurate the more people continue to use it!

The frontend for the mobile application has a few different functions. First and foremost, the application has the functionality for a user to take a picture, submit it for analysis, and display the results in a way that is engaging. There is also functionality pre-built into the app to tie into other websites to provide a way for the user to purchase any plants they have recognized themselves. This gives PlantPal a strong potential business application.



A basic Neural network with 1 Hidden layer. Our network uses 16 layers!

Our Main PlantPal Logo

Team 18: Interactive Voice Recognition System

Sponsored by: UConn CSE Department
Faculty Advisor: Dr. Dong-Guk Shin

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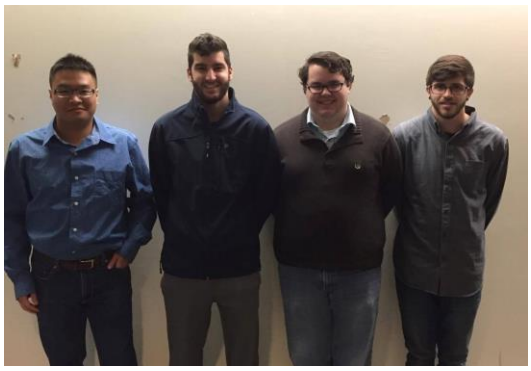

From left to right: William Chin, Matthew Beaulieu, Anthony Dell'Agli and Christopher Saunders

COMPUTER SCIENCE & ENGINEERING

Our voice recognition system, LISA* (Listening Intently and Serving Automatically), is a web application that allows users to define specific voice commands and assign a process of actions to these commands. LISA* was originally built to improve the user experience on the University's data visualization tool. The UConn CSE department built a data visualization tool to handle the medical data of hundreds of patients. The tool is a web application that allows a user to diagram a gene and create graphs to compare patients. Each diagram and graph takes a fair amount of time to create since there are many options to choose from. LISA* allows the user to speak a sentence to create what originally took minutes. In addition to working on the University's tool, LISA* also works on normal webpages. The user can diagram a gene as easily as they can update their social media.

The process of voice recognition requires breaking down an utterance into a sequence of sounds and determining how they can be connected into a word, phrase, or sentence. This requires three separate models working together. The acoustic model tells the system what each phoneme sounds like. A phoneme is the smallest building block of speech, a single sound. When we speak, those phonemes get strung together in a sequence to make a word. The phonetic model provides a key for converting a sequence of phonemes into a word in our vocabulary. However, we have some words in our languages which are indistinguishable from each other. To remedy this issue, the language model provides context for making a grammatically valid phrase or sentence. It uses the rules of grammar and statistics to narrow the hypothesis to a normal sentence in our language. There is always some uncertainty within each model, but the combination of these three models work together to lower the overall uncertainty, resulting in a better solution. The voice recognition system of LISA* is powered by CMU Sphinx, an open source project developed by Carnegie Mellon University. Specifically, a JavaScript version called PocketSphinx.js. It is able to run entirely in the browser and provides all three models, as well as the ability to edit or redefine the phonetic and language models. LISA* automatically builds a language model from our commands list and faithfully executes an action based on result.

```
107580    "selfie": "S EH1 L F IY2",
107581    "selfies": "S EH1 L F IY2 Z",
107582    "selfish": "S EH1 L F IH0 SH",
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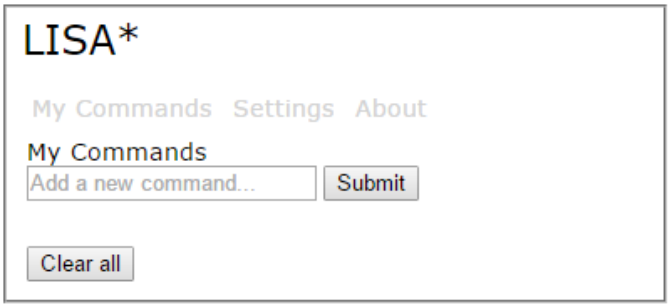
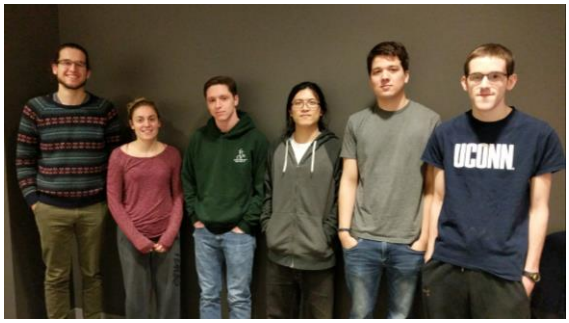


Team 19: CIDER – Core Internal Data and Evaluation Resource

Sponsored by: UConn Center for Open Research Resources and Equipment
Sponsor Advisor: Dr. Dan Schwartz
Faculty Advisor: Dr. Bing Wang



From left to right: Christian Kuntz, Alicia Affinito, Mark Bluemer, Aaron Huang, John Bojorquez and Domenick D'Onofrio

CIDER

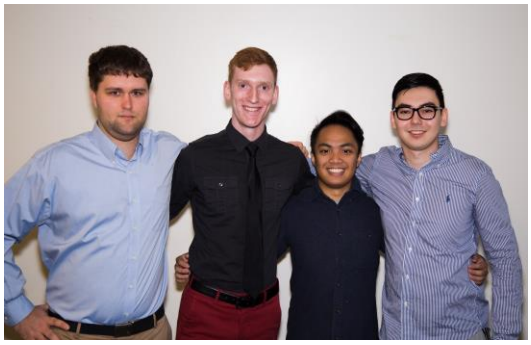
The center for open research, resources and equipment (CORE) currently offers information about using services offered by various research facilities on campus. In most cases, the prospective user of a resource would follow an external link to that facility's web page, and then fill out a web form so that the director of that particular facility can keep track of how much to bill the user, as well as various statistics, such as the revenue over a period of time, revenue per service, the total number of users, along with many other metrics that the director of a facility may want.

The main problem was that each facility had their own web form, and some facilities did not even have a web form; instead, they resort to pencil and paper. The most prominent problem was the complex information flow in regards to billing. After the web form was submitted by the user, the facility director would manually process the data into an excel sheet in a format acceptable by Kuali, the UConn financial/billing system. With CIDER, the process of reserving and paying for resources is streamlined so that 1) facility directors don't have to waste time processing web forms, and 2) there is less room for error. We predict that other schools may have similar issues with billing and resource management. As a result, this software is open source so that other schools can modify it for their own needs.

The software for CIDER consists of a React (library for JavaScript, HTML, CSS) front end and PHP back end with a MySQL database. We translated the real world model to a database design that was flexible and modifiable in the future. This had to be remedied with many entity relationship diagrams and with migrations in the software. Additionally, we interfaced CIDER with the existing SOAP API provided by the university's financial system, which was a challenge due to the complexity and the lack of documentation. This required additional processing of CIDER data into XML files formatted for the Kuali team to be able to handle.

Team 20: Real-Time Analytics Platform for Industrial Process Monitoring and Control

Sponsored by: UConn CSE Department
Faculty Advisor: Dr. Song Han



From left to right: Hunter Carpenter, Alex Devaux, Janus Manlapaz and Daniel Tsoy

D.A.R.T. LAB

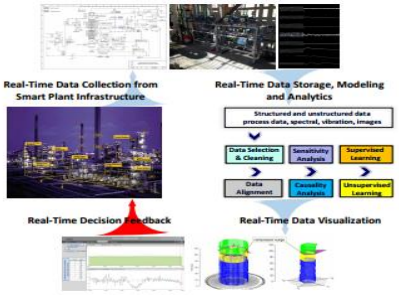
COMPUTER SCIENCE & ENGINEERING

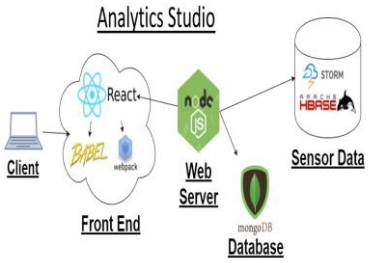
The current solution for industrial process monitoring and control systems is inefficient and outdated. Sensory data is initially archived in historians, then processed by an analytics application. Unfortunately, this system does not process data with low enough latency to allow for a real-time monitoring of these environments. In addition, it is becoming progressively more difficult to utilize all of the information generated by the Industrial Internet-of-Things efficiently, especially without extensive programming knowledge.

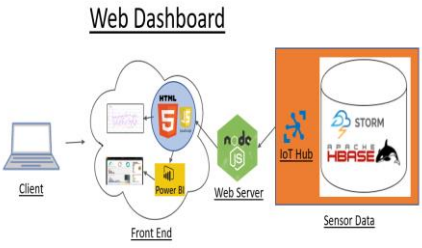
To interface with and monitor such a large, ever-growing set of plant resources, our team plans to create a web-based analytics studio capable of supporting large-scale continuous data analytics in real time. The studio will feature two parts, one dedicated to monitoring sensory information in real time, and the second part that provides a simple interface for users with limited programming abilities to efficiently process information and interact with the Industrial Internet-of-Things. The web application will be accessible by any device with internet connectivity (tablet, smartphone, computer) but is intended for desktop computer use.

For the monitoring application, users will be able to monitor different sites of the industrial plant, create monitoring presets for each zone, and create and view real-time data as it comes in from the server or directly from the data flow system. This tool aims to improve the standards for industrial process monitoring, while also providing an intuitive interface to easily view and manage data from many different sources.

The main feature of the analytics studio is the “code builder”, a work area that has visual representations of code fragments. The user can select these “blocks” that represent data sources, analytical filters, output formats, and other important process monitoring tools. Then, the user can combine these blocks to create executable programs.







Team 21: Historical Storm Analysis Tool

Sponsored by: UConn CSE Department
Faculty Advisor: Dr. Swapna Gokhale

From left to right: Joseph Amedeo, Andrew Guerra, Samah Saeed, Jordan Force, and Matthew Nelson

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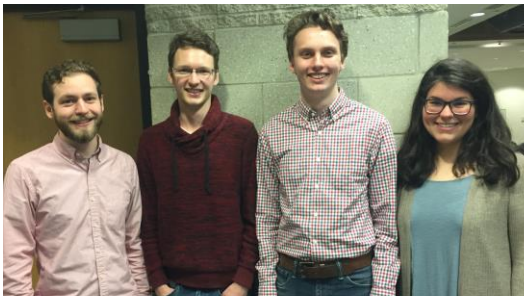
The Historical Storm Analysis Tool is a website application that can be used to help interpret data from the National Climate Data Center (NCDC) Storm Events Database. The NCDC is a database created and maintained by the National Weather Server (NWS) and the National Oceanic and Atmospheric Administration (NOAA). The database includes detailed information about every storm that has occurred within the United States since 1950. Some of the information included are: storm date, time, state, county, event type, injuries, deaths, property damage, magnitude, location, and many more. Our goal with the Historical Storm Analysis Tool is to make all of the data from the NCDC database easily accessible to our users.

To accomplish this task, the project will demonstrate data using the three following formats: tables, graphs and maps. Each format will be supported by a query system, a powerful database search tool. This tool will allow users to specify constraints on the searched data. For example, a user might want to return all storms that caused more than $10,000 in property damage in 1976. By using the querying tool the user can specify these constraints, and the system will only return results matching that specified criteria. Returned data can be displayed in several ways, the first and most simple way will be through a table. The table will show you the raw data queried from the database. This table can be manipulated via sorting by column header, removal of columns, and limiting row display to prevent overcrowded pages**.** In addition to the table, the user will also be able to view a graph of any variables that they want. For example, the user could compare the frequency of 10 different storms occurring in Connecticut in a specific 20-year period. This will allow the user to easily view and identify trends in the data by quickly looking at a graph. Lastly, this tool will generate a heat map to help display the storms that have occurred in the Unites States. We are using the Google Maps API and our own visualization methods to demonstrate storms in a visually appealing and easy to navigate way.

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Team 22: User-Interface for Copy Number Variation Detection



From left to right: Dylan Leonard, Denis Vritov, David Karwowski and Michaela Forte

Sponsored by: UConn CSE Department

Faculty Advisors: Dr. Sheida Nabavi, Dr. Dong-Guk Shin

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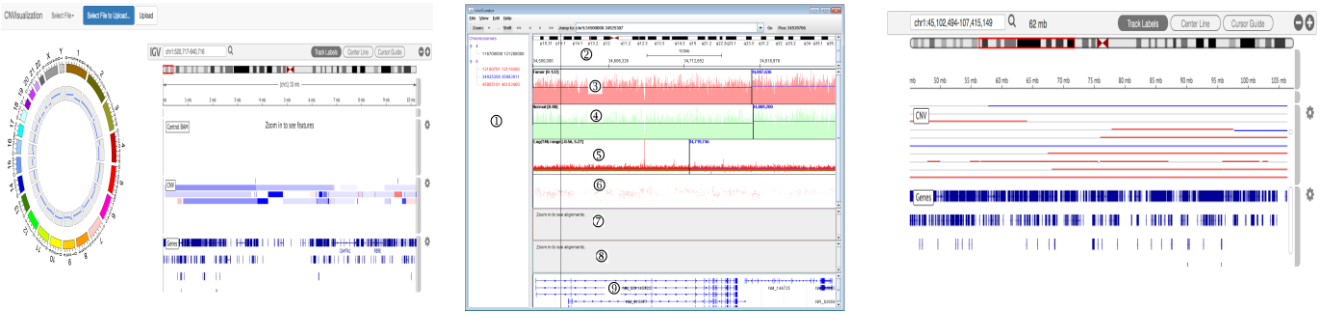
CNVisualization is a web-based genome visualization tool which offers a tailored copy number variation visualization experience. Copy number variation (CNV) is an occurrence in which certain areas of the human genome are repeated, and in which these repetitions vary across individuals. Copy number data on its own does not provide much value to researchers, which is why tools such as CNVisualization must give these researchers the ability to view, interact with, and better analyze CNV data. CNVisualization achieves this by offering the high-level convenience of a lightweight, web-based genome browser, with features and functionality tailored to studying CNV data in particular. By providing the end-user with a fast, interactive genome browser that offers detailed CNV-specific visualizations such as CNV segmentation, CNV regions, and CNV Log R ratios, users can visualize relevant CNV data alongside other relevant genome data such as alignments and read counts.

Copy number variation data alone does not provide researchers enough information to draw any meaningful conclusions. It is necessary to visualize both CNV-specific data alongside general genome data across multiple samples to begin to see more meaningful patterns. CNVisualization is being built to support researchers studying copy number variation patterns of breast cancer samples. As such, the platform will support CNV-specific and general genome data visualization abilities across multiple regular and tumor samples, allowing for the most effective CNV visualizations.

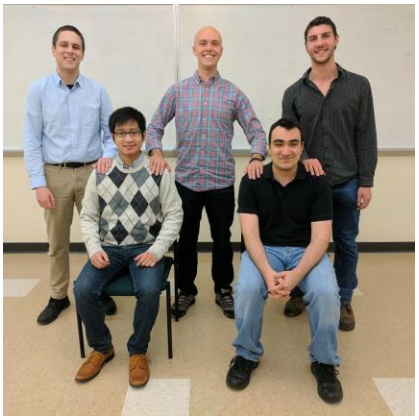
CNVisualization will be an open-source platform which can be easily hosted on a user's own server, offering a convenient alternative to desktop-only applications. The platform is being built on top of the existing JavaScript-based Integrative Genome Browser, which will allow it to perform as each user may need it to, as well as allow it to be integrated with other web tools, resulting in a customized experience for each user. CNVisualization aims to be a customizable, scalable web tool that will allow each user to tweak it as needed for their personal requirements. By incorporating general genome web browser capability, CNVisualization can be as simple or as complex as each user needs by allowing users to upload and select data they wish to visualize, add and remove visualization tracks easily, and aggregate sample data into one file for convenient visualization in one track.



Left to right: CNVisualization, CNVCurator, IGV.js Genome Browser

Team 23: Android Application Risk Assessment and Analysis

Sponsored by: UConn CSE Department
Sponsor Advisor: Dr. Abdelfattah Amamra
Faculty Advisor: Dr. Yufeng Wu



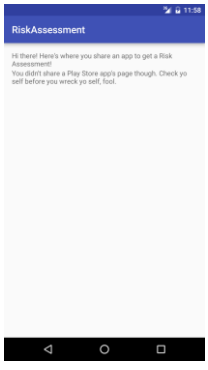
From left to right: Francis McKiernan, Vincent Chov, Jonathan Meier, Nathan Sattar and Andrew Thivierge

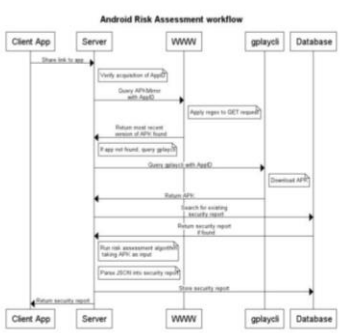
COMPUTER SCIENCE & ENGINEERING

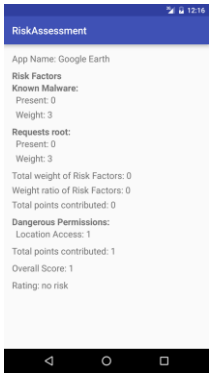
Android applications are constantly being developed and updated on the Google Play store, allowing developers to upload apps available for all users to download as needed. Upon submitting an application to Google Play, the submission is checked for forms of malware. However, users are subject to more risks than simply malware. Android applications allow the use of many phone features that interact with private data. Although applications currently list the permissions for features that are required for full functionality, these features may be exploited to collect personal data on users without their explicit consent. Without a proper explanation to each permission, a user has to assume that a feature required by the application is necessary for the application's functionality. This is a massive security risk, as many users lack the resources, time, and knowledge to check the exact behavior of an application by viewing the application's code. Using our risk assessment algorithm, a user will be able to see if an application has the potential to covertly collect data or is likely safe to use.

Our application allows users to submit Google Play applications for review to our server by sharing the Play Store link for the application in question to our risk analyzer. This request is then processed by a remote server, which fetches the application in question from an APK aggregator. The application in question is then searched for potentially harmful permissions and exploits regarding private user data, and then returns a risk factor score of 0-5 to advise a user of the potential risk of an application, 5 being the most severe. The application in question is rated on the permissions it requests along with its behavior. Identification tags are also taken into account; for example, a music player should not need access to contacts and SMS/MMS messages, while a messaging application would require such access.

While the analysis informs the user of potential issues regarding the requested application, it does not prevent the user from downloading the application. The user may still choose to download a high-risk application as it may be necessary to the user; our application only provides an analysis and advises the user given the potential risk of an application, allowing a user to make an informed decision.







Team 24: Distributed Computing on the Blockchain: Electronic Pollbooks over Ethereum

Sponsored by: UConn Center for Voting Technology Research
Sponsor Advisor: Dr. Alexander Schwarzmann
Faculty Advisors: Dr. Alexander Russell, Dr. Laurent Michel

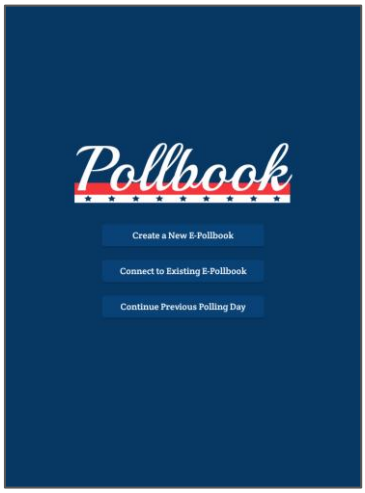
From left to right: Jessica Li, Lauren Biernacki, Aimee DiPietro and Sheryl Choi

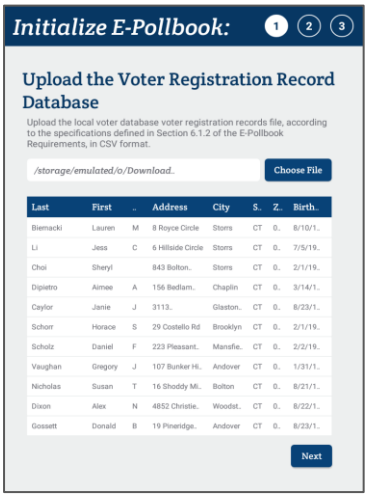
COMPUTER SCIENCE & ENGINEERING

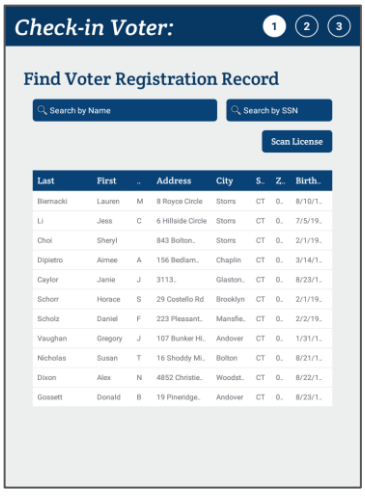
An electronic pollbook is a computerized system that aims to replace the traditional paper-based voter check-in process. In addition to the susceptibility for human error, a considerable disadvantage of the paper based method is the time-consuming search needed to locate each voter record. While an electronic pollbook provides greater convenience to a poll worker, it is not trivial to implement, since it must be secure, fault tolerant, and guarantee correctness. Our implementation leverages Ethereum, a platform that abstracts Bitcoin style blockchains, to create a reliable, distributed system that does not have a single point of failure.

A blockchain is made up of a series of cryptographically signed blocks that encapsulate both data and a pointer to the previous block, similar to a singly-linked list. The data contains events that occurred during a certain time period, allowing the blockchain to form a sequential record of the system. The Ethereum platform consists of a network of nodes, each one maintaining their own copy of the blockchain. The blockchain achieves consensus among nodes through its protocols. For example, all updates to the blockchain are broadcasted to the entire network. Ethereum is resilient in the face of packet losses as well as adversaries engaging in its protocols. In particular, dishonest users cannot change the history of the system without agreement from a majority. Therefore, the system remains secure as long as a majority of the community remains honest. Furthermore, since all nodes have a copy of the records, this distributed architecture is fault tolerant. Nodes can leave and rejoin the network at any time without impact on the system.

Poll workers interact with the blockchain through a user-friendly Android application. When checking in a voter, the worker can search for records using the license or social security numbers. The application then queries the blockchain to check if that person is authorized to vote. The voter's status is relayed back to the poll worker operating the tablet to allow the voter to proceed to the voting booth.







Team 25: An Electronic Survey System

From left to right: Daniel Fasciano, James Donlevy, Michael Wicks and Alexander Kennedy

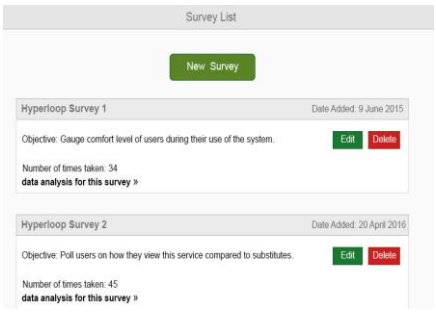
Sponsored by: UConn CSE Department
Faculty Advisor: Dr. Swapna Gokhale, Dr. Sanguthevar Rajasekaran

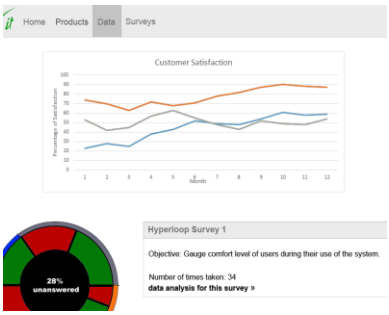
COMPUTER SCIENCE & ENGINEERING

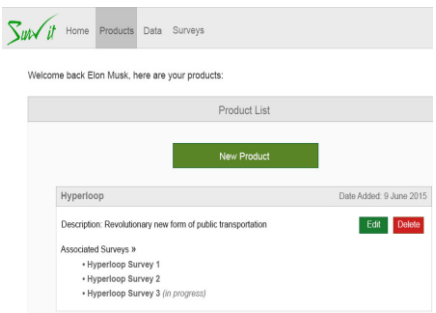
With the not-so-recent boom in online shopping, customers have been taken away from business places and can now buy goods or services without ever leaving the house. With the sheer amount of products being sold, online companies are significantly outperforming physical stores. With the buyers at home, the sellers are left with a perplexing question: How do we know if they like our product? Furthermore, online companies want to know how they can improve or change the product to better fit the needs of their clients.

Our goal is to bridge the gap between the company and the consumer by using an online surveying website, Surv it. This website has many useful features that can help the company follow the progress of their products. First and foremost, it allows companies to create surveys that can be adapted to any product or service. With a simple, yet powerful, GUI that allows for maximum customization getting product feedback becomes simple. Surv it gives the company serious tools to examine the feedback in real time, such as: charts and graphs, a feed of recently submitted surveys, and a score of how successful a product is based on its feedback. Like with the survey creation tools, there is a large set of tools at a company's disposal for filtering and viewing the data, giving the company as many options as possible in order to display the data in a way to maximize usability. Surv it also features a method to catalogue products and their associated surveys. These features are only what is on the surface.

The true power of the website lies in its ability to adapt to any company. With a myriad of options for surveys and data, companies will be able to: see key trends in feedback, determine which surveys to use for specific types of customers, and add their logo and product pictures for their clients. Surv it can provide the security that bigger companies need and the simplicity that small business love. Just as the internet brought shopping away from the store, Surv it will bring the customer service desk to the internet.







Team 26: Personal Cardiac Arrhythmia Detection via Smart Wearables

Sponsored by: Cigna
Sponsor Advisor: Steve Mastrianni
Faculty Advisor: Dr. Bing Wang

From left to right: Dalton Miner, Dale Galloway-Haggett, Eric van Heel, Scott Cote and Daniel Almanzar

COMPUTER SCIENCE & ENGINEERING

A cardiac arrhythmia, in its most general definition is an irregularity in one's heartbeat. It is in most forms a sudden increase or decrease in the distance between heart beats which then returns to its "normal" rhythm (normal refers to the individual's current heart rate). An arrhythmia can be an indication of a more serious heart problem, even in people who are healthy and exercise regularly. However, arrhythmias often go unnoticed unless consulted by a physician or cardiologist administering an ECG/EKG (electrocardiogram) test.

Leveraging technology to detect cardiac arrhythmia can help Cigna, a Health Services company, improve their customer's health, well-being, and quality of life. Prevention and early detection are key strategies aimed at reducing costs for all parties. Besides cost advantages, a customer may spend less time ill or in the hospital, which is invaluable.

In this senior design project, we've collaborated with Cigna to develop an approach that uses smart wearables for personalized cardiac arrhythmia detection. Several technologies, sensors, and algorithms have been evaluated to determine best performance and lowest cost of production. Specifically, we've developed several customized wearable prototypes with a PPG (photoplethysmogram) sensor and compared the results to off-the-shelf wearables capable of providing heart rate data. The wearables transmit data through Bluetooth to a smartphone app that we've developed, which collects and stores the data in activity logs and provides easy-to-use interfaces that display heart rate over time. More importantly, the app alerts the user if any interruption in their normal heart rhythm occurs (using researched and tested detection algorithms). Our current tests and results are promising, but still show room for improvement in developing a superior arrhythmia detection algorithm.