UCI

Autonomous Ground Based Vehicle Control, Planning and Execution

Students: Milan Patel (EE), Jason Watkins (CSE), Ali Younis (CSE)
Mentor: Professor Brian Demsky
Department of Electrical Engineering and Computer Science

Goal Statement

The main goal of this project is to build a ground based robot that is able to autonomously navigate through a known map towards a goal region using onboard sensors (GPS, IMU, encoders) and processing.

Introduction and Background

In recent years the topic of robotics has rapidly gained popularity within the research community and large companies such as Google, Qualcomm and Tesla. A particular focus area in robotics is the area of autonomous driving. Tesla and many other car manufacturers have been developing driverless technology for many years, and are now starting to deploy their technology. This senior design project has the specific goal of helping its team members gain knowledge and expertise in the field of robots, using the same principles of control, estimation and planning that many of the industry leaders are using in their approaches. Specifically, this project is designed with the goal of learning state estimation and ground based robot control. The stretch goals of this project are present to allow the team to expand into different aspects of driverless technology.

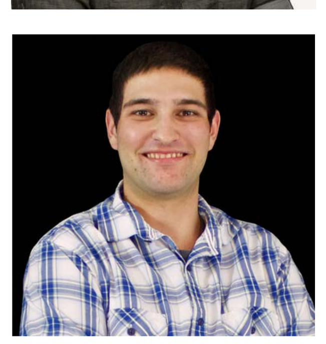
Our team has extensive experience in robotics. Between us, we have completed internships working in the field at companies including Honeywell Aerospace, NASA and Qualcomm. We also have extensive software and hardware experience from in class and extracurricular projects.

The Team

Professor Brian Demsky (Mentor):
- Assist with Project Planning
- Assist with Implementation and Algorithmic Design

Milan Patel (EE):
- Hardware Design
- Low Level Software
- Algorithm Development in Matlab

Jason Watkins (CSE):
- Control and State Estimation
- High Level Software and Algorithm Implementation and Design



Ali Younis (CSE):
- Control and State Estimation
- Assist with Low Level Software
- High Level Software and Algorithm Implementation and Design

Approach

Our approach is as follows:
- Use off the shelf hardware as much as possible.
- Focus less on writing low lever drivers and more on high level software and algorithms.
- Incrementally add functionality to ensure success of the robot as a whole.

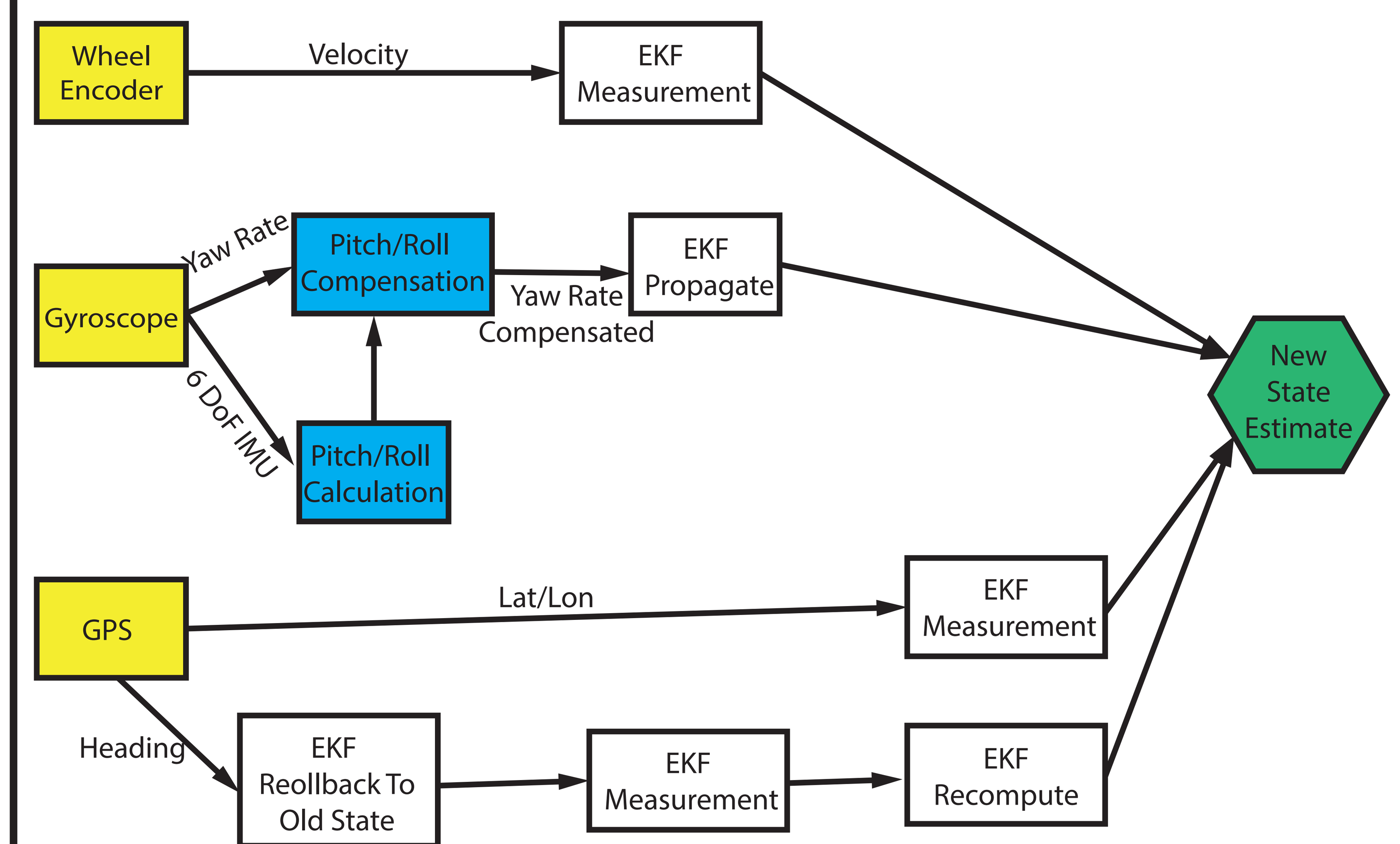
We would like people to notice:
- Simplicity in our minimalistic robotic design.
- Capability of the robot.
- Complexity of algorithms that make a simple robot function in a complex way.
- Real world applications of the algorithms developed and used.

Contact

Web: http://srproj.eecs.uci.edu/projects/autonomous-ground-based-vehicle-control-planning-and-execution
Email: milanp@uci.edu, watkins1@uci.edu, ayounis@uci.edu

Localization

Localization is done using an Extended Kalman Filter to fuse sensor data from a GPS, a wheel encoder and a gyroscope.



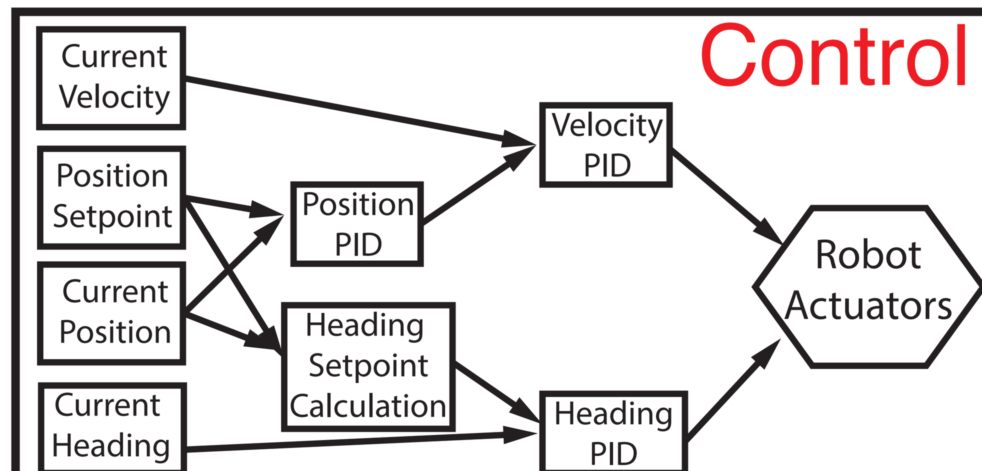
Challenges

Major Challenges Faced:
1) Noisy magnetometer data
2) Delayed GPS heading data due to heading calculation
3) EKF propagation model errors due to HW limitations.

Solutions

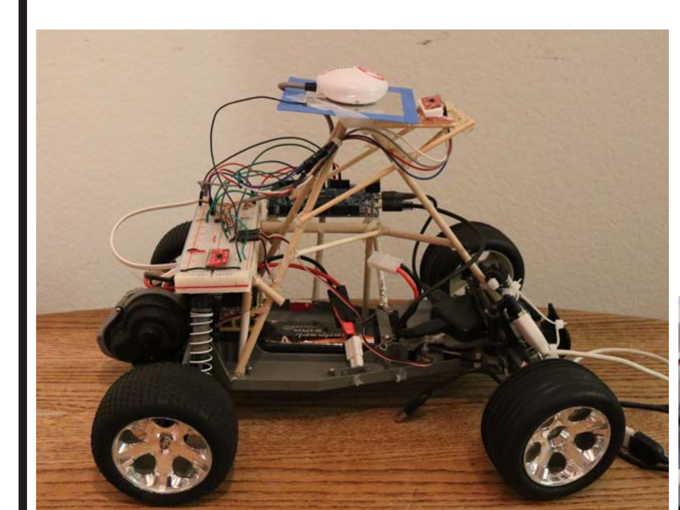
1) Use GPS heading instead of magnetometer heading.
2) Capture the current state of the EKF and recompute when the GPS heading measurement data is available.
3) Use gyroscope to propagate instead of relying on HW to be accurate.

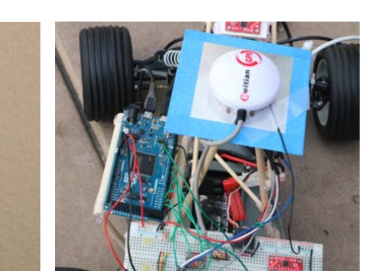
Control

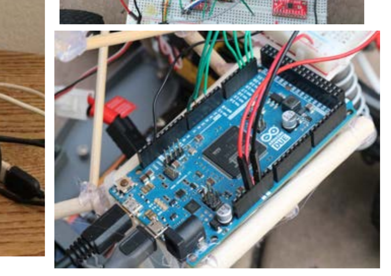


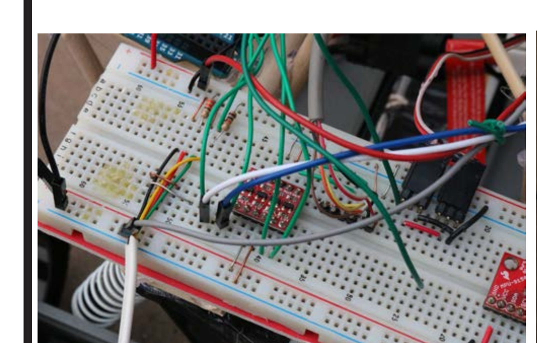
We use a simple PID successive loop closure control scheme. The PID was tuned by hand using techniques from the DIY drones community.

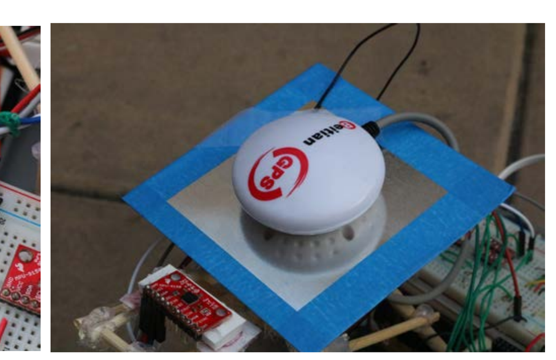
Robot Images







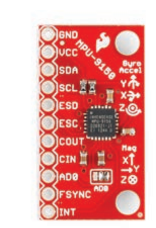




Hardware Used

Arduino Due:
- 84MHz, 32-Bit ARM Cortex-M3
- Serial, SPI, i2c, PWM

MPU9x50 IMU
- 3.3V, Low Noise
- 9-DoF



u-blox M8 GPS
- 5v UART
- GNSS, GLONASS, GPS
- 10Hz update, 30s Lock

Homemade Wheel Encoders
- Optical IR sensor detects pattern on wheel well

"Curiosity killed the tree..."
– M.P.

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Self-Sustaining Server Mesh Network

Daniel Ring, Jeff Greenfield, Kevin Okamura
Professor Keyue Smedley
Department of Electrical Engineering and Computer Science

Introduction & Goal Statement

Since the release of the Raspberry Pi, low-power Linux systems have become common. They have reached the point where a small solar panel is sufficient to both power the device during the day and charge a battery to allow it to continue running at night. Connecting multiple of these devices together creates a network that will continue operating indefinitely, even in the event of a major utility failure.

Innovations

Self-sustaining – Mesh nodes power themselves, allowing placement of connected sensors in difficult-to-reach locations.

Fully autonomous – Mesh nodes do not depend on the power grid or any existing communications infrastructure.

Distributed – The network will remain active as long as at least one node is working and in range of client devices.

Fault tolerant – A disruption in the path to any given node will not disable it unless no other path exists.

Progress & Current Status

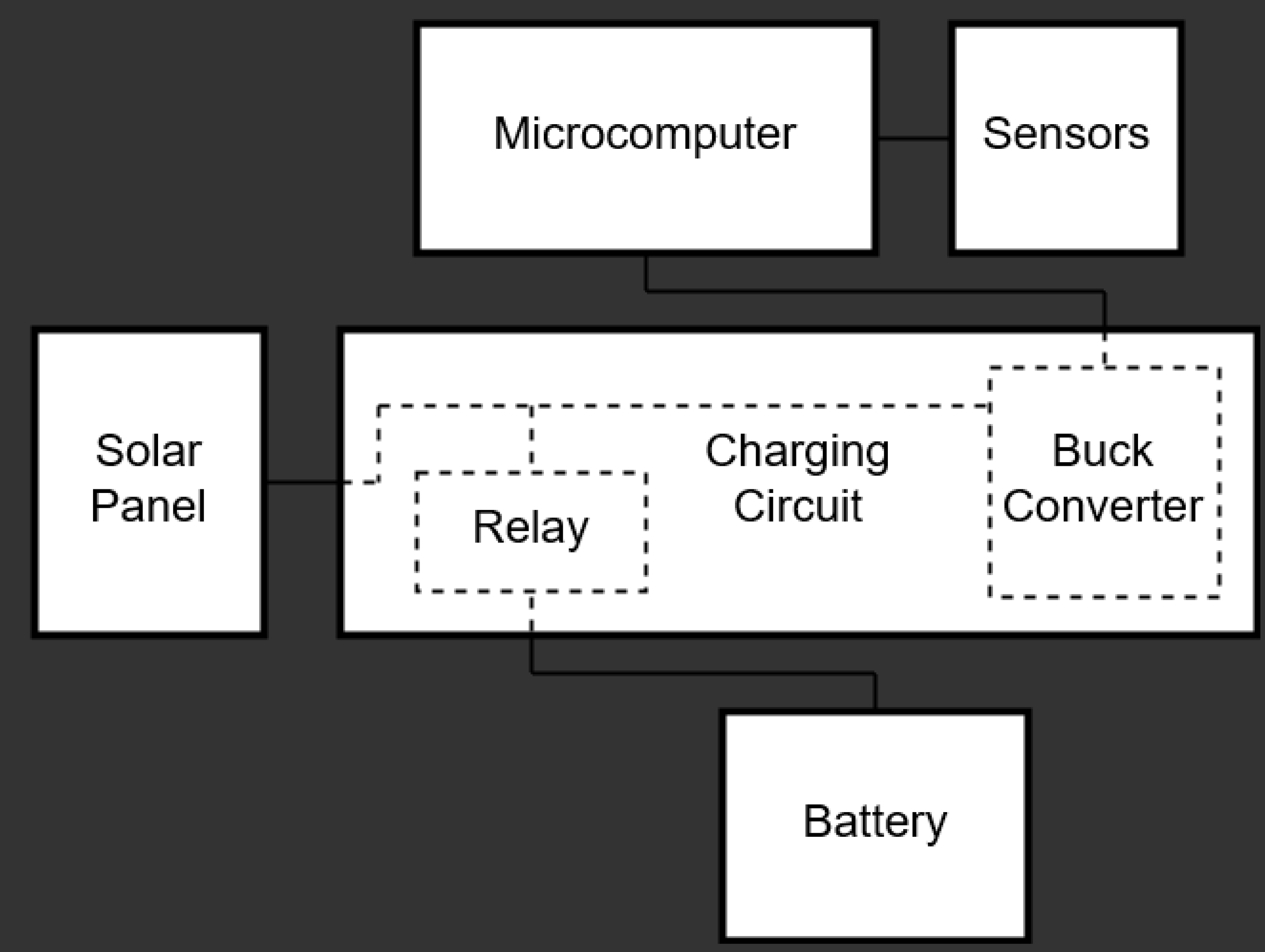
The project design, specifications, charging circuit design, and software prototype for the mesh nodes have been completed. Manufacturing of the final charging circuit has begun and all components for the mesh nodes have been purchased. Work on the final mesh software is in progress and on schedule. Final integration and testing is expected to be complete by the end of the 2017 winter quarter.

System Overview

Each self-sustaining mesh node consists of:

- Solar panel
- Charging & power delivery circuit
- Battery
- Low-power microcomputer (e.g. Raspberry Pi Zero)
- Wireless network adapter

Nodes communicate with each other and with client devices over the wireless network, allowing remote access to connected sensors via their GPIO ports.



Team Members

Daniel Ring – Computer Engineering
- Skills: C/C++ programming, system administration, IoT development, Raspberry Pi, OS-level networking, SDR
- Technical Contributions: Software, overall design, processing hardware, hardware/software integration
- Roles: Team Captain, Design Lead, Software, Networking

Jeff Greenfield – Electrical Engineering (Communications)
- Skills: C and VHDL programming, circuit design, wireless communications
- Technical Contributions: Circuit design, solar power hardware
- Roles: Hardware, power circuit design

Kevin Okamura – Electrical Engineering (Circuit Design)
- Skills: Circuit design, PSPICE
- Technical Contributions: Hardware, circuit design
- Roles: Hardware, power circuit design

Schedule

The 2016 fall quarter was used to develop the design and specifications of the mesh network and its underlying self-sustaining servers.

Initial development of the mesh software and design of the final power circuit took place in the first half of the 2017 winter quarter. Manufacturing, software integration, and final testing will be performed in the final half of the quarter.

Contact

Visit https://wolfishly.me/mesh or contact ringd@uci.edu for more information.

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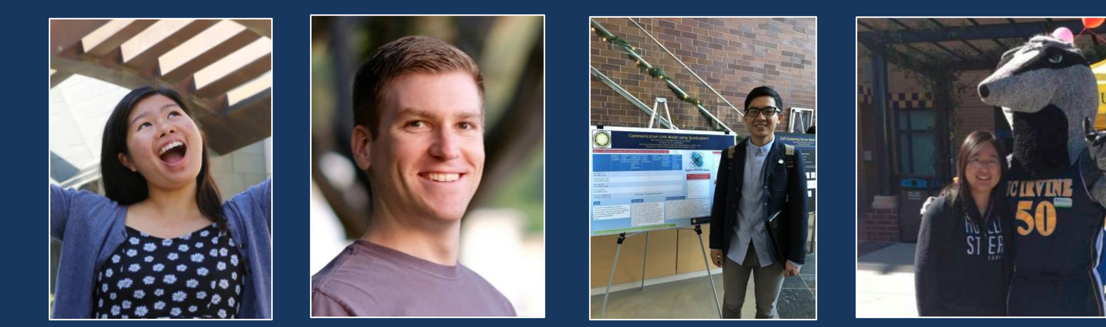
Communication Link Model using a Quadcopter

Linda Banh, Matt Butrovich, Pino Cao, Yan Huang
Professor Lee A. Swindlehurst
Northrop Grumman Mentor/Expert in RF and Communications: Jeffrey Yang
Department of Electrical Engineering and Computer Science



Follow our blog: https://sites.google.com/uci.edu/squadcopter/

Goal

- To construct and validate an airborne communication link model. Parameters such as altitude, observation angle, and atmospheric attenuation will be taken into account.
- To improve current space/defense communications technologies by automating communications analysis process

Milestones and Proposed Timeline

Link budget MATLAB code	Ground station design	Airborne radio design and finalize Bill of Materials	Test VCO+PLL performance in lab	Payload layout and materials design	Antenna design	Antenna assembly and drone performance testing	Test antenna performance in lab	Payload and vehicle integration	Outdoor demo and data collection at NGC
11/27/16	12/18/16	12/28/17	1/21/17	2/4/17	2/11/17	2/18/17	2/25/17	3/4/17	3/11/17

Approach

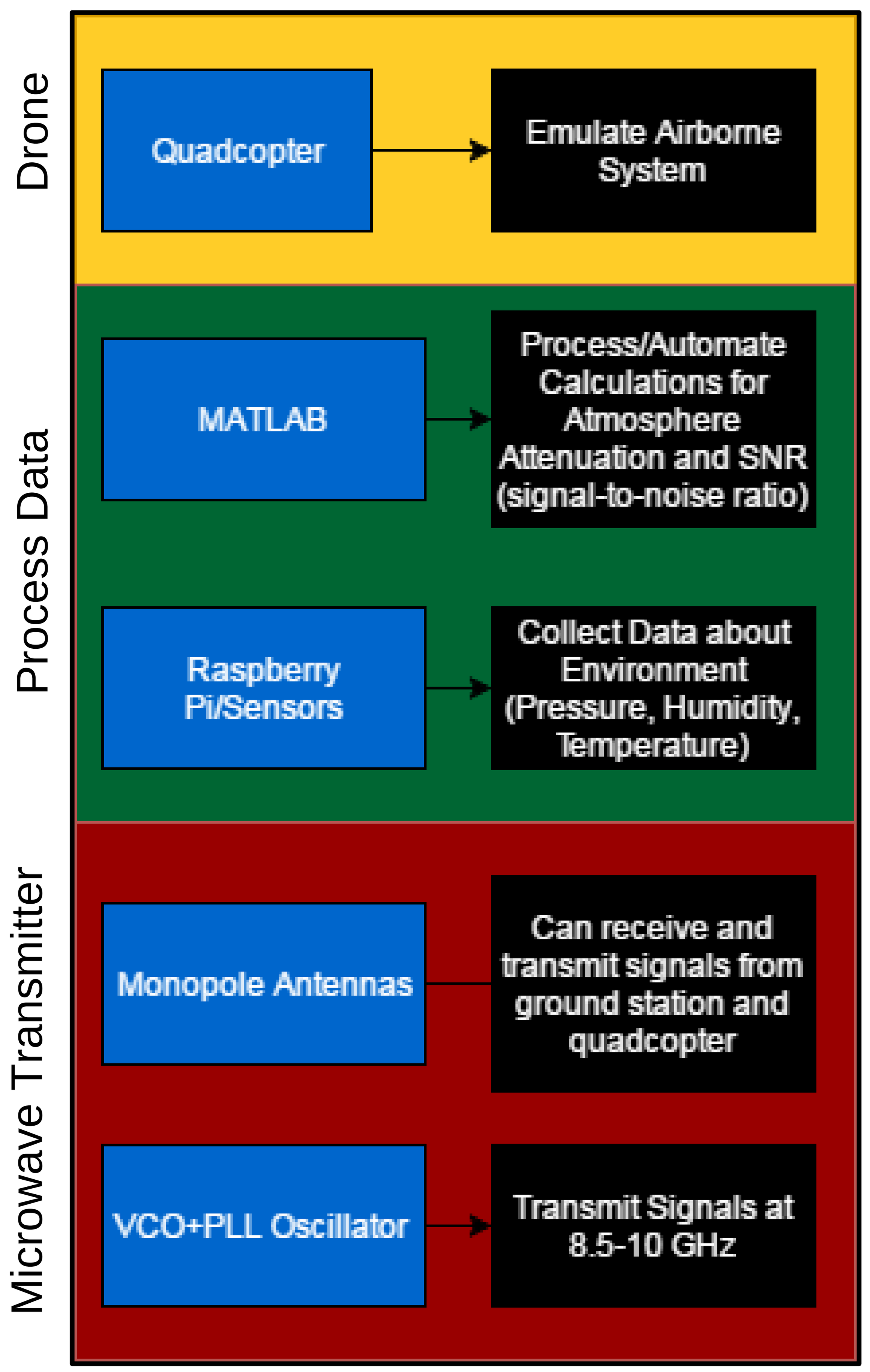


Figure 7. Schematic for System Integration

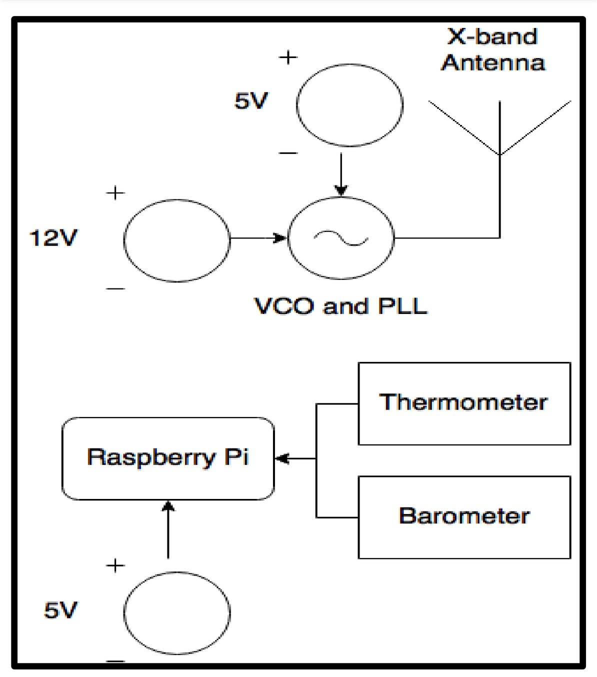


Figure 6. Output Power Performance for VCO+PLL at 8.5, 10 and 10.02 GHz

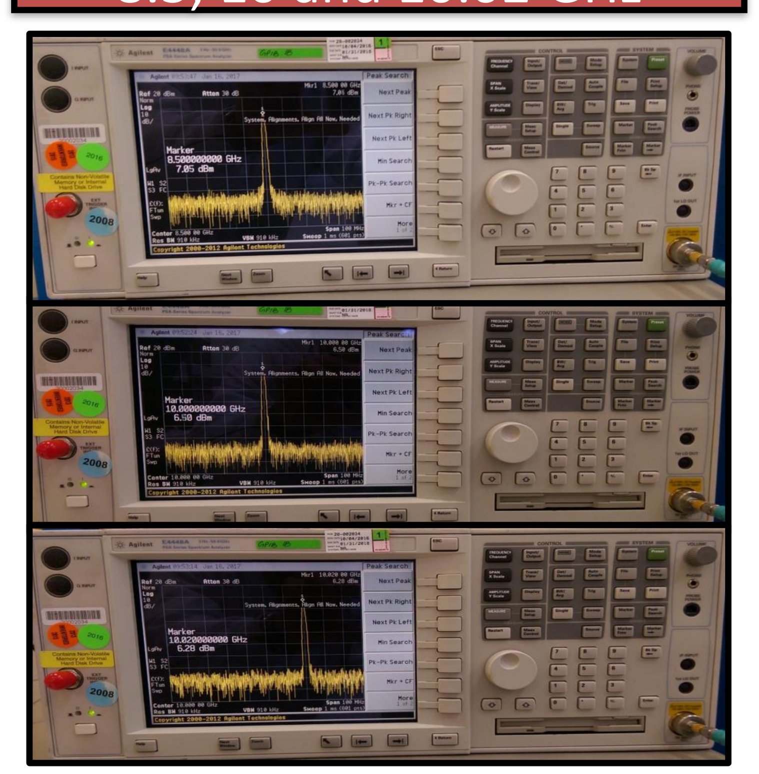
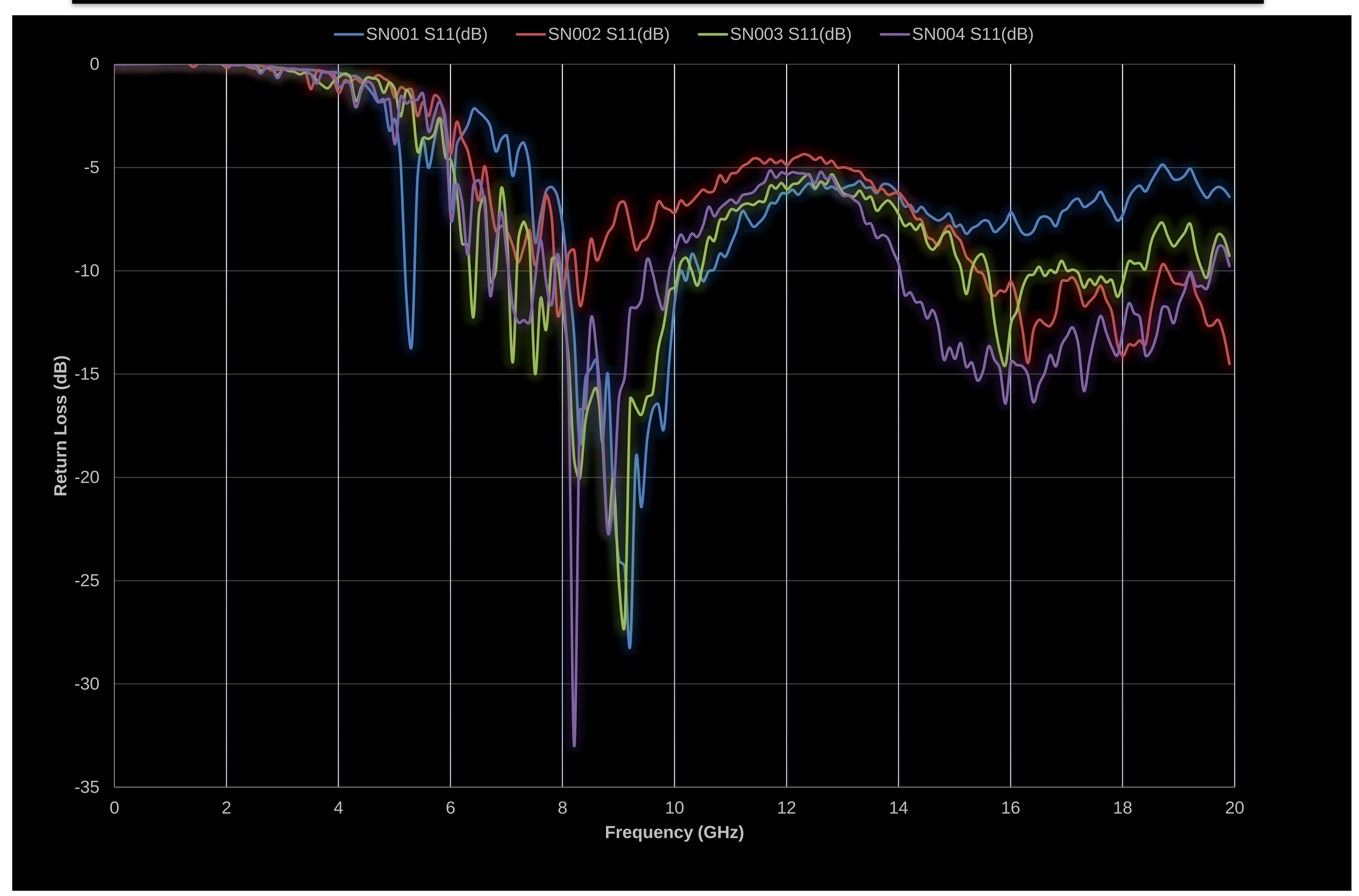


Figure 1. S11 Test on Four Monopole Antennas



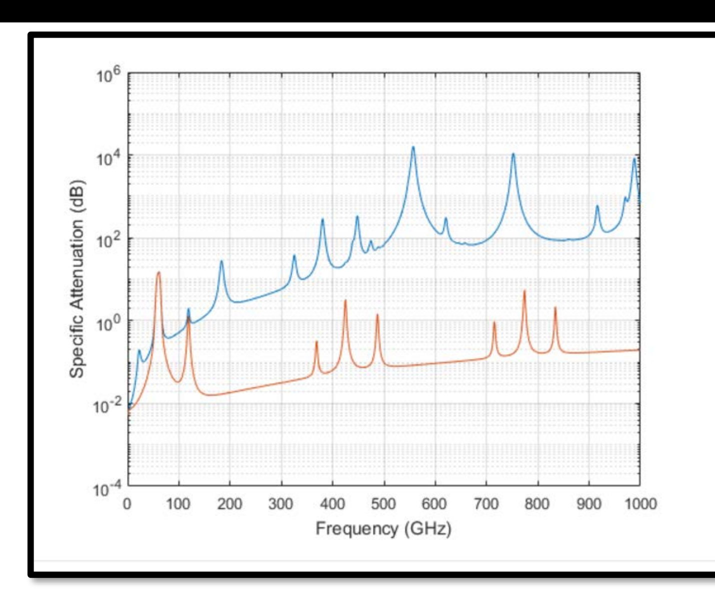


Figure 5. Prediction Model for Atmospheric Attenuation on MATLAB

Figure 2. 3DR Solo Quadcopter

Figure 3. Two of Four Monopole Antennas that were Handmade

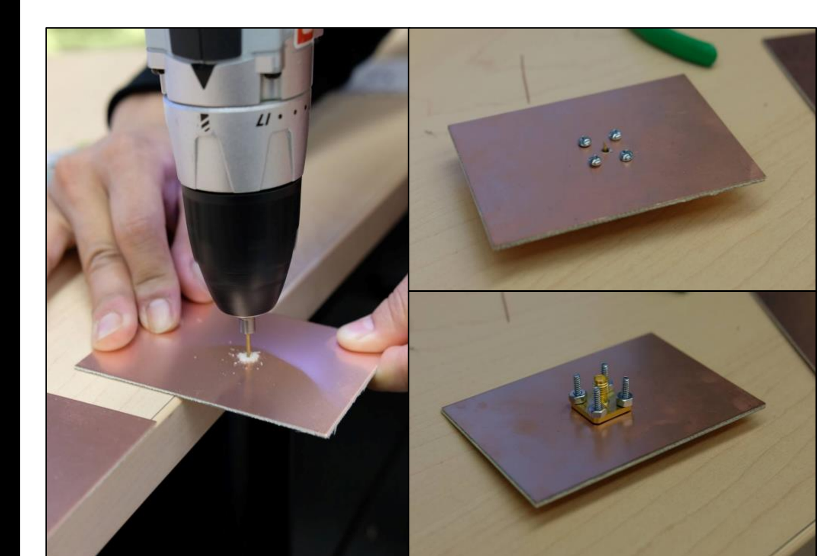
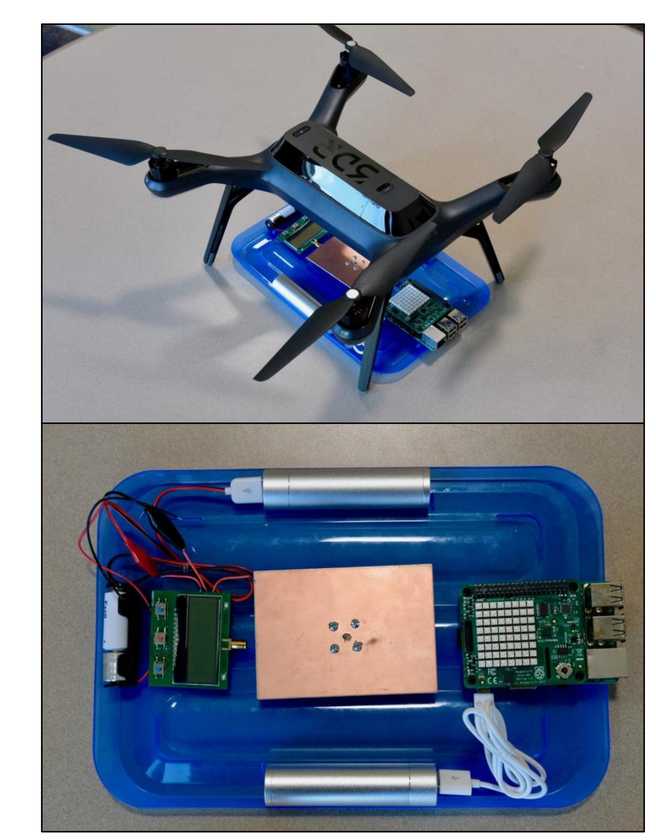


Figure 4. Payload Model



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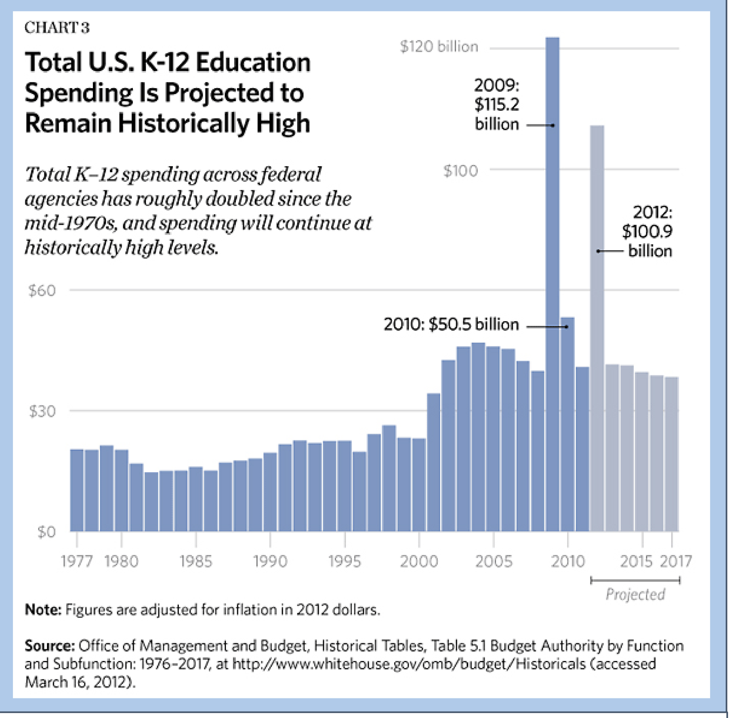
SmartMON: A Device Usage & Tracking System for Ed-Tech Admins

Team Members: Hieu Nguyen, Tejia Zhang, Ryan Bald, George Mansour
Project Advisors: Dr. Michael Klopfer, Dr. Crystal Rapier, and Prof. G.P. Li
California Plug Load Research Center (CalPlug)

Introduction & Background

Education spending for K-12 is at historical highs. As seen from the figure below, educational spending has averaged about 40 billion dollars over the past 10 to 15 years. One of the largest contributors to this spending is on IT. In 2015 U.S education institutions spent 6.6 billion dollars on IT. The use of technology is extremely common in education and various other fields. The majority of schools in the U.S have technology such as computers, TV's, projectors laptops, and tablets in the classroom with an aim to enhance the student's ability to learn. Unfortunately, many of these expensive resources often go without full intended usage. Expensive training for integration of technologies educators may not be implemented. The concern could be a mismatch in expectations between administrators, educators, and technical staff. Verbal and written assessments from educators may not fully provide the depth of the problem. Depending on the site or district political climate, a problem may not even be shared to administrators or technology administrators. The success of pilot deployments may not be able to be fully assessed ahead of scheduled rollouts. Could there be a way to independently audit technology usage to make smarter education tech. decisions? A simple solution to this problem is what this project intends to provide.



Note: Figures are adjusted for inflation in 2012 dollars.
Source: Office of Management and Budget, Historical Tables, Table 5.1 Budget Authority by Function and Subfunction: 1976–2017, at http://www.whitehouse.gov/omb/budget/Historicals (accessed March 16, 2012).

Demonstration Materials and Resources

Hardware: We were using a microcontroller called "Photon" at first, after discussed with our mentor Dr. Michael, we adopted "Smartenit", an IOT smart plug, as our hardware. It has high accuracy build-in sensors and also WIFI module. After we set it up, the Smartenit automatically send the measured RMS current, voltage, instantaneous demand, current summation, and power factor, 5 different kind of factor to our back-end server via MQTT protocol. The Smartenit IOT plug is the efficient and ideal hardware for our project.

Servers: To host our front-end and back-end software programs and MQTT (communications system) broker, we use two Ubuntu servers. Server number one acts as the sole provider for MQTT. We installed Mosquitto (a private/local MQTT broker) on both servers but number one is used for all communications between the Photon and Node.js. The second server is used as our main development server. We installed MEAN Stack on it and created both our front-end and back-end on this server.

Software MEAN Stack: Our application will run on top of a MEAN stack (MongoDB, Express, Angular, Node). MongoDB is the database we are using to store all of our pertinent data (including, but not limited to, the current, voltage, and power going through a device). Node.js will be used as the server side to our application (serving requests to our application's web page, etc.). Angular.js and Express.js will be our front-end and back-end frameworks, respectively.

Goal Statement

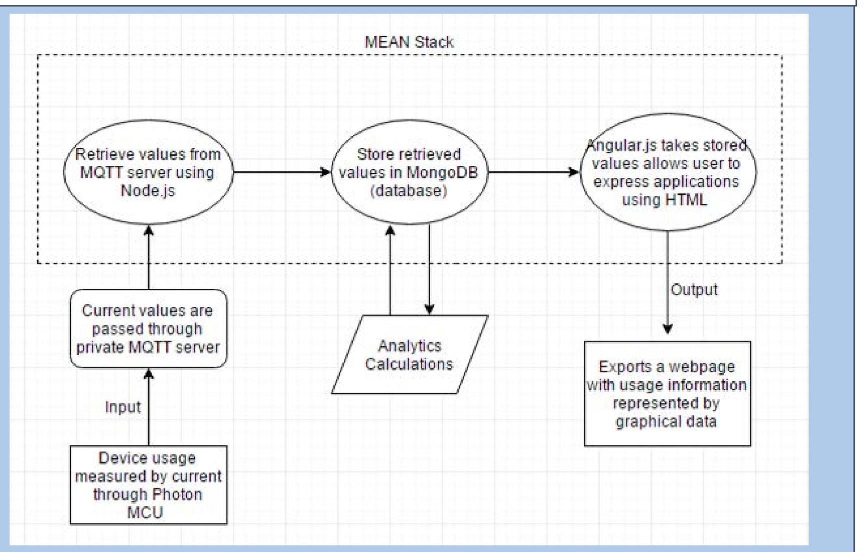
This project seeks to develop a low cost auditing system to provide visibility into the utilization of technology purchases for education. By monitoring power consumption, device usage can be inferred, analyzed, and displayed to provide useful information about the adoption of educational training programs or the usage of new devices. Problems in deployment can be caught and corrected earlier in pilot sites before mass deployment occurs. This system would not only provide a real time dashboard showing recent device usage and trends, but would also automatically author usage reports. Analysis of usage trends automatically occurs within the device server-based analytics engine. The information provided by this system can augment information gathered in discussions between administrators, technology staff, and educators to provide full visibility for the effectiveness of technology implementation.

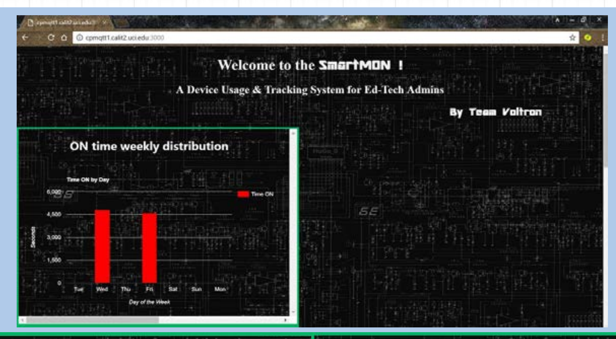
The system is comprised of two parts: 1) A low cost hardware module that plugs in-between the device and the wall, and a server based analytics engine. Multiple devices may be plugged into a single hardware monitoring module. Many modules can be deployed simultaneously across multiple sites. 2) A cloud based server analytics system that gathers, stores, and analyzes data. This system has a web-based interface to clearly provide the output of analytic analysis to the end user to assist in actionable technology decisions.

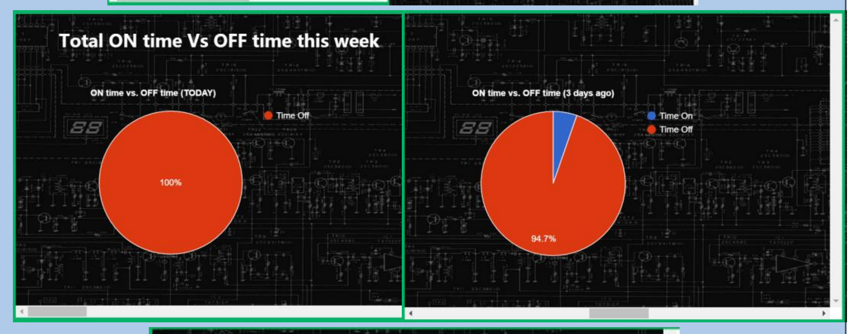
Design Process and Implementations

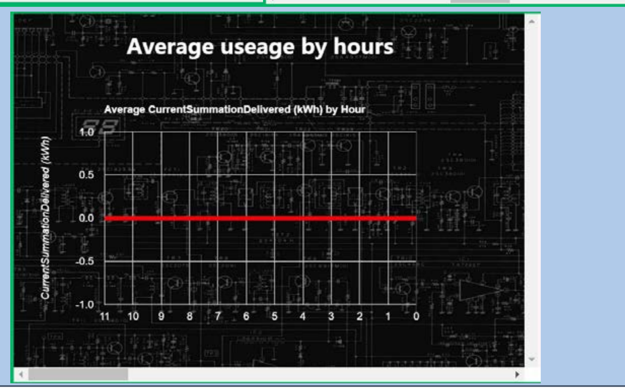
Input and MQTT:
For the demonstration, will be using Smartenit sensor to record our input, the output current of the monitored device. This recorded input will then be passed to Mosquitto, an MQTT broker we have standardized on.

MEAN Stack:
We begin with using Node.js to pull the messages from Mosquitto. Since MQTT is just a protocol for passing messages, the data it receives cannot be stored, which is where MongoDB comes in. Still using Node.js, we are able to transfer these pulled messages to our database in MongoDB. We then use the stored data to do all of our calculations and analysis. Using the five values that the Smartenit sensor measures (see Hardware section), we are able to produce nifty graphs and charts that we believe are the most effective for users to determine the extent to which their device is being used. The charts are developed using Google Charts API's and displayed on our web page through the use of Angular.js for the front-end and Express.js for the back-end.

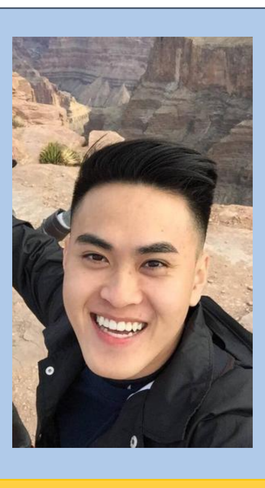


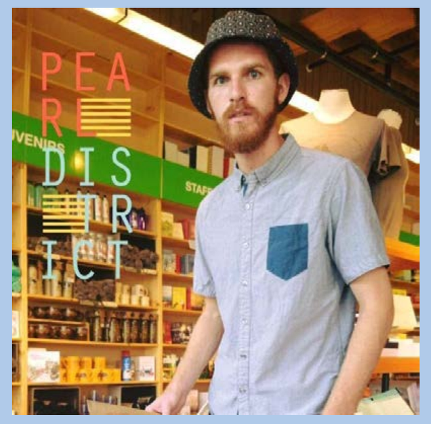


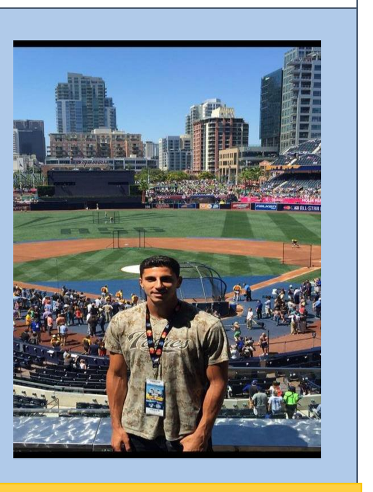




Team Organization and Tasks







Hieu Nguyen (Electrical Engineering, B.S.)
- Programmed and setup Photon
- Tested prototype with CloudMQTT
- Made connection from Node.js to MongoDB

Ryan Bald (Computer Science & Engineering, B.S.)
- Front-end development
- Data manipulation from MongoDB
- Data visualization on web page

Tejia Zhang (Electrical Engineering, B.S.)
- MCU programming
- Hardware setup
- Mosquitto server setup
- Basic web application developing

George Mansour (Electrical Engineering, B.S.)
- Hardware design
- Microprocessor setup
- Initialized current measuring device

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Tejia Zhang: tejiaz@uci.edu
George Mansour: gmansour@uci.edu

Team Mentor:
Michael Klopfer, Ph.D.: mklopfer@uci.edu
Prof. G.P. Li, Ph.D.: gpli@calit2.uci.edu

Team Website:
http://srproj.eecs.uci.edu/projects/project-group-number-4-smartmon

Progress

The current status of our Smartmon device is in the later analytical development stages. Currently the device is able to monitor the real time rms current, voltage, power factor, current summation, and instantaneous demand. From these measurements, we have derived various algorithms to analyze the data and have outputted the analytical graphs onto a webpage. So far, for our analysis, we have been successfully able to output the average of Smartenit values for the past 12 hours, the total on time vs off-time per work day, the total time on per day vs week day, the times turned on in a weekday, percentage of the most used operation mode, and all working conditions. These analytics are in real time but are currently only for the measurements of a PC. Our users will be able to plug their PC into the Smartmon device and will then be able to see various graphs that analyze their overall usage of that device. Our next task is to come up with the analytics for devices such as a projector and a T.V. The challenge here will be coming up with the best graphs to analyze the data most efficiently as they pertain to these devices.

Acknowledgements

CalPlug — California Plug Load Research Center, University of California · Irvine
The Henry Samueli School of Engineering, University of California · Irvine

UCI Samueli School of Engineering
Department of Electrical Engineering and Computer Science

Basketball Sports Sensor Glove

Chris Valenzuela, Chung-Yu Chen, Shahrooz Maghsoudi, Kendrick Welch
Professor Chin C. Lee

Introduction:
Sports technology is something that we feel could become the next big thing. With many teengaers activiley training in sports, this device could help everyone's shot mechanics. "Solid Shot" is one sports sleeve that has already been created and is being used by professional athletes all around the world.

With our basketball sports sensor glove we can read your wrist angle after you make a free throw and also determine whether one's angle is position correctly before attempting a shot. The angle is then displayed on the LCD attached to the player's arm..

For more information, See the link below:
http://srproj.eecs.uci.edu/projects/sensors-improve-practice

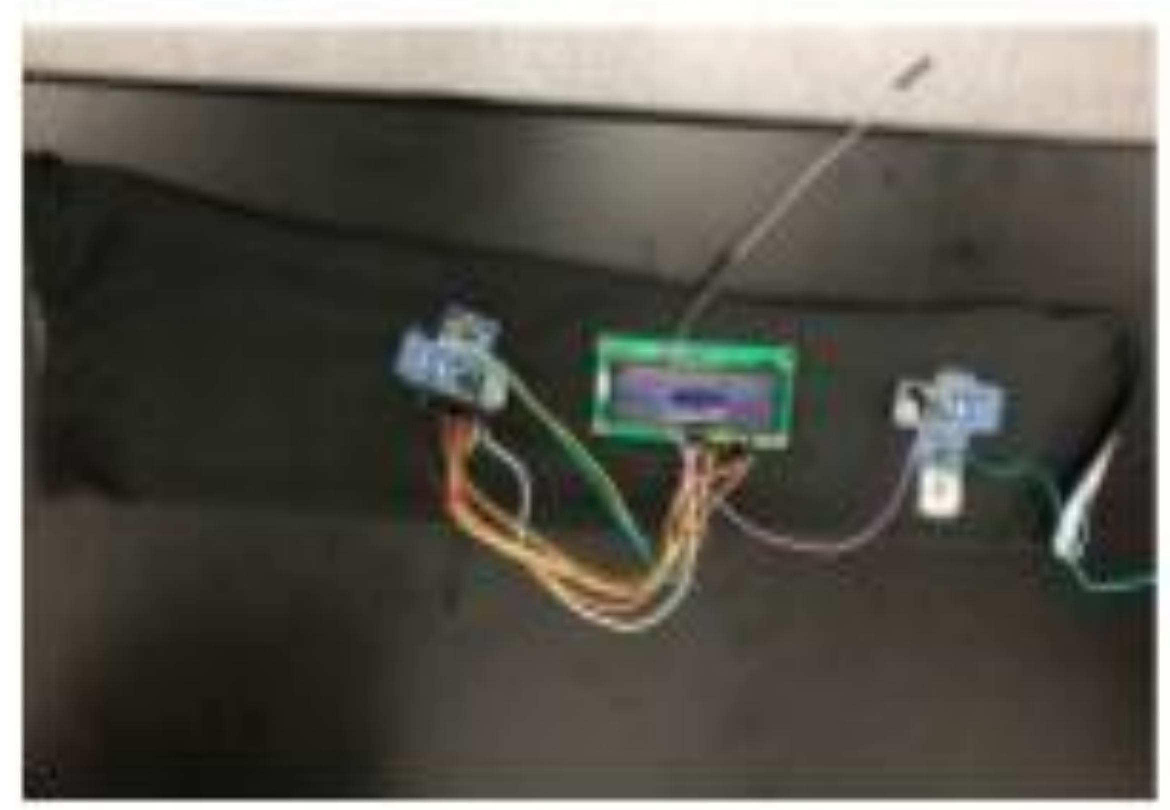
Goal Statement:
Our goal is to develope a basketball sleeve that records whether or not a shot has been taken and displays the angle it was taken at. They could then use this information to adjust their shot.

Ideally, our device would help the user with their form since it would alert them if they have their arms positioned incorrectly

Approach:
We are building a prototype that predicts someone shot as accurately as possible. We want users to see how the proper form could drastically improve someone's skills and how this type of device supports that. This idea could then be translated to different sport sciences such as the proper football throw or the proper golf swing. It does not have to be limited to one sport and because it is flexible it could reach a larger audience.

CURRENT STATUS:
Hardware:
- **Accelerometers -** We have two accelerometers; one on your wrist to predict whether a shot has been taken and one on your elbow to correctly position your arm into a 90 degree angle.
- **Microcontroller -** Since only one Accelerometer could be attached to one microcontroller we had to implement our design with two MCUs, one for each accelerometer.
- **LCD Screen -** We have one LCD Screen which will demonstrate the shot characteristics (i.e shot angle etc..)
- **Battery -** There is a battery attached to the side of the arm sleeve in order to power up the two MCUs and LCD screen.

Software:
- **Accelerometers -** We have successfully created a code that measures whether a shot has been taken and where to position your elbow.
- **LCD Screen -** Our code will depict the shot angle given the information received from the MCUs



TEAM MEMBERS:
Professor Chin C Lee: Professor Lee is a faculty member of the UCI EECS department. He conducts research in the area of material and manufacturing technology.

Chung-Yu(Joe) Chen: Joe is a 4th year electrical engineer specializing in circuit design.

Chris Valenzuela: Chris is the project leader. He is a 4th year electrical engineer specializing in signal processing.

Kendrick Welch: Kendrick is a 4th year electrical engineer specializing in circuit design and semiconductor and optoelectronics.

Shahrooz Maghsoudi: Shahrooz is a 5th year electrical engineer specializing in signal processing.

Schedule

Week 1-2: Determine which sensors will be included in the design

Week 3-4: Select components based on compatibility

Week 4-5: Create and debug code for the microcontrollers

Week 6-7: Assemble project hardware

Week 7-8: Test hardware and create benchmark data

RESANG: An Application that Brings More Meaning To Group Chats

Front End (Paul Chun - CpE, Kyle Garica - EE)
Back End (Heran Patel - CSE)
Machine Learning (Tej Vuligonda - CSE)
Department of Electrical Engineering and Computer Science
Professor Sameer Singh - Advisor

BACKGROUND

- ***Problem:*** With an increase in group chats, comes an increase in photos and videos being shared. These chats tend to become disorganized and bury these photos and videos.
- ***Solution:*** Resang employs machine learning to cluster your group chat content in a desirable and meaningful way

INNOVATION

Why are we unique?

1. Resang is the only application on the market to provide context and meaning to past content (specifically photos) in group chats.
2. Resang accurately portrays memories based on the machine learning algorithms and clustering.
3. Snapchat, a competitor, is too temporary in nature, doesn't provide historic group chatting capabilities, and doesn't cater to bring life to previous memories from past weeks, months, or years.

TEAM

Heran Patel, Team Lead | Tej Vuligonda, Data Scientist | Paul Chun, Frontend | Kyle Garcia, Frontend | Sameer Singh, Mentor

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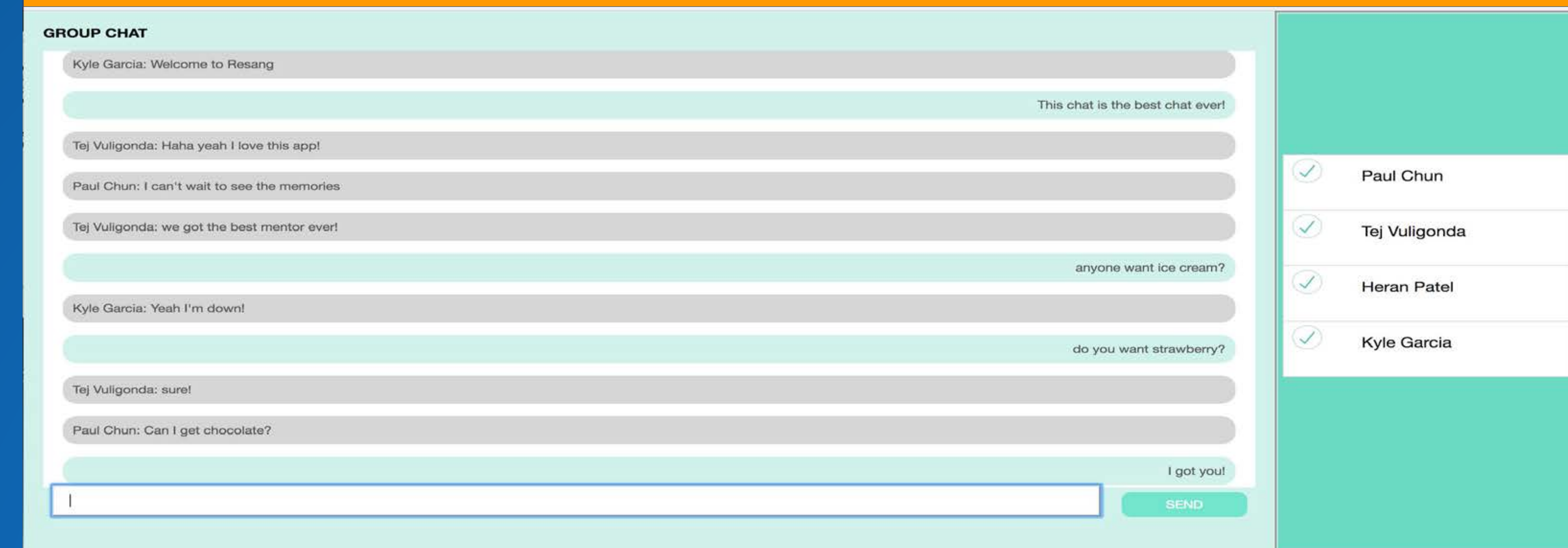
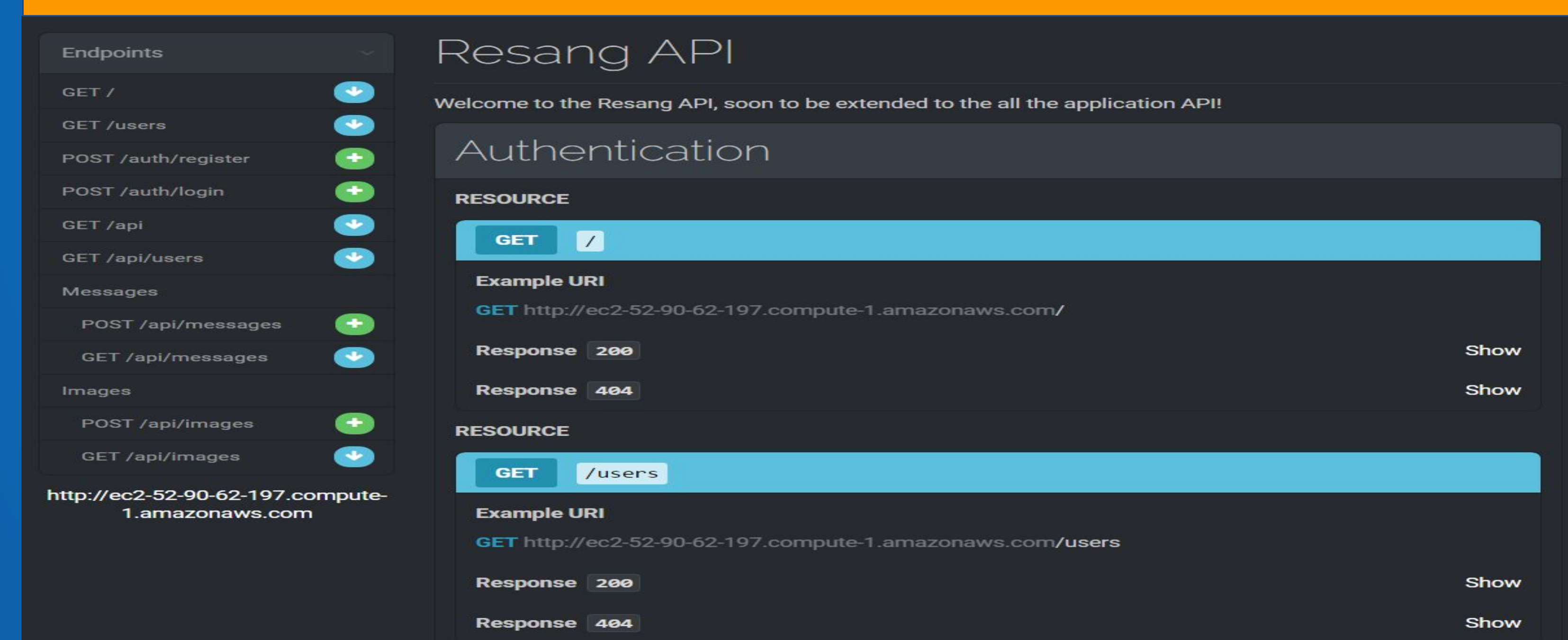
FRONT END

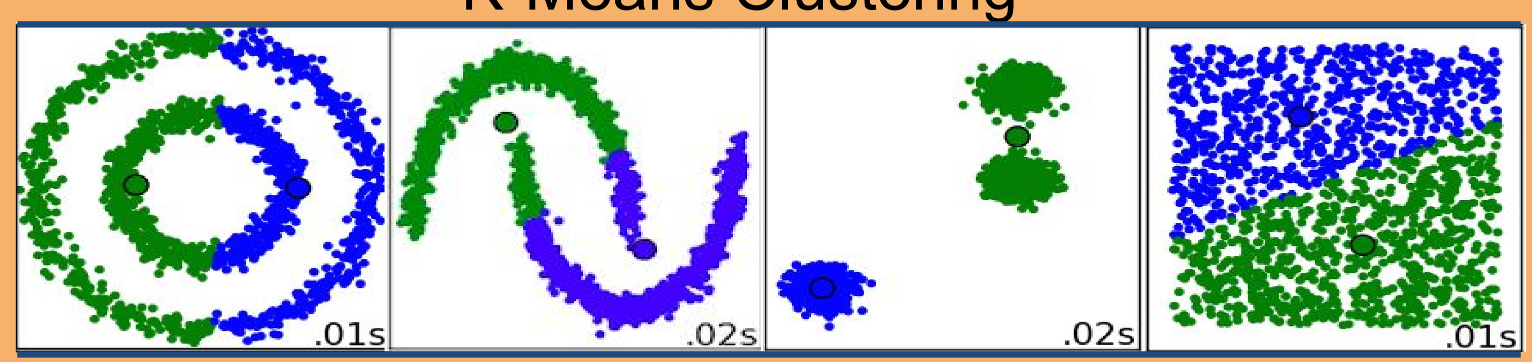


BACK END

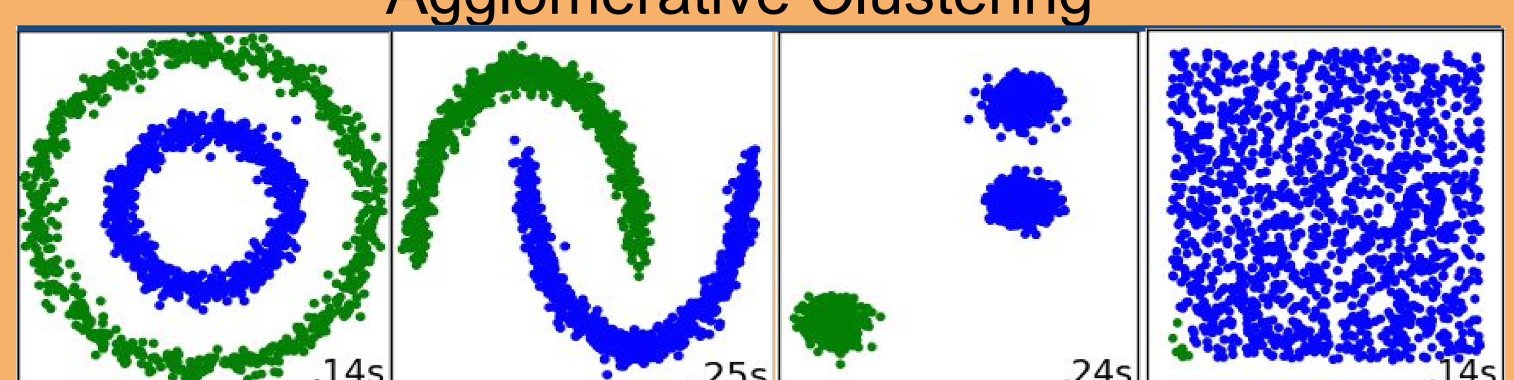


MACHINE LEARNING

K-Means Clustering



Agglomerative Clustering



TIMELINE

SEPTEMBER - DECEMBER

- Designing and Prototyping
- Building a Backend Authentication Service
- Building a Simple Frontend Chat Application
- Research/Design Machine Learning Algorithms

JANUARY - FEBRUARY

➢ **FINISH DEVELOPING WEB APPLICATION**
  - Frontend Image Uploading/Retrieving Process
  - Backend Machine Learning Integration
  - Connecting the 3 components together
- LAUNCH APPLICATION TO THE WORLD

FEBRUARY - MARCH

- Testing and Debugging the Application
- Application Updates and Feedback Modifications
- Develop on the future desired features

FUTURE ADDITIONS

- Natural Language Processing (NLP) implementation to determine relationships among users
- Video & Audio analysis for memories
- Real Time Language Translation
- Mobile Application

http://srproj.eecs.uci.edu/projects/group-chat-and-snapchat-redefined

MANS-i

Mansi Tyagi, Andrew Sperry, Nathan Le, Steven Chow
Professor Richard Lathrop
Department of Electrical Engineering and Computer Science

Optimized Swarm Robotics

Objective

To discover a relation between the complexity of a maze and the optimal number of robots needed to find a target within the maze.

Introduction

Swarm robotics is defined as a field of multi-robotics where a large number of robots work together cohesively in a distributed and decentralized way to solve complex scenarios or tasks. Each robot follows a set of local rules that are simpler than the globally complex objective. Currently, there are a wide variety of design implementations that have previously been developed to solve mazes. These include left or right turn only algorithms, depth-first search, breadth-first search, last-in-first-out, random mouse, wall follower, shortest path, and many others. Our team hopes to take this one step further by providing an ideal relation that determines the optimal robot swarm count to use given a particular style or complexity of maze.

Members

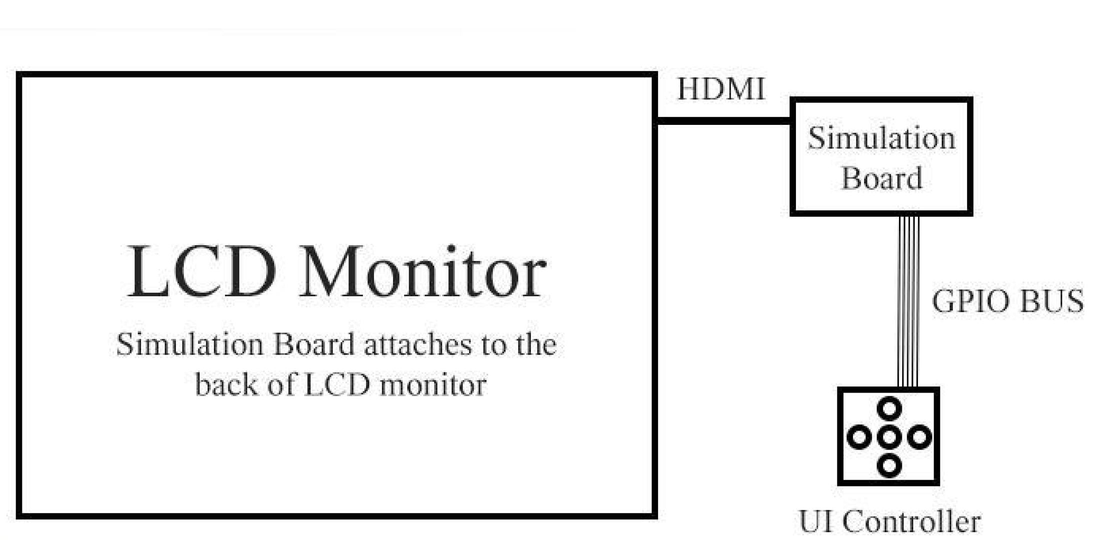
Mentor	**Team Manager**	**Vision Manager**	**Hardware Manager**	**Software Manager**
Richard Lathrop	Mansi Tyagi	Andrew Sperry	Nathan Le	Steven Chow
Information & Comp. Sci.	Computer Sci. & Eng.	Computer Sci. & Eng.	Electrical & Comp. Eng.	Computer Sci. & Eng.

Approach

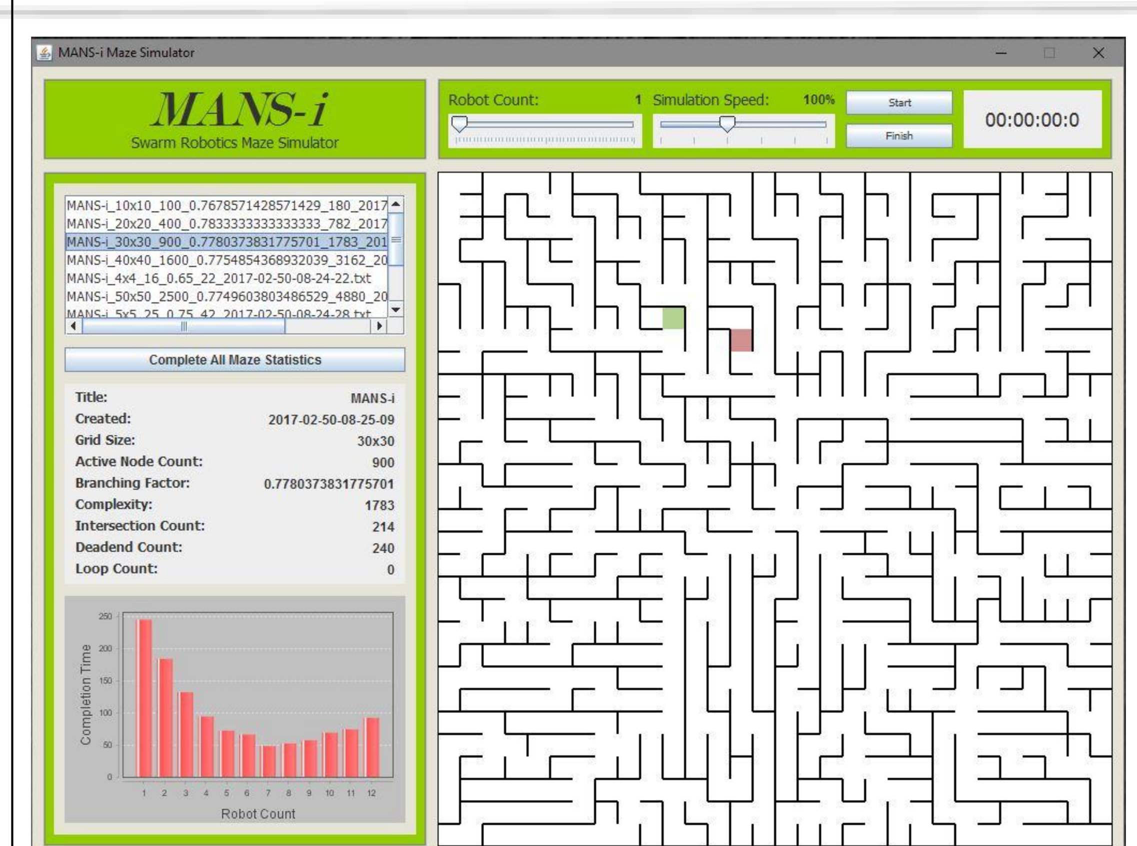
To build a portable hardware setup that runs a graphically based UI simulation environment for generating widespread simple maze statistics.

Design & Results

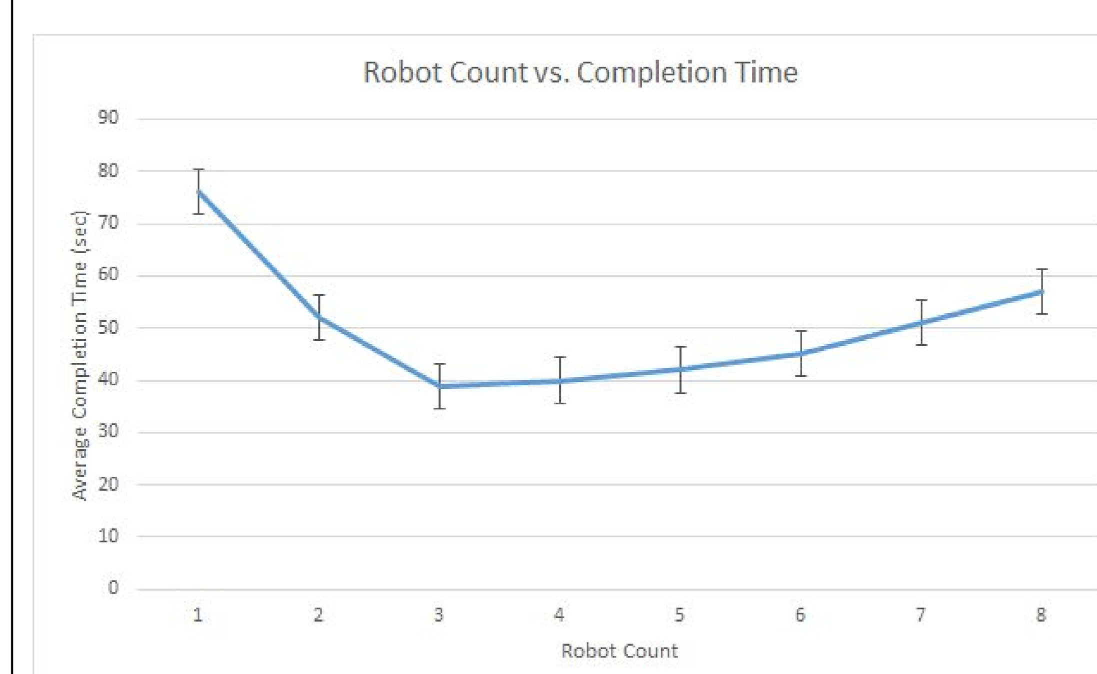
System Design



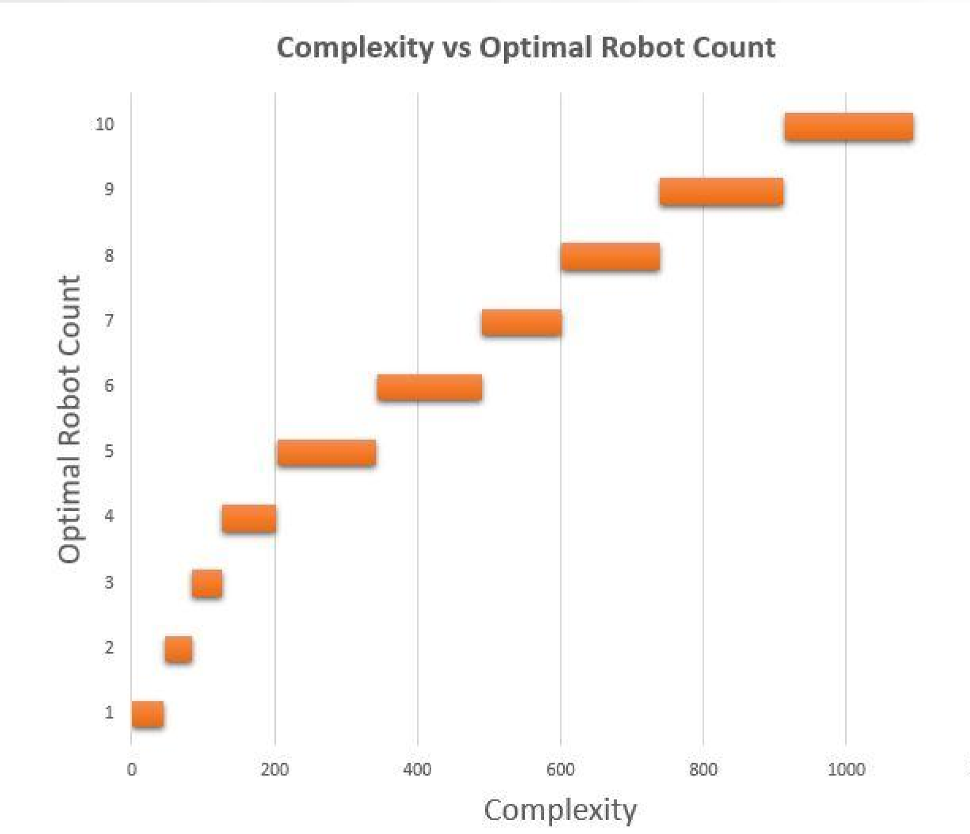
Simulator GUI Design



Generalized Maze Trend



Relation Results



Info

Website: http://srproj.eecs.uci.edu/projects/swarm-robotics-maze-solving-system
Contact: Mansi Tyagi <mansit@uci.edu>

The Henry Samueli School of Engineering
University of California · Irvine

Online Parking

Franklin Hool, Kevin Ngo, Michael Herrera, Alex Tran
Professor Brian Demsky
Department of Electrical Engineering and Computer Science

INTRODUCTION

Pay-by-space parking is generally done by purchasing a temporary parking permit from a permit dispenser at a corner of a parking lot. It is up to the customers to make sure they leave the parking space before their permit expires, or return to the dispenser to purchase more parking time.

GOALS & OBJECTIVES

► Provide convenience to pay-by-space parking with online transactions via smartphone
► Ensure reliable and secure communication between user application and server

INNOVATIONS

► Eliminate the need for physical parking permits
► Car detection by pressure sensor or inductive detectors
► Real-time parking spot finder through mobile application
► Online transactions

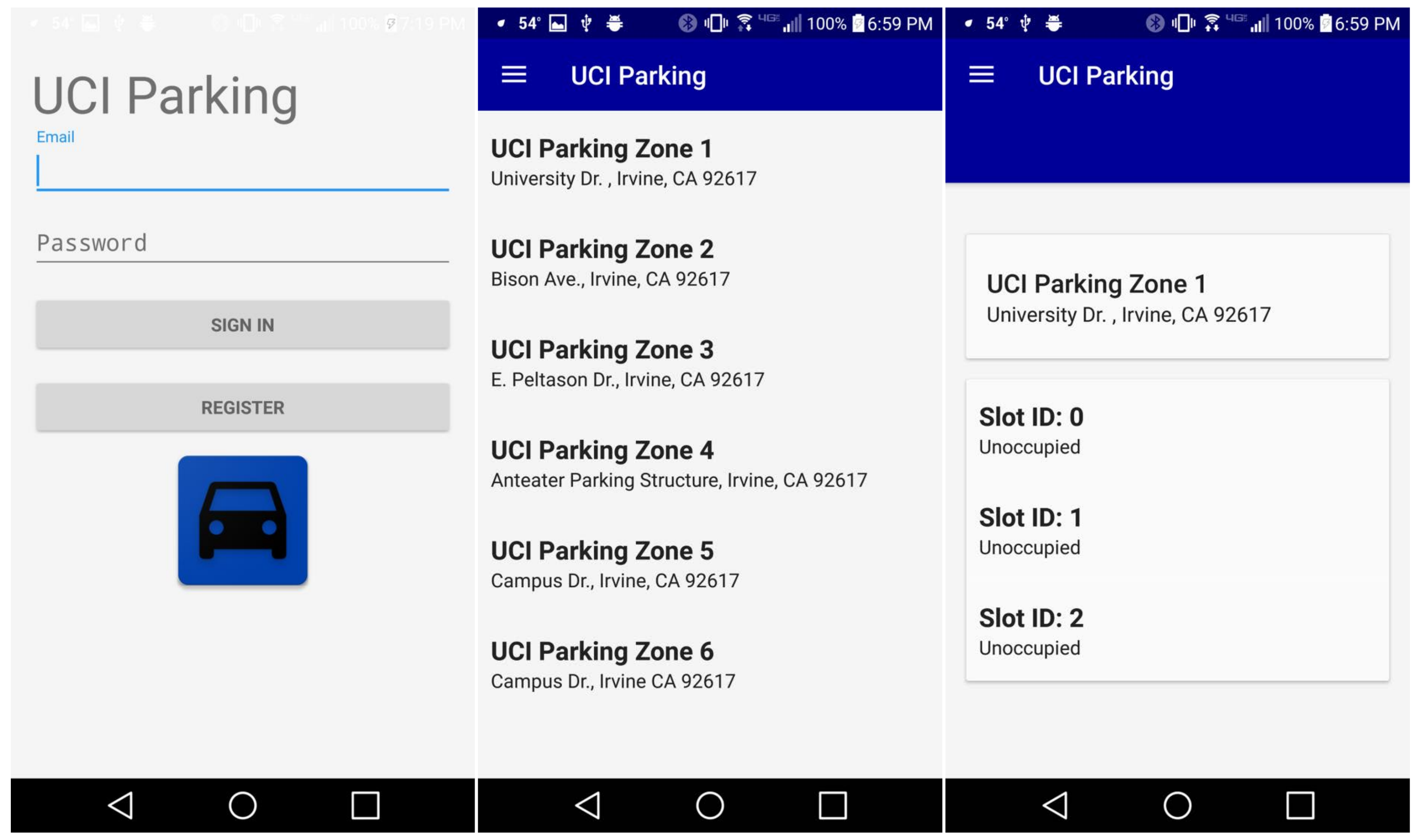
TIMELINE

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 9
Research, Planning										
Server Communication										
UX/UI Design										
App Development										
MCU Prototyping										
Data Management										
Unit Testing, Simulation										
Report, Presentation										

RESPONSIBILITIES

► Franklin: System server
► Kevin: Android to Hardware communication
► Michael: MCU Hardware/Software
► Alex: Android Application UX/UI Design

ANDROID APP PREVIEW



More information: http://srproj.eecs.uci.edu/projects/parking-system

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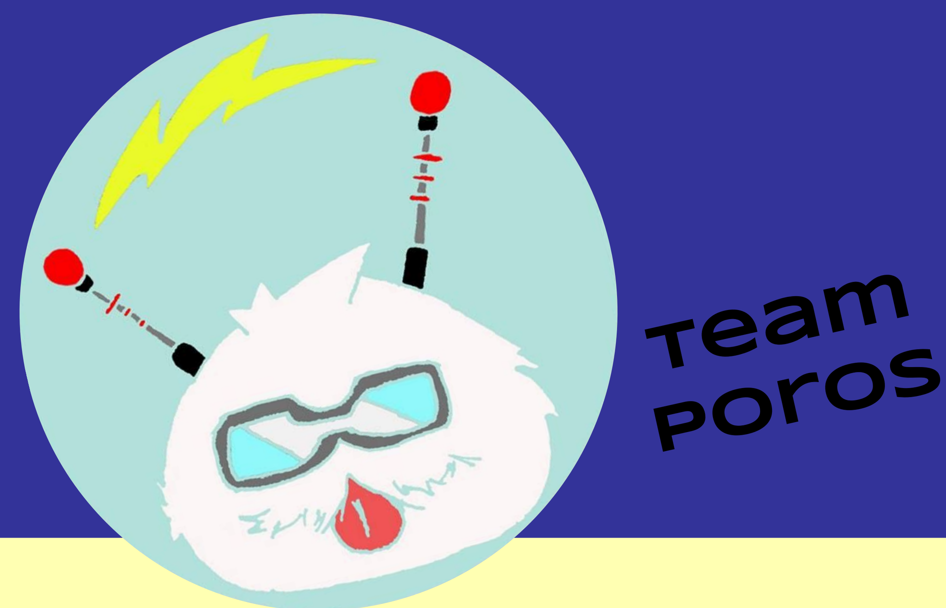


Hardware in the Loop Simulation of Solar and Storage Inverters

Team #9: Tin Hong, Jia Jun Su, James Yi, Kelvin Zheng
Advisor: Professor M. Green
University of California Irvine

Goal Statement

The goal of this project is to find a way to integrate the control and communication of a solar inverter with a Real Time Digital Simulator (RTDS) hardware-in-loop (HIL) simulation through the use of the RTDS compiler which is RSCAD

Introduction

- What is Hardware in a loop testing?
- Hardware in a loop is a testing method in which a real time simulation is created to test a physical hardware for its capacity and functionality
- Pros of HIL includes, testing imposed extreme condition on a hardware that might be difficult to emulate in real life, save time by testing conditions before hardware is fabricated and make changes to improve hardware, save money by not having to create additional hardwares in case one breaks from extreme conditions.
- Our test involves HIL testing on a solar inverter. This test is used to allow the solar inverter to communicate with a RTDS (real time digital simulator) for the purpose controlling the solar inverter.
- The design of the simulation will be done over RSCAD and will be simulated using the processing capabilities of the RTDS

Team Memebers

Hardware in a loop creates a virtual plant or stress conditions that the hardware being tested might encounter. To do this for our hardware in a loop simulation for a solar inverter, we need to be able to communicate with the controller that will actuate the solar inverter.

- **Professor Green**
  - **Mentor**
- **Tin Hong, Electrical Engineer - Circuit Design**
  - -Simulation design and results analyzer
    - Tin knows more about power simulation than other group members, so he will be setting up conditions and other parameter that needs to be tested so that the solar inverter works as intended or solve any problem that the solar inverter might encounter.
- **Jiajun Su, Electrical Engineer - Circuit Design**
  - -Hardware design and wiring of the system
    - Jiajun will be responsible for setting up the block diagram and schematics so that information can be fed into the plant to simulate stress conditions for the solar inverter. He will also be studying power system and its components to design the circuit for the simulation. Jiajun is specialized in IC circuit and knows how to use Matlab, as well as simulink which will be the program that simulates the virtual plant.
- **James Yi, Computer Engineer**
  - -Software design of the system
    - James will be the main programmer for the hardware in a loop simulation since he has been doing coding for most of his classes so he will be able to pick up coding skills with relative ease. He will be learning to use the RSCAD to code and design the circuit and its components.
- **Kelvin Zheng, Electrical Engineer - DSP**
  - -Implementing the systems together
    - Kelvin is specialize in signal process, so he has a better idea on what can be done for the solar inverter to be connected to the controller. He will also further study control systems and its components to devise transfer functions and filters for the simulation.

Power Systems

- Majority of the Power component will be included in a RSCAD library for drafting purposes.
- Components such as Resistor, Capacitor, Inductors are included.
- Filters, Breaker, Faults are also included in the drafting system.
- Output such as node voltage and branch currents can be monitored using RSCAD's runtime or through the RTDS's output port to a oscilloscope.

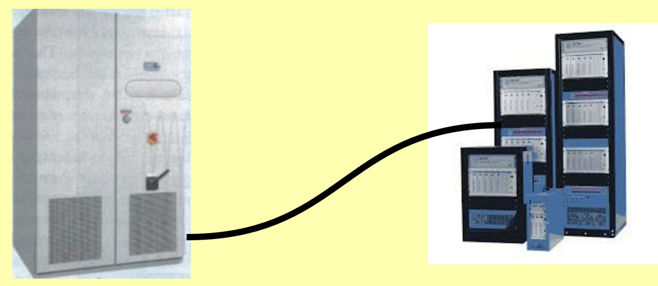
Control Systems

- Control systems manages,commands, directs, or regulates the behavior of the device/system.
- The control system of the project will be simulated through RSCAD using components such as transfer functions and data conversion.
- RSCAD also includes signal generation and signal processing components
- Control system components will be used in conjunction with power system components to form the design that represents the desired simulation scenario.

Schedule

1. Research on project
2. Go to the Edison Labs to get acquainted with the researchers and tools available to us there
3. Do the project
   a. Create code to do HIL testing of the solar inverter and the RTDS
   b. Create code to communicate between the RTDS and the solar inverter
4. Test the project on the physical RTDS and solar inverter machines

NOTE: Scheduling will be more detailed when research and outline of code is done.



Approach

Unlike a conventional hardline connection to the inverter, our design will allow an engineer to change parameters of the solar inverter within the power simulation software, RSCAD, in a wireless, more convenient coordination between hardware and simulator. The RSCAD software is split into two main parts. The Draft program and the CBuilder program.

The CBuilder program is used to create components, such as PV inverters. The circuit is first drawn, then C programming is used to set the behavior. These components can be tested and simulated in the Draft program.

The Draft program is used to build and simulate transmission and distribution circuits.

Project Website

To find further information on the project, please visit

http://srproj.eecs.uci.edu/projects/group-9-poros

Progress and Current Status

Not Complete	(red)	Note: Edison has finalized the requirements for the project and has given us a packet about the project
Over Scheduled Time	(blue)	Note: When senior design scheduling details for next quarter are released, this will be updated

Number	Main Task	Sub Tasks/Short Descriptions	Start	End	Time Needed	11/14/2016	11/21/2016	11/29/2016	12/5/2016	1/9/2016	1/16/2019	1/23/2016	1/30/2017	2/6/2017	2/13/2017
1	Research	Research (Some done before week 1)	10/3/2016	11/21/2016	1 Week										
2	Go to Edison's labs		N/A	N/A	N/A										
3	Creating the project		2/6/2017	5/15/2017	~3 Months										
3.a	Creating the project	Create code to do HIL testing of the PV Inverter	2/6/2017	5/15/2017	~3 Months										
3.a.i	Creating the project	Test and record results of the HIL testing	5/8/2017	5/15/2017	~2 Weeks										
3.b	Creating the project	Create code to do HIL testing of the RTDS	2/6/2017	5/15/2017	~3 Months										
3.b.i	Creating the project	Test and record results of the HIL testing	5/8/2017	5/15/2017	~2 Weeks										
3.c	Creating the project	Create code to communicate between the RTDS and the PV Inverter	2/6/2017	5/15/2017	~3 Months										
3.c.i	Creating the project	Create suitable time difference (needs to have as little delay as possible)	2/6/2017	5/15/2017	~3 Months										
3.c.ii	Creating the project	Find way to propagate a strong signal	2/6/2017	5/15/2017	~3 Months										
4	Testing	Test the project on the actual solar inverter and RTDS machines.	5/22/2017	5/29/2017	1 Week										

Number	Main Task	Sub Tasks/Short Descriptions	Start	End	Time Needed	2/20/2017	2/27/2017	3/6/2017	3/13/2017	3/20/2017	3/27/2017	4/3/2017	4/10/2017	4/17/2017	4/24/2017
1	Research	Research (Some done before week 1)	10/3/2016	11/21/2016	1 Week										
2	Go to Edison's labs		N/A	N/A	N/A										
3	Creating the project		2/6/2017	5/15/2017	~3 Months										
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3.b	Creating the project	Create code to do HIL testing of the RTDS	2/6/2017	5/15/2017	~3 Months										
3.b.i	Creating the project	Test and record results of the HIL testing	5/8/2017	5/15/2017	~2 Weeks										
3.c	Creating the project	Create code to communicate between the RTDS and the PV Inverter	2/6/2017	5/15/2017	~3 Months										
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Number	Main Task	Sub Tasks/Short Descriptions	Start	End	Time Needed	5/1/2017	5/8/2017	5/15/2017	5/22/2017	5/29/2017
1	Research	Research (Some done before week 1)	10/3/2016	11/21/2016	1 Week					
2	Go to Edison's labs		N/A	N/A	N/A					
3	Creating the project		2/6/2017	5/15/2017	~3 Months					
3.a	Creating the project	Create code to do HIL testing of the PV Inverter	2/6/2017	5/15/2017	~3 Months					
3.a.i	Creating the project	Test and record results of the HIL testing	5/8/2017	5/15/2017	~2 Weeks					
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3.c	Creating the project	Create code to communicate between the RTDS and the PV Inverter	2/6/2017	5/15/2017	~3 Months					
3.c.i	Creating the project	Create suitable time difference (needs to have as little delay as possible)	2/6/2017	5/15/2017	~3 Months					
3.c.ii	Creating the project	Find way to propagate a strong signal	2/6/2017	5/15/2017	~3 Months					
4	Testing	Test the project on the actual solar inverter and RTDS machines.	5/22/2017	5/29/2017	1 Week					

Project Blindspot

Faisal Alshaka, Narvik Ghahremanians, Lynn Dannan, Gaurav Venkatesh
Professor Michael Green – Department of Electrical Engineering and Computer Science
University of California Irvine

Project Purpose

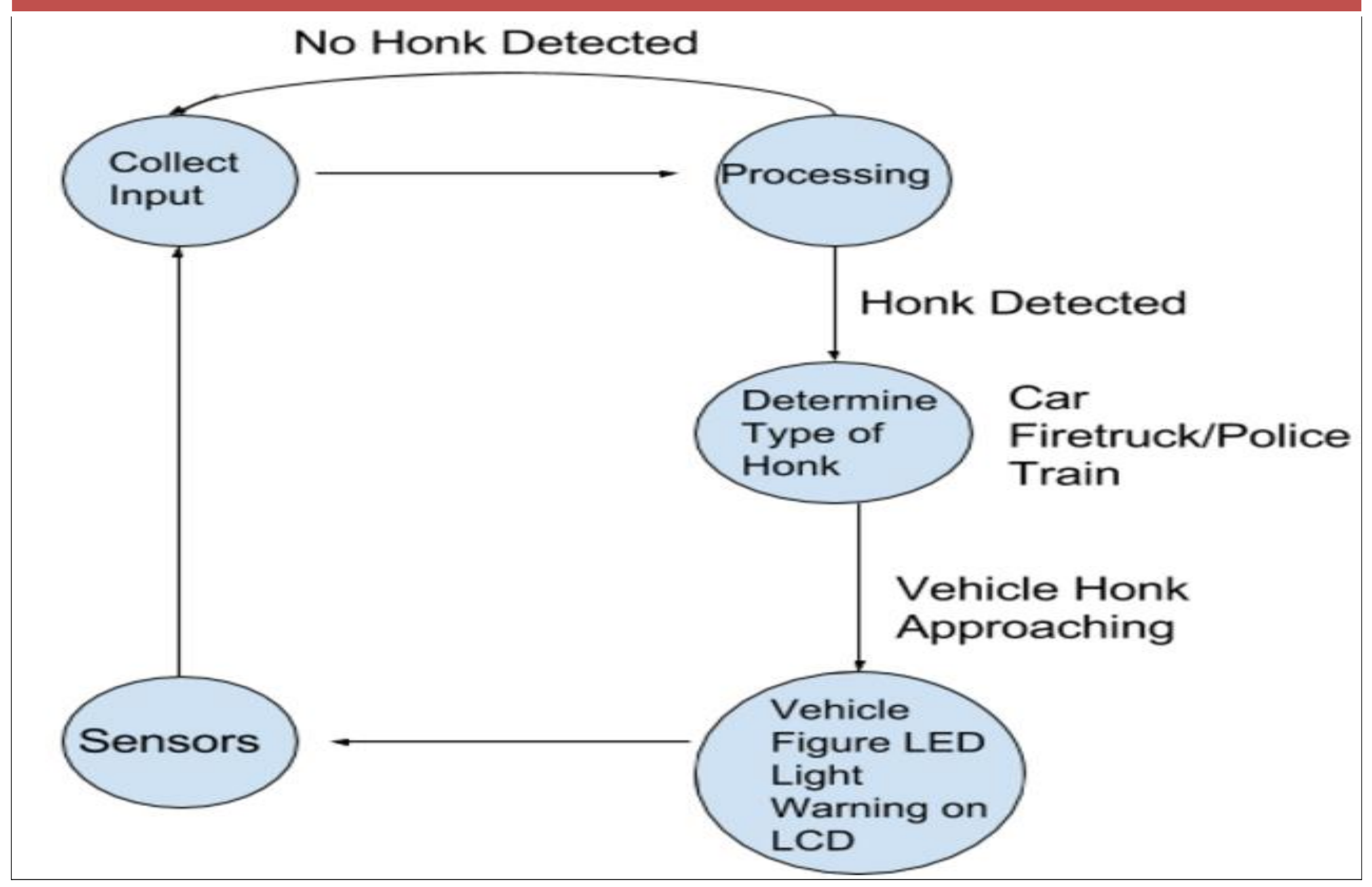
The main idea of this project is to create This senior design project is focused on devising a technology that will alert deaf drivers to critical sounds -- including various types of automobile and truck horns in close proximity and sirens from emergency vehicles -- from their surroundings by transforming incoming audio signals into visual signals displayed on an LCD screen.

Background

The deaf community has commonly been a marginalized and disenfranchised part of society, and the increasing sweep of technological advancements throughout recent years have often emphasized the alienation of that critical group of our civilization. There have been increasing efforts to help the deaf community integrate better into our continuously evolving times, there still remain many challenges to overcome and many solutions to create in order to make it easier for people with disabilities to coalesce into the ever changing technologies of our time at the same pace as the rest of society.

In an effort to tackle this imperative problem, we decided to focus our attention on creating technology that will assist deaf drivers in operating their vehicles safely and easily. More specifically, this technology will comprise of alerting deaf drivers to incoming honking and sirens.

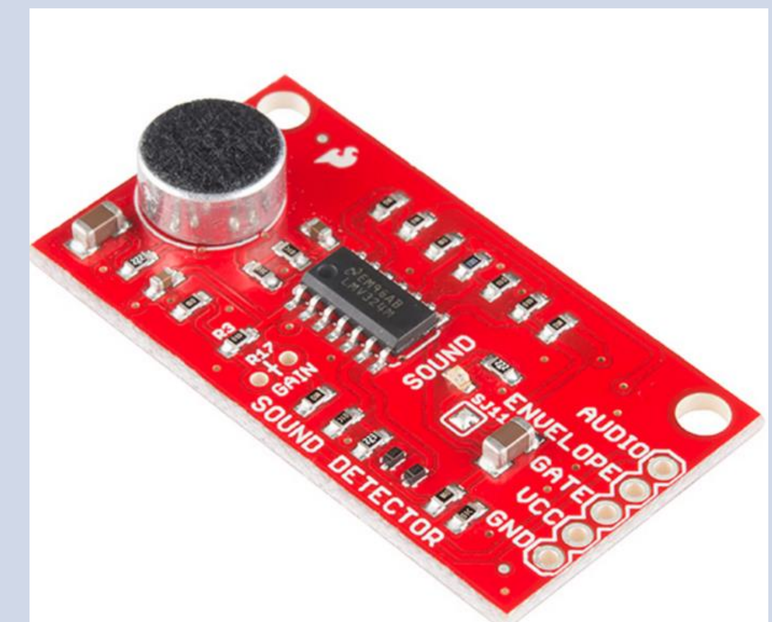
Approach

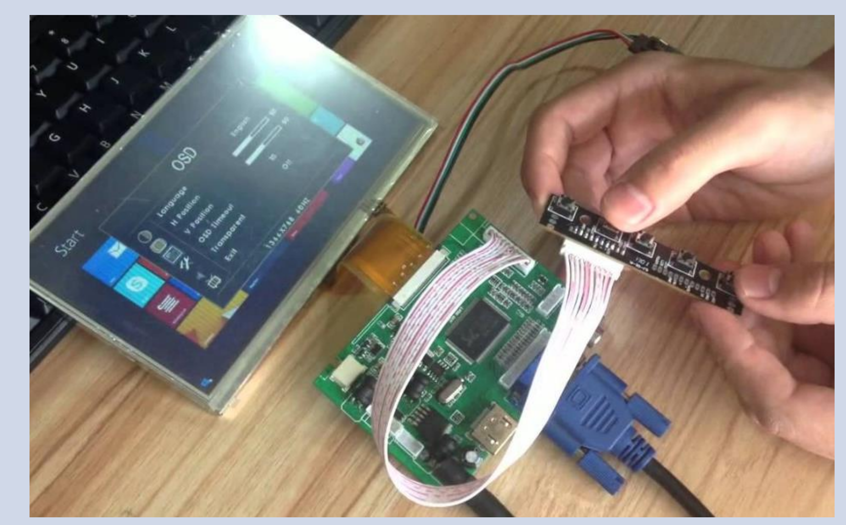


Team Organization

Faisal Alshaka B.S. Electrical Engineering	Hardware, DSP, Circuit Design, Sensor Placement
Lynn Dannan B.S. Electrical Engineering	Hardware, Filter Design, Circuit and Sensor Connection
Narvik Ghahremanians B.S. Computer Engineering	Software, GUI, Pattern Recognition Algorithm, Programming
Gaurav Venkatesh B.S. Computer Engineering	Software, GUI, Pattern Recognition Algorithm, Programming

Progress





Additional Project Information

More information about Project Blindspot and its progress can be found by visiting our website:
http://srproj.eecs.uci.edu/projects/project-blind-spot

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Water Cooler Buddy

By Team ULTRA

Hugh Dang (Computer Science and Engineering, B.S.), Binh Nguyen (Computer Science and Engineering, B.S.), Phat Quach (Electrical Engineering, B.S.), Duy Nguyen (Electrical Engineering, B.S.)

Faculty Mentors: Professor G.P. Li & Dr. Michael Klopfer (CalPlug/ Calit2)

Department of Electrical Engineering and Computer Science

Introduction & Background

Energy conservation has always been a major target in the United States in order to increase economic revenue as well as to protect the environment. In addition, with the evolution of technology and the diminishing of hardware price, more and more smart devices are invented and brought to the market. From personal wearable devices like smart watch, smart band, etc. to home appliances like refrigerator, oven, etc., there is a huge potential for us to explore. Despite the fast development, we found out that the current technology of water dispenser is wasting energy. Our main motivation for this project is to modify the current water cooler dispenser so that it can save more energy by putting the device in energy conservative mode when no one is using it. One major unresolved problem exists in conventional model is it still operating 24/7 to constantly heat up and cool down water, even when nobody is around. Ultimately, we aim to build the first of its kind to target the new market and especially to help people use energy more efficiently and minimize the inconvenience.

Goal Statement

Our project aims to reduce the energy consumption within water cooler by controlling the water heat and cooling process. The machine will be on performance mode when people around, otherwise it will be on standby mode which will limit the energy consumption. We will using sensors such as motion, proximity sensor to determine the state of machine. The reason we implement this system because the normal water cooler always have to consume energy to keep temperature of water even when no one will use it. There will be relays implemented that control the temperature in the cold and hot tank. Our system will also allow users to control the temperature of water by mixing. The water cooler dispenser will intelligently switching state depend on the environment around in order to minimize the energy consumption which will lead to maximize energy management.

Team Organization and Tasks

Dr. G.P. Li
Dr.Michael Klopfer

Hugh Dang (Team Captain)
- Analyze and research sensors.
- Manage Project
- Software integration testing and procedure and protocols.
- Development and implementation of sensor to cloud
- Handle data output

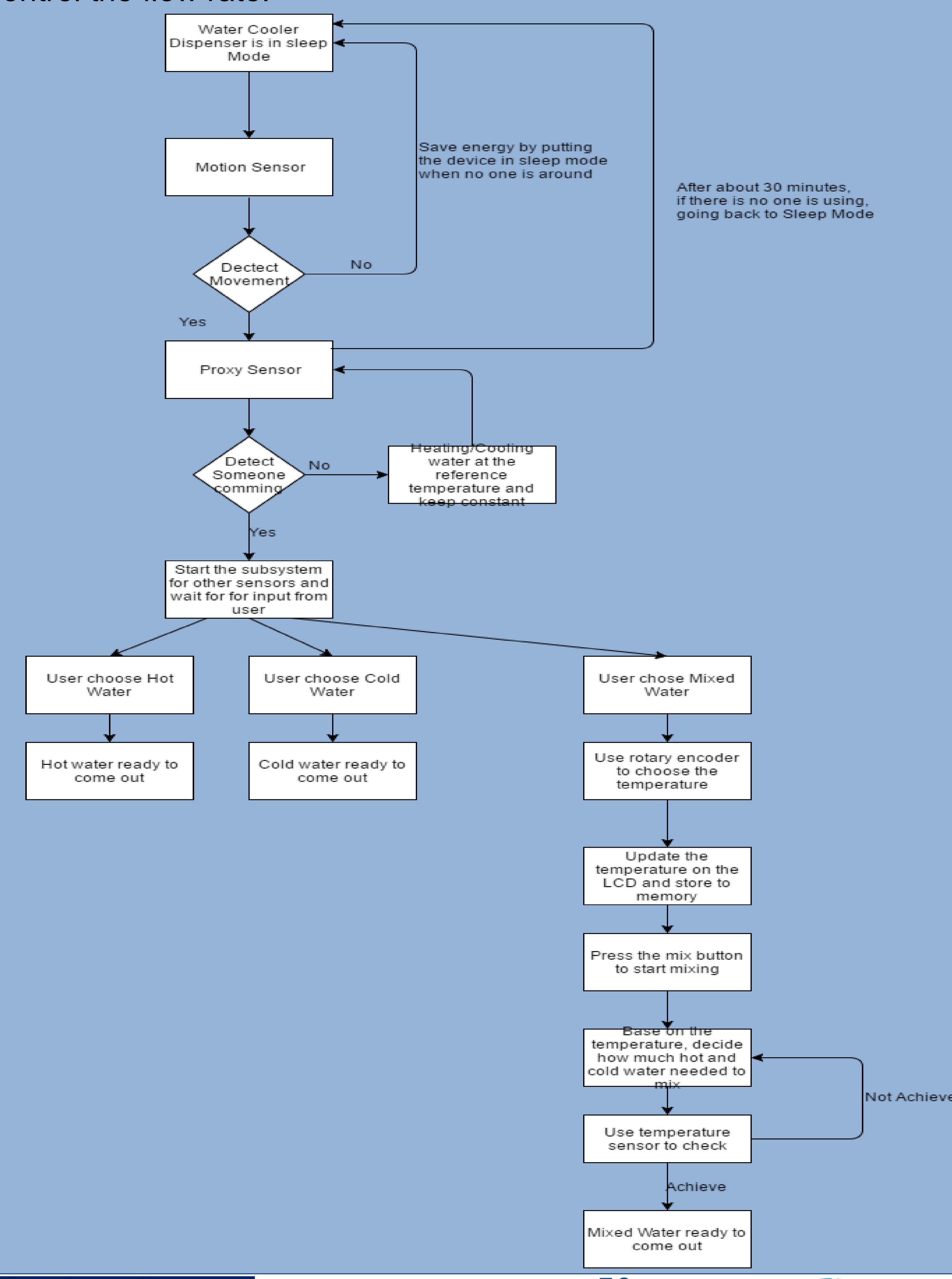
Binh Nguyen (Firmware Developer)
- Research and develop MQTT server
- Manage input data and create graph.
- Develop demo software for prototype.
- Analyze and research the relay and apply it into micro-controller.

Duy Nguyen (Hardware Developer)
- Design schematic and layout for the system.
- Research and modify the current circuit system of water cooler
- Hardware and system documentation
- Design cooling system

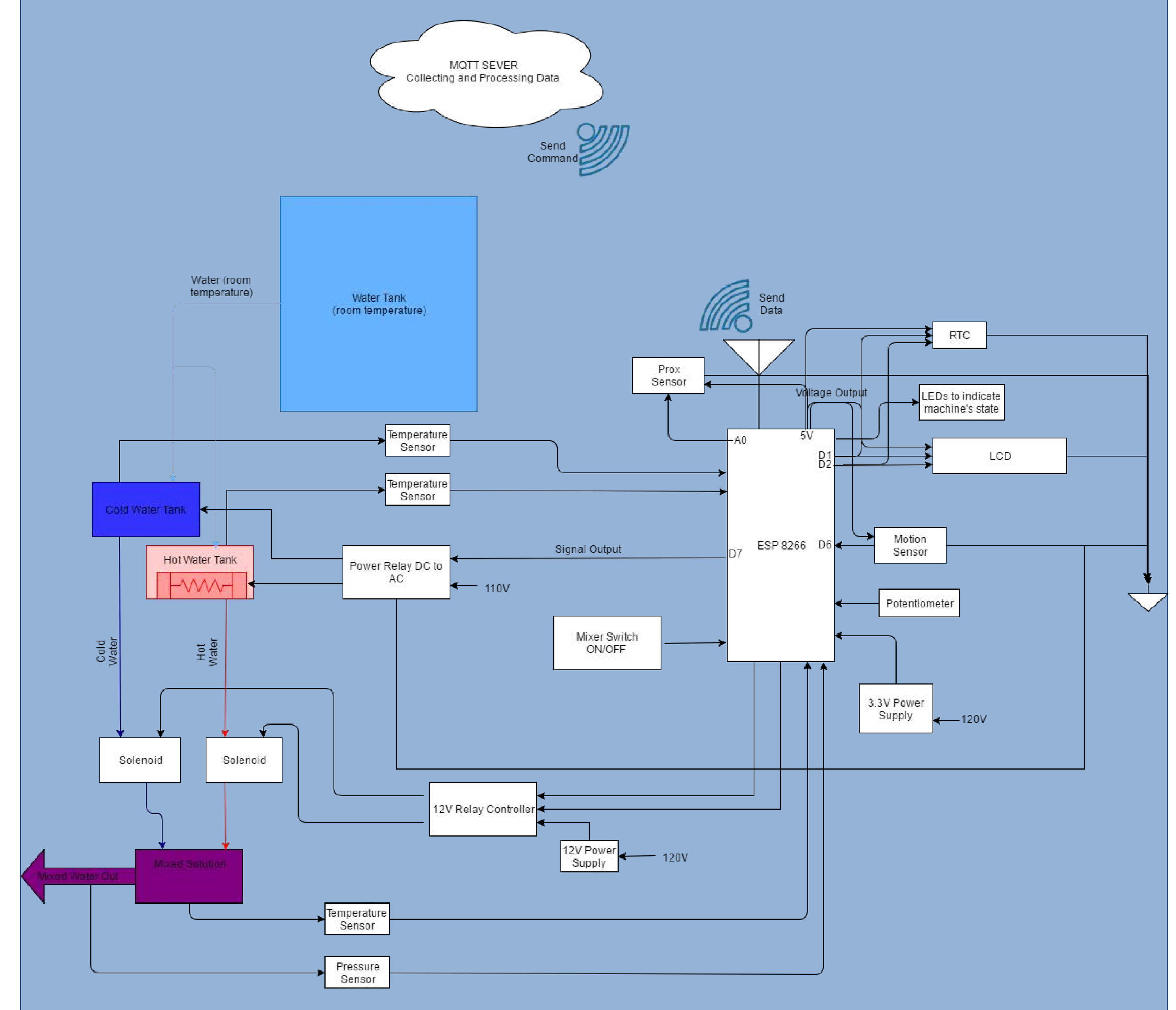
Phat Quach (Hardware Developer)
- Design heating water system.
- Research and develop method for mixing water.
- Implement relay into the system.
- Develop the prototype

Approach & Implementation

Main parts of project:
- **Water Tank Modification**: The relays will be attached to the cold and hot tank in order to control from microcontroller. Temperature sensor will also included.
- **Motion/Proximity sensor:** These sensors will accurately scan the environment around to determine the mode of the machine (on or standby).
- **Mixer Tank Modification:** The mixer tank will be added where the water flows from both the cold and hot tank. Each path of water will have a solenoid that will help to control the flow rate.



Design



System Schematic

Current and Future Work

Current:
- We had successfully implemented the energy improvement system into the water cooler.
- We are developing the algorithm for mixing system. Our objective is to produce a mixed water within +/- 5 degree Celsius error.
- Our biggest problem is finding a good solenoid that costs efficiency and has a good flow rate.

Future:
- Develop a cross platform mobile application to control the machine
- Apply reinforcement learning algorithm into controlling system.

Contact Information:

Project Website: http://srproj.eecs.uci.edu/projects/water-buddy
Binh Nguyen: binhnn1@uci.edu
Duy Nguyen: dnguyend933@gmail.com
Hugh Dang: hughdang93@gmail.com
Phat Quach: pquach4@gmail.com

Drone Mapping of Radio Frequency Signals in 3D

Matthew Joslin CSE - Reginald Martinez EE - Nehme Saikali CPE - Anissa Tran CPE
Professor Peter Burke
Department of Electrical Engineering and Computer Science

Executive Summary

Our project measures the strength of radio signals in three planes. We have achieved this by attaching various types of antennas to a radio receiver mounted on an autonomous quadcopter that measures the strength of RF signals in the 5.8GHz frequency band. Our onboard Raspberry Pi 3B interfaces with the Pixhawk flight controller to read GPS, altitude, and signal strength data, and compiles the data into files which we will use to create 3D maps in Python.

Introduction

Background: A large number of devices make use of wireless signals. Additionally, there are a number of products that can be used to take signal measurements at ground level. Currently, there is a lack of products which allow for measurements to be taken from the air. Our project will provide an autonomous platform that can be used to test the reception of various antenna types at different heights. With a greater degree in freedom of motion, it will be possible to track how signal strength varies in a real world test bench.

Market: Our project will be useful to major cell phone companies because it will allow them to generate 3D maps of their service without being constrained by city roads. It will also give these companies a platform on which to evaluate various antenna designs and their efficacy in varying altitudes as well.

Approach: Current RF mapping is accomplished by driving in a vehicle to create a 2D map. This project will automate the process and produce a 3D map using a quadcopter.

Timeline:

Fall Quarter:
1. Acquire Materials to Construct Quadcopter and Measure RF Signals
2. Safety, Licences and Regulations
3. Download Necessary Coding, Flight Controlling and Mapping Software
4. Assemble Quadcopter and Initiate Autonomous Flight
5. Create Examples of 3-D Maps Using Simulated GPS Measurement Data

Winter Quarter:
1. Write Raspberry Pi GPS Data Logging Script
2. Connect the Python MAVLink Interface
3. Log Signal Data From Autonomous Flight Missions
4. Generate Final 3-D Maps for Three Antenna Types
5. Final Poster/Report

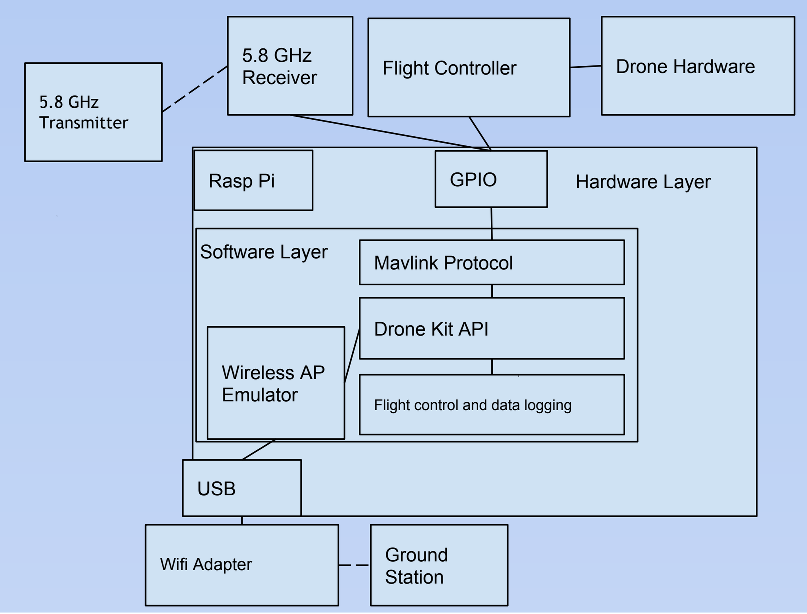
Budget: Funding for this project was provided by two sources. Our main source of funding comes from a UROP grant for $400. Any other expenses are covered by the project faculty mentor. We also utilized parts previously purchased for the Engineering 7A/B class. The following image shows our main expenses:

Qty.	Unit	Description	Catalog #	Unit Price	Extended Price
1	1 pack				$0.00
1		Adafruit ADS1115 16-Bit ADC – 4 Channel with Programmable Gain Amp		$18.18	$18.18
1		Frsky 3/16CH X Series Dual-way Receiver X4RSB w/		$30.48	$30.48
1		Fat Shark FSV2442 32ch 5G8 Race Band Receiver		$30.00	$30.00
1		ImmersionRC 600MW 5.8 GHz A/V Transmitter		$49.00	$49.00
1		Raspberry Pi 3 Model B Motherboard		$36.91	$36.91
1		Crazepony 2pcs TBS Antenna 5.8G 1.26DBi 4 Leaf		$35.99	$35.99
2		Turnigy 330mah 3s 30c Lithium Polymer Battery		$29.96	$59.92
1		ImmersionRC SpiroNet RHCP Mini Patch 8dBi IRL		$27.26	$27.26
					$0.00
					$0.00
					$0.00
					$0.00
				Sub Total:	$287.74

Quadcopter Construction

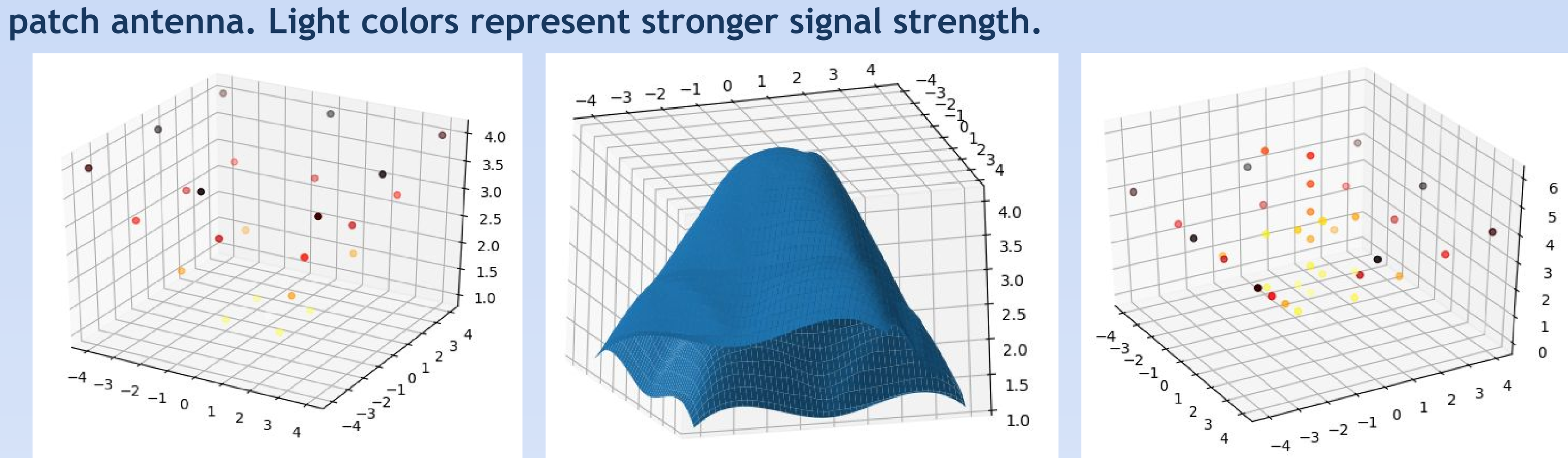
Quadcopter Build Specifications:
- 5.8GHz Patch, Cloverleaf, and Dipole Antenna
- 30 Amp Speed Controllers
- 3300mAh 3s LiPo Battery
- Aerosky MC3525-860kV Motors

Continued:
- Fat Shark 5.8GHz Receiver
- ImmersionRC 5.8GHz Transmitter
- Onboard Raspberry Pi 3 B
- 3-D Printed Landing Gear
- Pixhawk Flight Controller
- FrSky Taranis Transmitter
- FrSky X4RSB Receiver
- 4 - 10 Inch Propellers
- 16-Bit ADC



Data Analysis

The following maps represent the respective data gathered through autonomous flight and data collection of the three 5.8GHz antennas. The first plot is an example of decreasing signal strength as distance increases. The second plot depicts a test flight path. The third displays example data for a patch antenna. Note that signal strength is strongest directly above for the patch antenna. Light colors represent stronger signal strength.



Sample 3-D Map Code:

```
fig = plt.figure(figsize=plt.figaspect(0.5))
my_data = np.genfromtxt('data.csv', delimiter=',',skip_header=1)
X = my_data[:,0]
Y = my_data[:,1]
Z = my_data[:,2]
xi = np.linspace(X.min(),X.max(),100)
yi = np.linspace(Y.min(),Y.max(),100)
zi = griddata((X, Y), Z, (xi[None,:], yi[:,None]), method='cubic')
CS = plt.contour(xi,yi,zi,15,linewidths=0.5,color='k')
ax = fig.add_subplot(1, 1, 1, projection='3d')
xig, yig = np.meshgrid(xi, yi)
surf = ax.plot_surface(xig, yig, zi, linewidth=0)
plt.show()
```

Sample Scatter Plot Code:

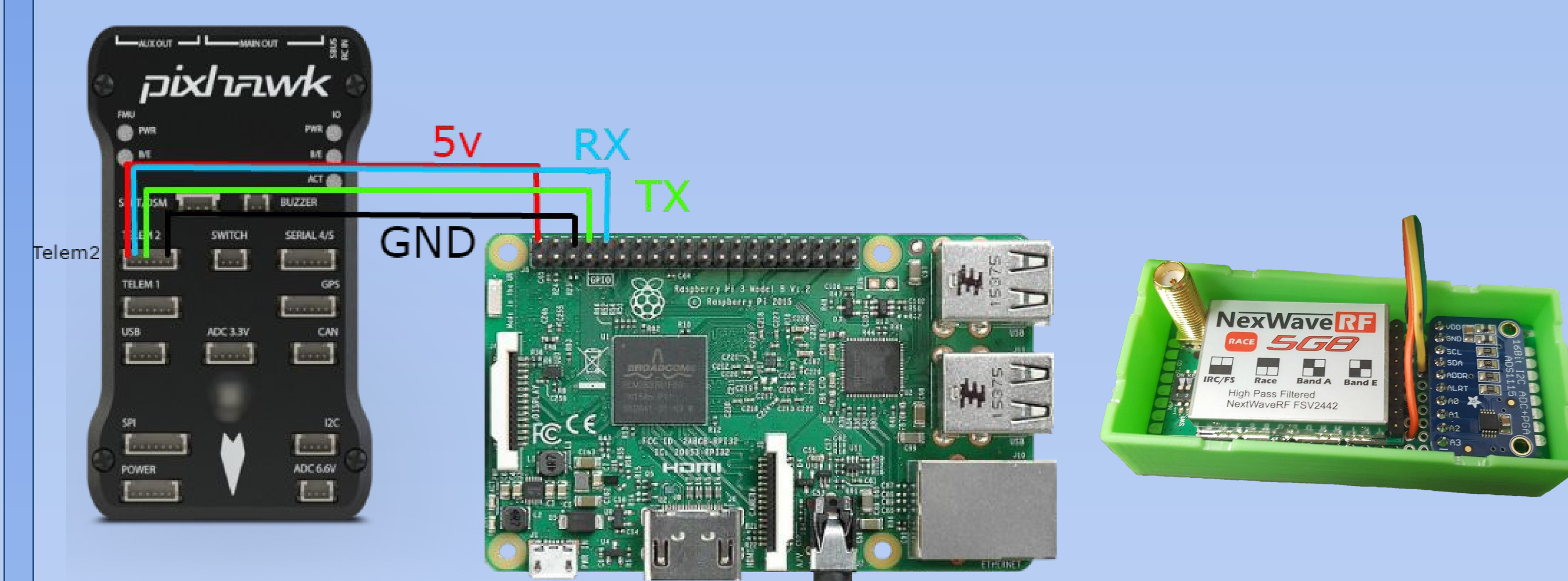
```
from mpl_toolkits.mplot3d import Axes3D
import matplotlib.pyplot as plt
import numpy as np

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

my_data = np.genfromtxt('data.csv',
delimiter=',',skip_header=1)
x = my_data[:,0]
y = my_data[:,1]
z = my_data[:,2]
c = my_data[:,3] #This is signal strength

ax.scatter(x, y, z, c=c, cmap=plt.hot())
plt.show()
```

Hardware Components



The graphic above shows how to connect a Raspberry Pi to a Pixhawk flight controller through the Pixhawk's TELEM2 port using the MAVLink protocol over UART to collect flight data. The Pixhawk alone cannot compile the GPS, altitude, and signal strength data simultaneously, so this connection is imperative in creating and rendering 3-D graphs. The 5.8GHz receiver is inside a 3D printed enclosure with the 16-bit ADC soldered on a PCB. Below are the three types of antennas analyzed in this project.

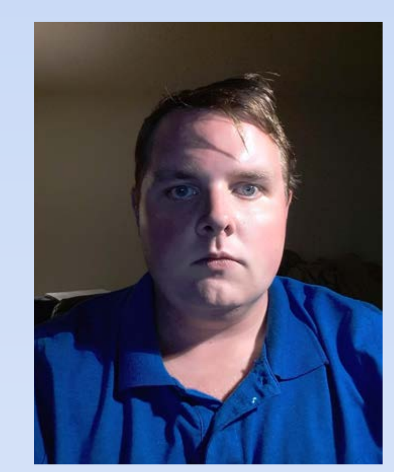
Cloverleaf Antenna

Dipole Antenna

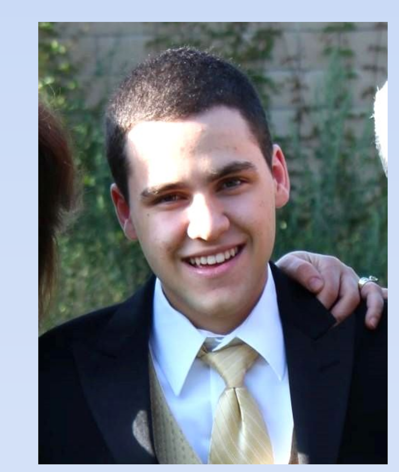
Patch Antenna

Meet Team RAMeN

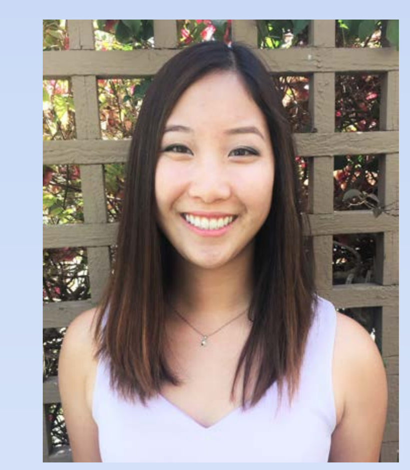
Reginald Martinez
Electrical Engineering



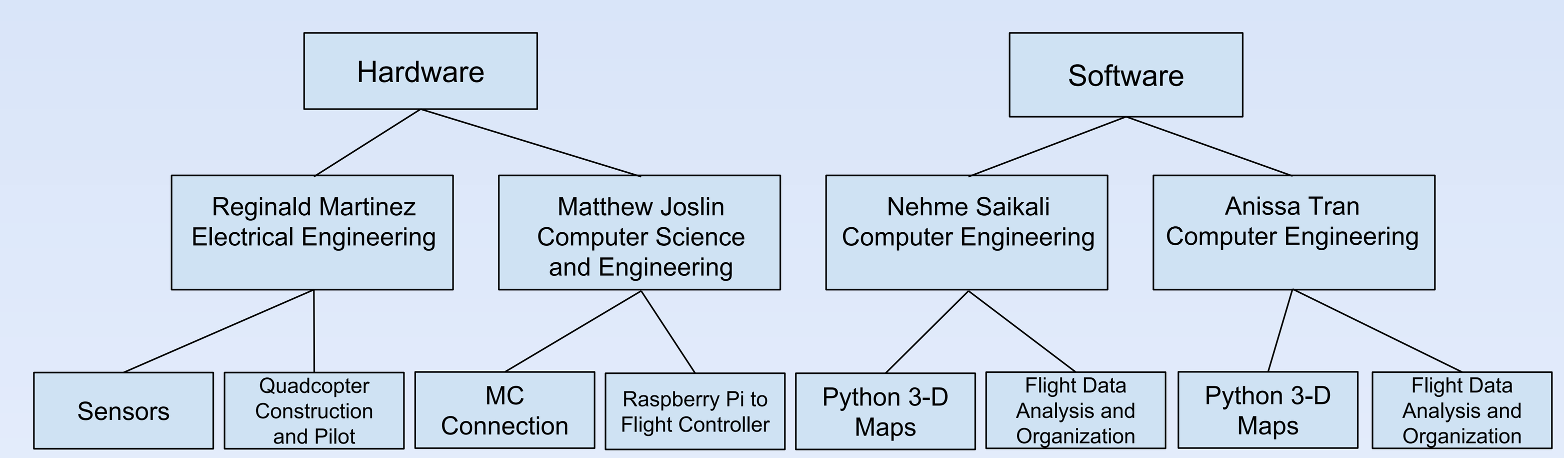
Matthew Joslin
Computer Science Engineering



Nehme Saikali
Computer Engineering



Anissa Tran
Computer Engineering



The Henry Samueli School of Engineering
University of California · Irvine

Website: https://canvas.eee.uci.edu/groups/8098
Contact Us For More Information: 925.989.3398 or chikhant@uci.edu

Team RAMeN

M.A.S.P.

Multi-Axis Stabilizing Platform

Jonathan Loui, Ivan Blanco, Austin Soedorsano, Ryan Yuen
Professor Rainer Doemer
Department of Electrical Engineering and Computer Science

Team Members

Mentor: Dr. Rainer Doemer

Jonathan Loui	CpE	Hardware assembly, sensor programming
Ivan Blanco	CpE	Implementation of servo and sensors with Arduino
Austin Soedorsano	CpE	Programming
Ryan Yuen	CpE	3D printing and design

Team (left to right): Austin, Ryan, Ivan, Jonathan

BOM

Arduino Due	$32.13
PU-6050 Gyroscope /Accelerometer	$7.99
Futaba Standard Digital Servo (x6)	$78.00
3-D printing	$30.00
Building Materials	$40.00
Total:	**$188.12**

Market

Our intended market is the casual bike commuter going from home to school/work, who needs a region of the bike minimizes shake or tilt to minimize damage (liquid spills, vulnerable laptops, and excessive camera movement).

Goal Statement

Develop a modular, multi-axis self-stabilizing platform. The primary goal is to make a mountable device for a bicycle that is capable of carrying a cup of any type of beverage without spilling it while moving. Secondary, the device will be detachable and can be used as a steady camera mount for smartphones and many other stabilizing applications.

Background

The Multi-Axis Stabilizing Platform (MASP) is a device installed at the center to the bicycle intended to counteract shake and tilt of the bicycle. This is accomplished by using Stewards platform design, with a 6 DOF gyroscope.

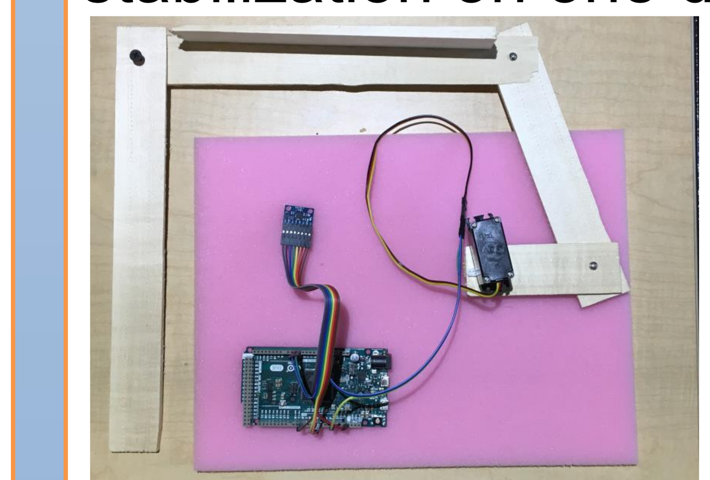
Innovations

As traffic problems worsen, more people are taking to the streets by commuting via a bicycle. However, bicycles are not equipped with cup holders so the delicious morning cup of coffee cannot be enjoyed on the road to work. With this device, users will be able to ride their bike and keep their cup or beverage right in front of them, without having to worry about keeping it in a spill-proof container.

The modular design will also allow for the platform to be fitted with a camera or phone mount, so rather than keeping a cup from spilling, it will be able to assist with steady footage for action sport lovers. Additionally, it will be easily detachable, so the user can transition from bike to foot effortlessly if they are filming their adventure

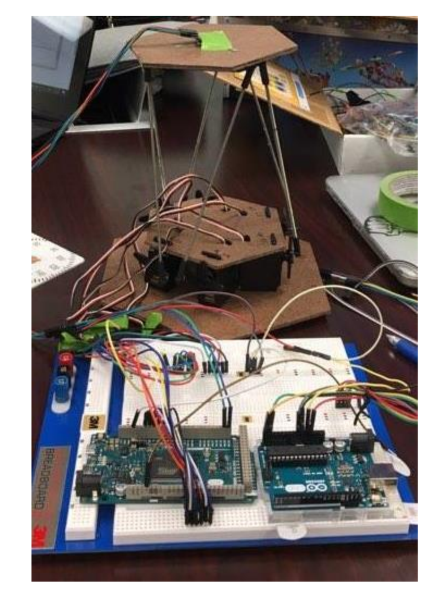
Milestones / Progress

Fall Quarter 2016(current): As pictured, stabilization on one degree of freedom

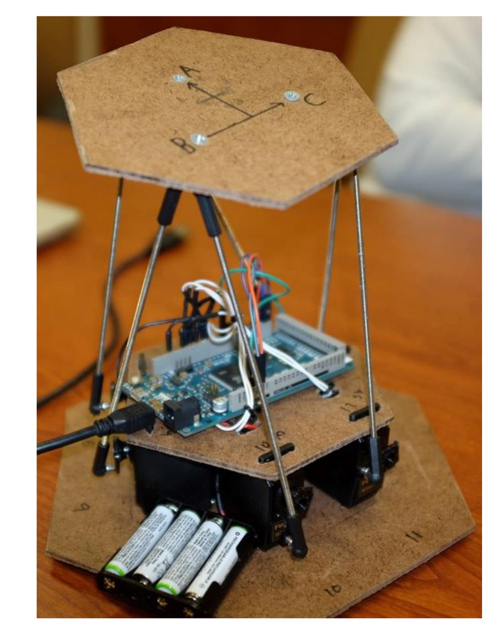


From humble beginnings…

Winter Quarter 2017(first half): Scale fall quarter progress up to 6 degrees of freedom

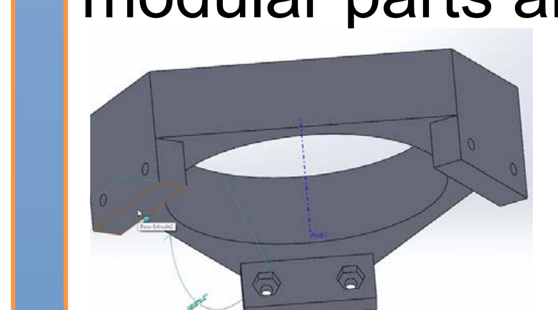


Testing Arduino UNO and Arduino DUE microcontroller behaviors

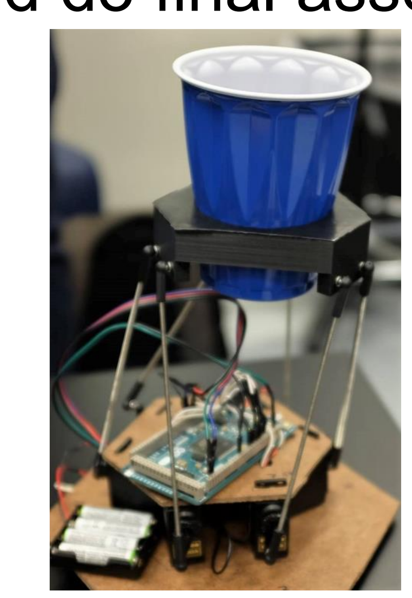


Completed prototype of design

Winter Quarter 2017(second half): 3D print modular parts and do final assembly / testing



3D Model of top platform



3D printed top platform installed on prototype 02/28/2017

Website

http://srproj.eecs.uci.edu/projects/stabilized-bicycle-mounted-cup-holder

THE HENRY SAMUELI SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA • IRVINE

IoT Occupancy Tracker

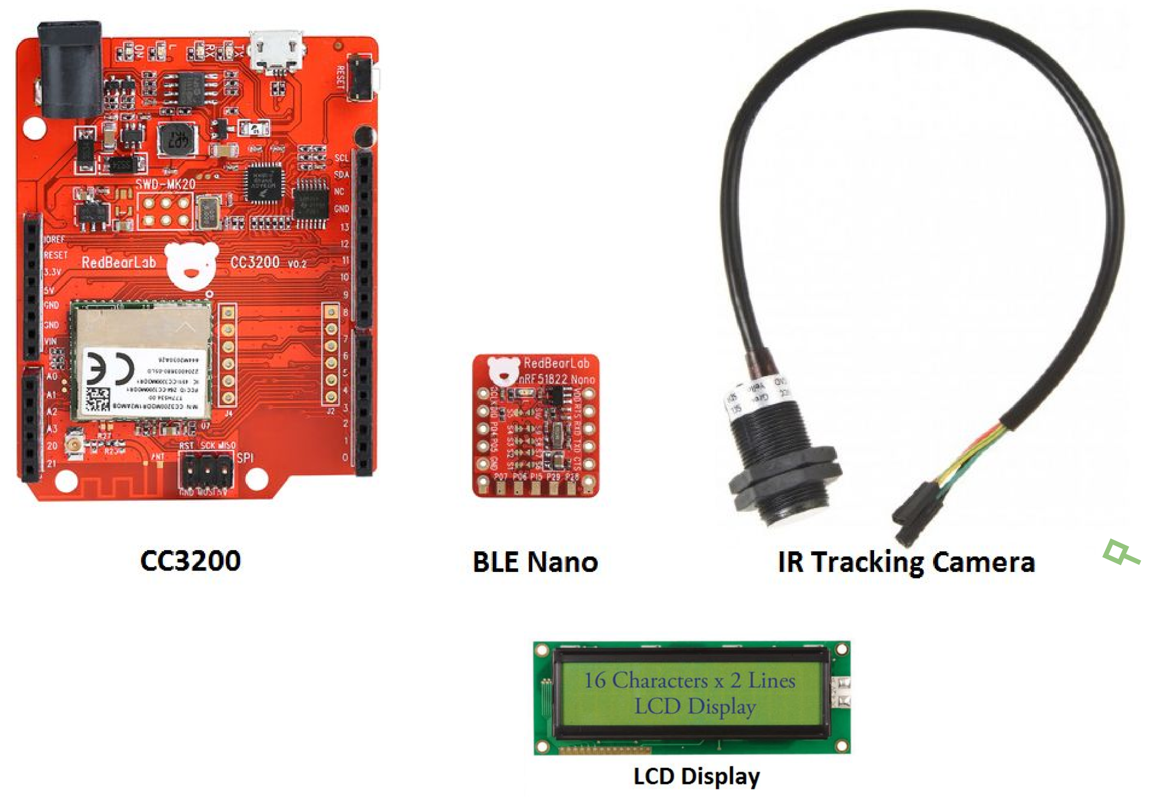
Project Group 14

Christopher Sherman (CSE), Jaron Chen (EE), Esther Poon (CSE), Margarette Catanghal (CSE) & Professor Pai Chou

Team Website: http://srproj.eecs.uci.edu/projects/project-group-14-door-tracker

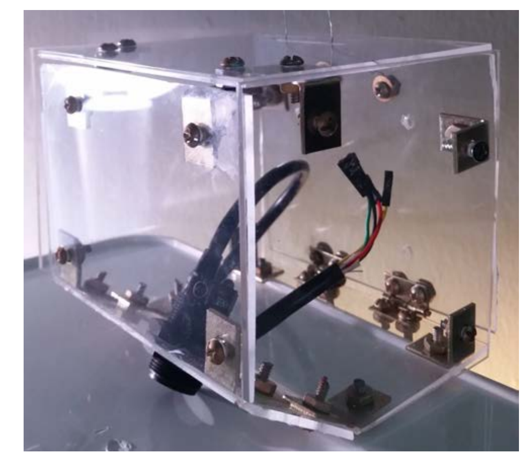
Department of Electrical Engineering and Computer Science: Senior Design Project (2016-2017)

Main Components

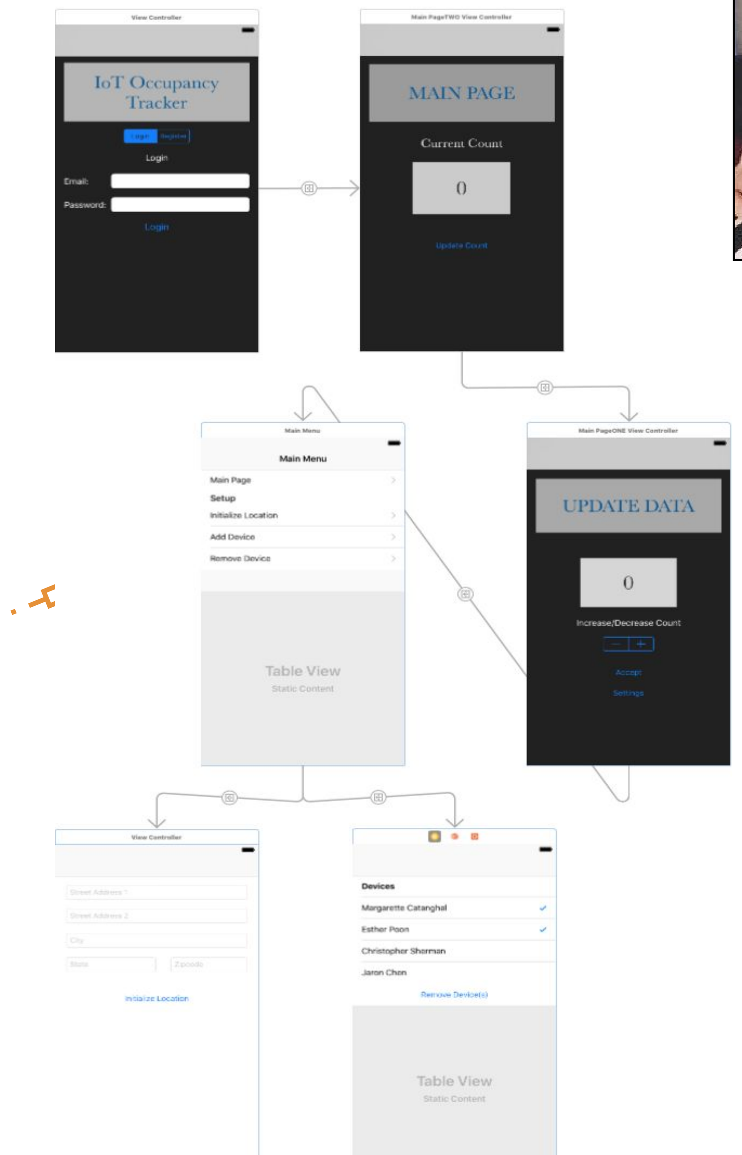


Esther

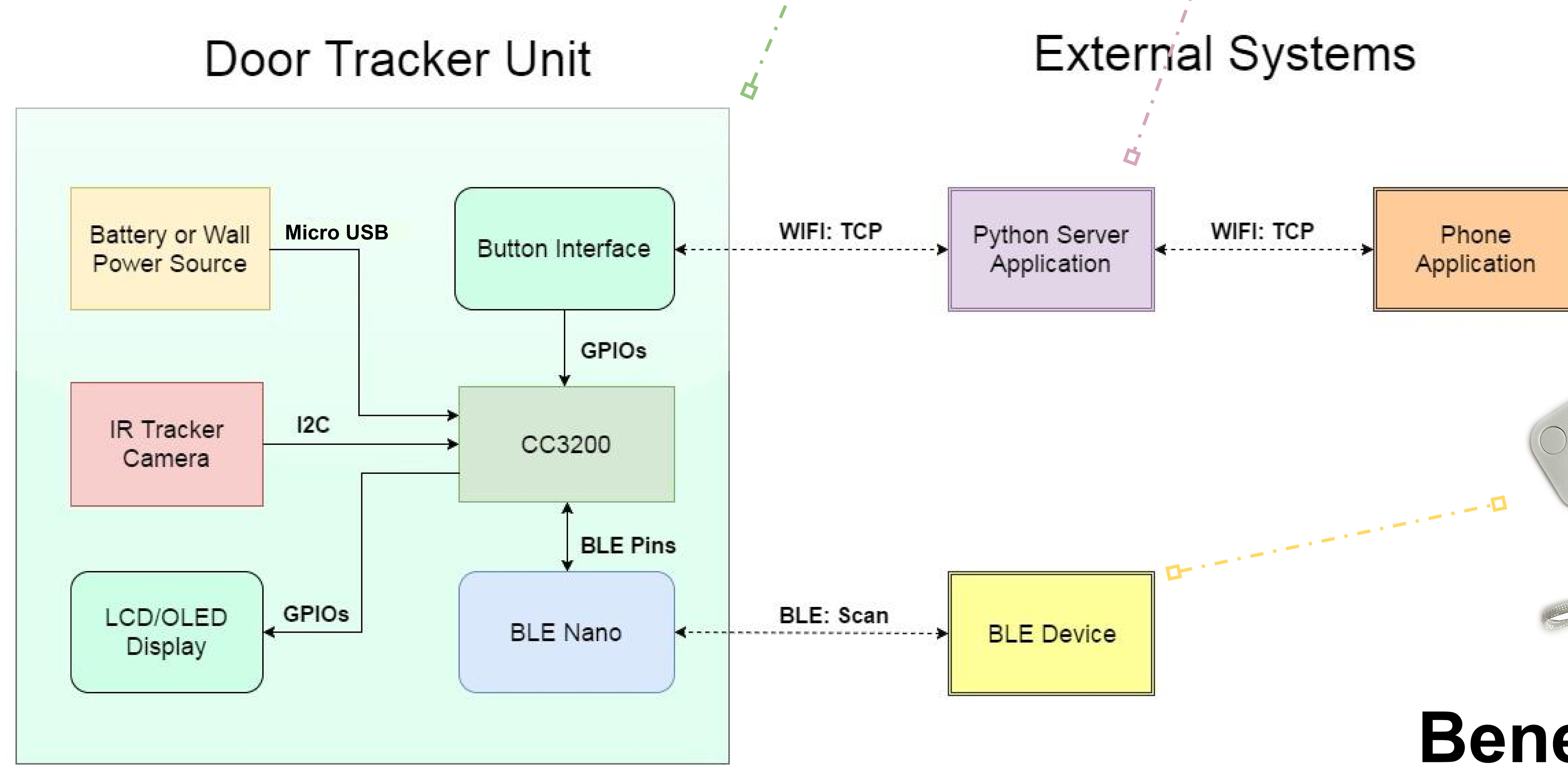
Jaron



Chris



Margarette



Forming the Idea

1. Jaron pitched a door tracker idea
2. We agreed upon current version of the idea because it:
   - has life-saving potential
   - has a wide range of applications
   - was a plausible goal to work towards
3. We planned how to build a wireless-networking door tracker to report occupancy

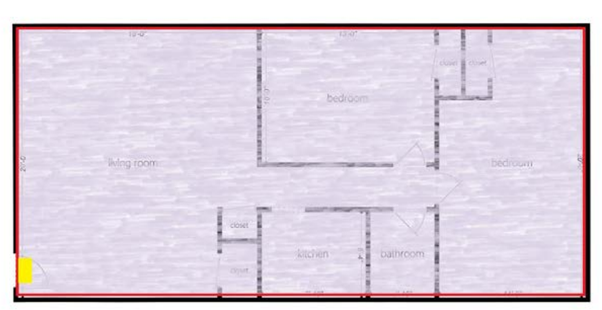
Obstacles/Challenges

- Ensuring that we could reach a certain level of sensitivity and specificity for the product
- Integrating all of the subsystems together
- Progressing around unfinished sections

How We Innovated

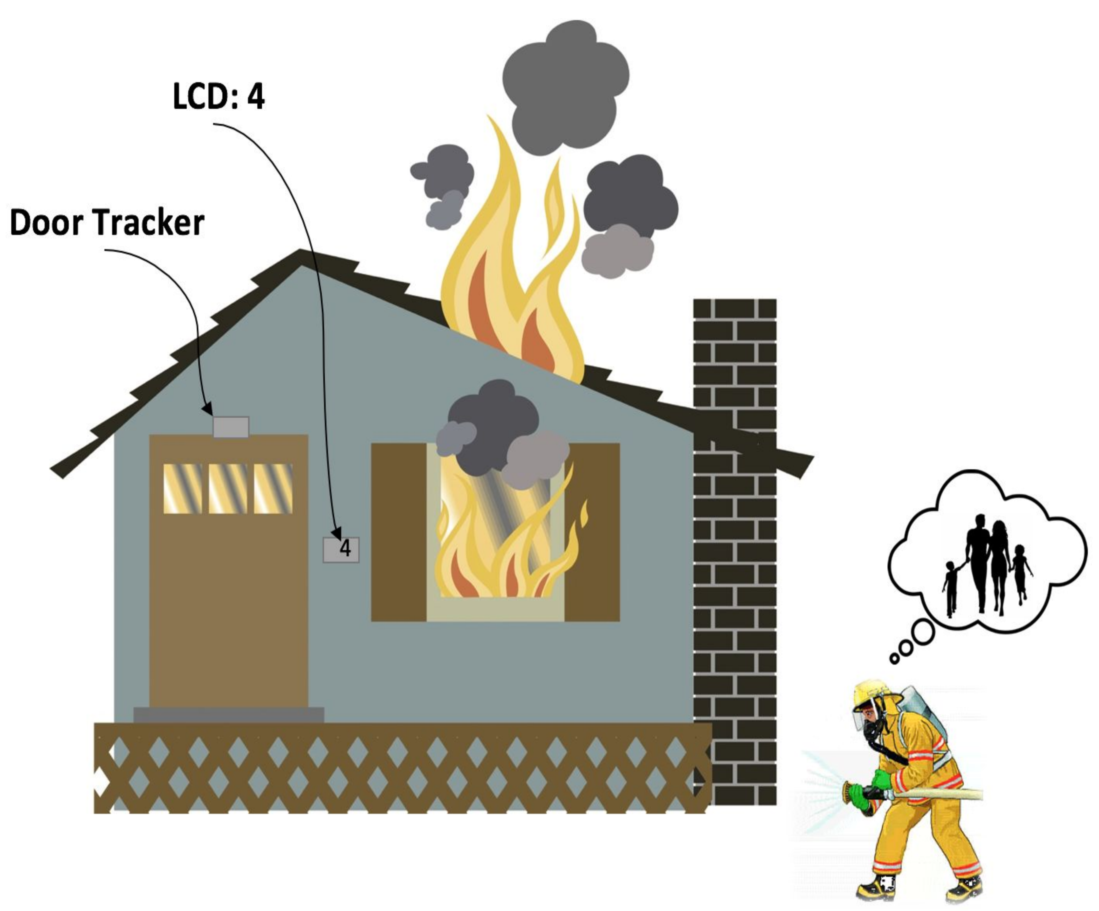
- Networked low power trackers through Wi-Fi
- More cost-effective than alternative technologies
- Provides wider range of applications than commercial competitors

Scalable & Flexible



Full Building Coverage

Room Specific Coverage



Benefits of Movement Statistics

- Emergency response
- Business analytics
- Smart home functionality integration

Future Possibilities

- Power Harvesting
- Device Recognition
- Smart Home Network Connection Application

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University of California · Irvine

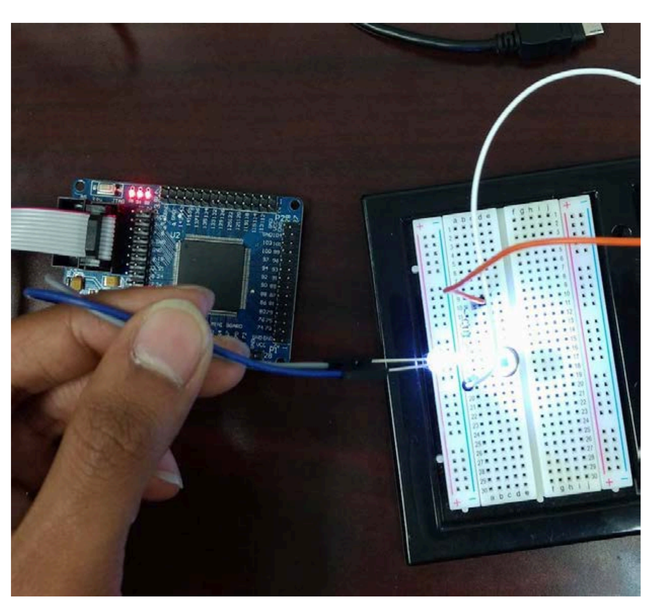
Visible Light Communications

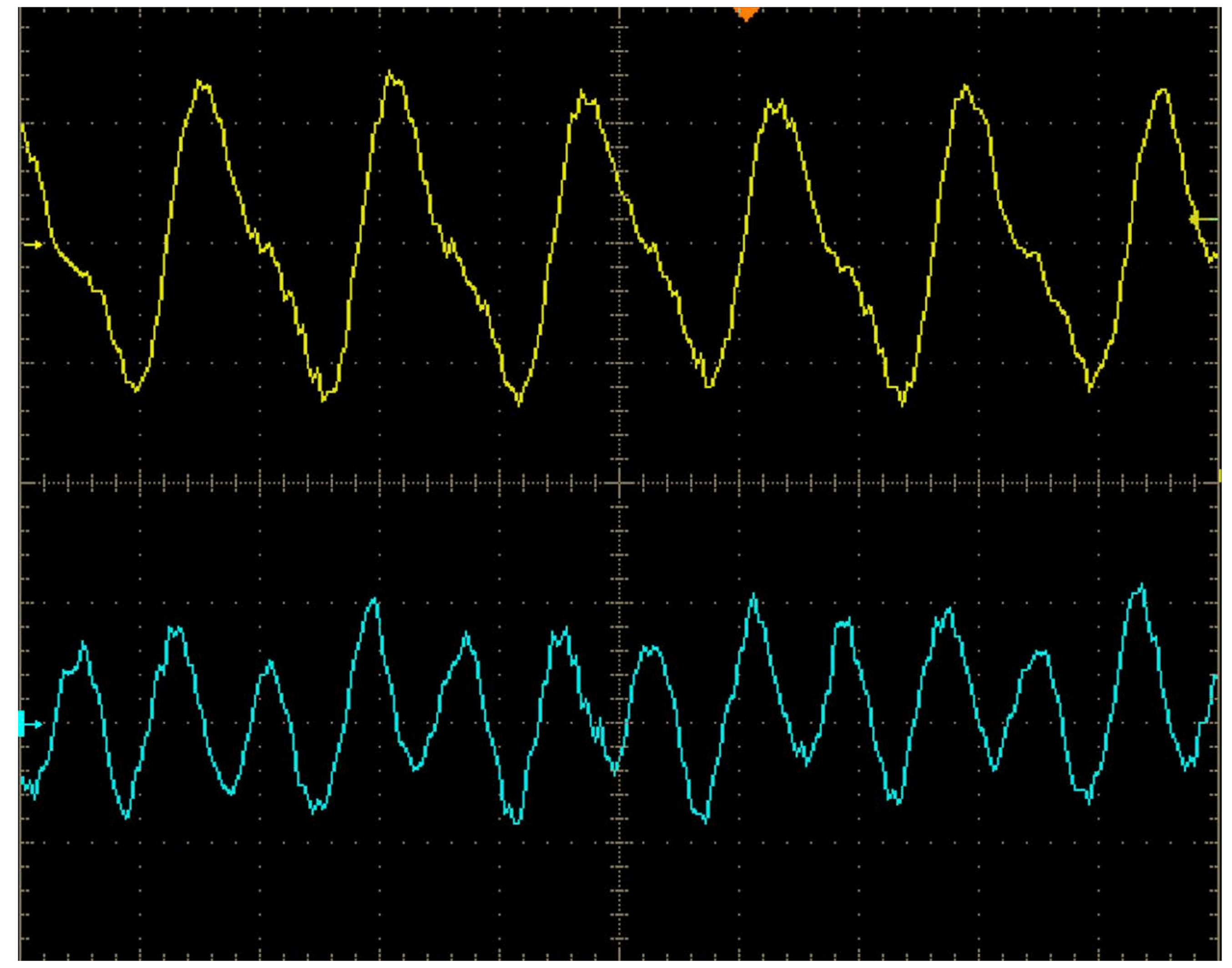
Abhishek Yellapu , Augustine Nguyen, Timothy Jan, Tony Phi, Zhengzhi Xiong
Professor Ozdal Boyraz
Department of Electrical Engineering and Computer Science

Goal statement:
Our main goal with this research is to create a high speed communications protocol using Visible Light.

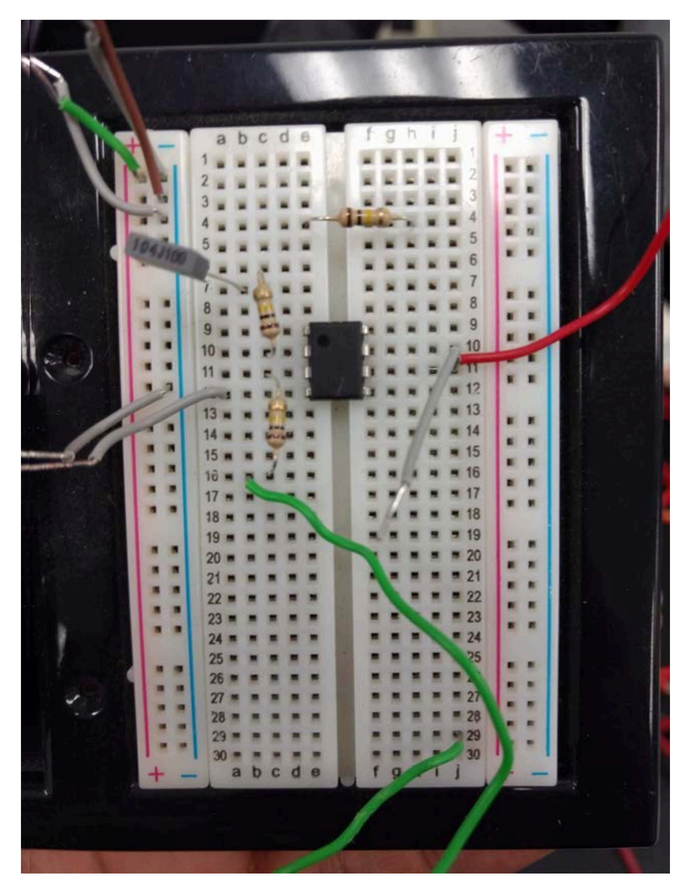
Introduction:
Visible light communication (VLC) is silently becoming an area of interest which has garnered interest from major companies such as, General Electric, Philips, and Disney. Disney's research team in Zurich has been working on creating multiple devices which work by communicating via visible light. It is projected to be a 6 billion dollar industry by 2018. We hope to create a system which will be able to transmit data at higher speeds over a greater distance.

Approach:
Initially we tried to build a system with an FPGA but that route was a little too complicated for the time we had. We are now reverse engineering an SFP, which is an optical transceiver. We are replacing the onboard IR laser and photodiode with LED emitter and diodes compatible with a visual light spectrum.





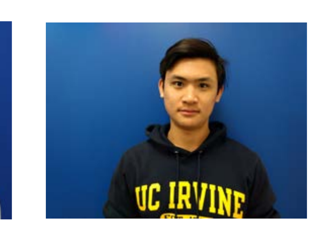
This wave form shows us that the SFP transmits data at a rate of 500 Mbps, the blue wave shows us the inverted data signal from the SFP as a verification

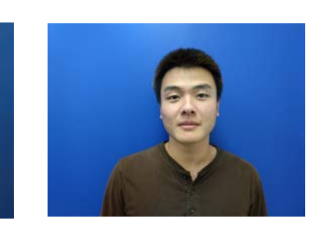


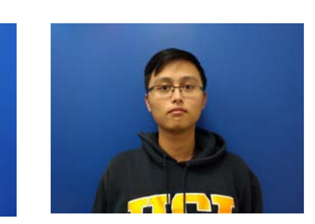
This is an image of the modulation circuit, we used this to modulate high powered LED's and the signal from the SFP

http://srproj.eecs.uci.edu/projects/visible-light-communication

Ozdal Boyraz: Dr. Boyraz established the Advanced Photonic Devices and Systems Laboratory back in 2005, His major researches include silicon based integrated optics and optical communications systems and devices.
Abhishek Yellapu: An Electrical Engineering major who is currently the team lead, working on the circuit and optical side of the project.
Augustine Nguyen: An Electrical Engineering major who is focusing on the optics side as well as circuit design.
Timothy Jan: An Electrical Engineering major who is working on circuit design and helping with encoding and decoding.
Tony Phi: A Computer Engineering major who is working on programming an FPGA and encoding and decoding of data.
Zhengzhi Xiong: An Electrical Engineering major who is working on power management and circuit design.







Date	Milestones
Nov 14th	Take apart Finisar Transceiver
Nov 20th	Learn how to program the FPGA
Jan 9th	Send ASCII data throgh the FPGA to an Arduino Receiver
Jan 17th	Deduce SFP pins and turn it on without an SFP port
Jan 25th	Set Up Amplifiers for the photodiode receiver
Feb 5th	Send 500mhz waves through wired SFP's
Feb 27th	Testing LED modulation systems for 1.2Ghz photodiode

Microwave Radiation Detector

Judith Liem, Jonathan Hoong, Kevin Wang, Tri Chung
Professor Filippo Capolino
University of California Irvine

Goal Statement

- The purpose of this project is to create a device which can detect when a faulty microwave radiates at a level that is above FDA standards and relay the information via Bluetooth to a smartphone app.

Background on Microwaves

- Microwaves use electromagnetic waves to transfer energy directly to water molecules in food, causing the molecules to vibrate and generate heat.
- Consumer microwaves generally operate at a frequency of 2.45 GHz and with a wavelength of 12.2 centimeters.
- Frequency shown to start harming the human body: over 10 hertz. Eyes are especially vulnerable to microwaves.
- Regulation set by the U.S. Food and Drug Administration (FDA): cannot exceed 5mW/cm^2 from a point 5cm or further from the external surface of the oven.
- Microwave doors work because the electromagnetic waves within a microwave are around 12cm and cannot pass through the holes in the door mesh, usually around 1-2mm.
- Microwaves can experience leakage if the door doesn't close properly or if the microwave is bent or damaged in any way.
- Market:
- There are a few microwave leakage devices on the market currently ranging from $40-100, but none with Bluetooth capabilities.

Design

- An overview of the design is shown in Figure 1. It starts with a microwave emitting a plane wave onto an antenna. The signal is rectified using a diode circuit and then sent to an Arduino through Bluetooth for processing.
- The antenna is modeled using the program HFSS; antenna parameters such as perimeter and copper thickness are adjusted until a resonant frequency around 2.45 GHz is achieved. An example antenna model is shown in Figure 2.
- The antenna is manufactured using copper cladding and an etching process of hydrogen peroxide and hydrochloric acid.
- The mobile app is designed to show the range of radiation on a meter, as shown in Figure 3. If the radiation approaches higher radiation levels, the red in the meter increases.

Process

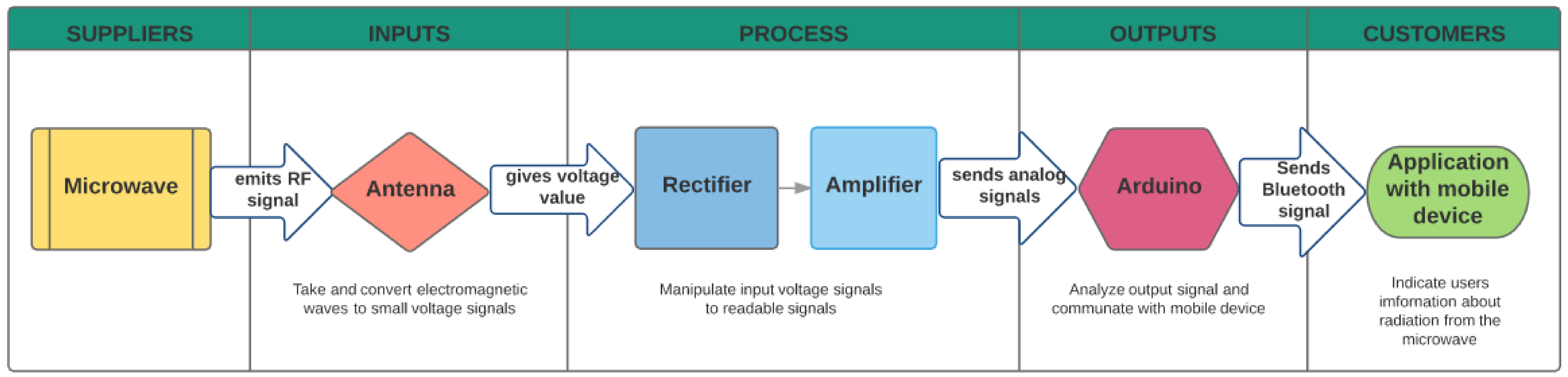


Figure 1: Full System Bock Diagram

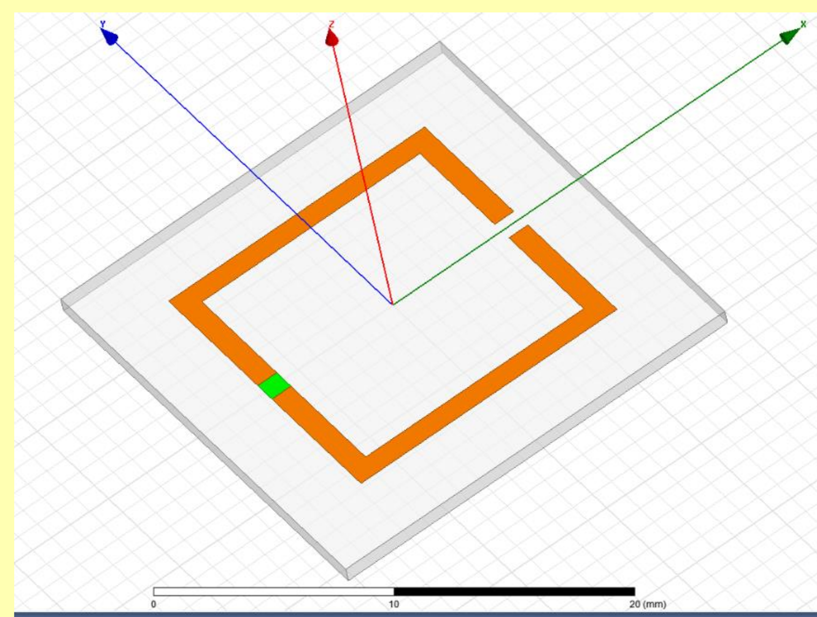


Figure 2: HFSS Antenna Model

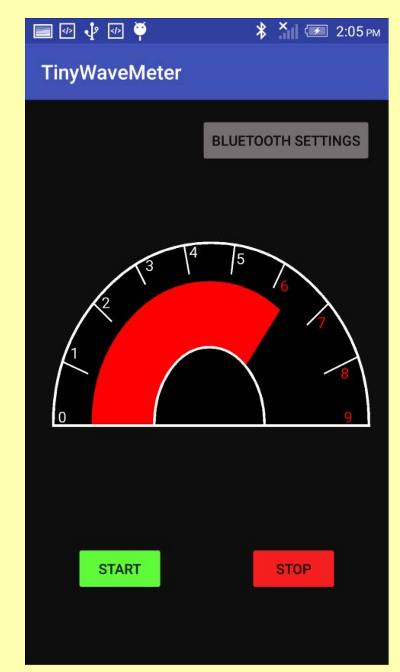


Figure 3: Main Activity Page

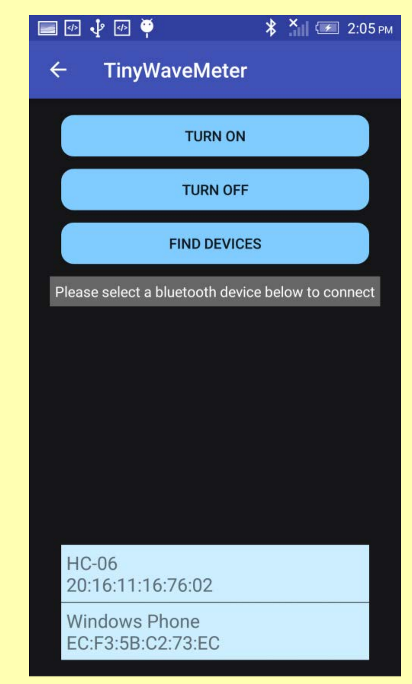


Figure 4: Bluetooth Settings Page

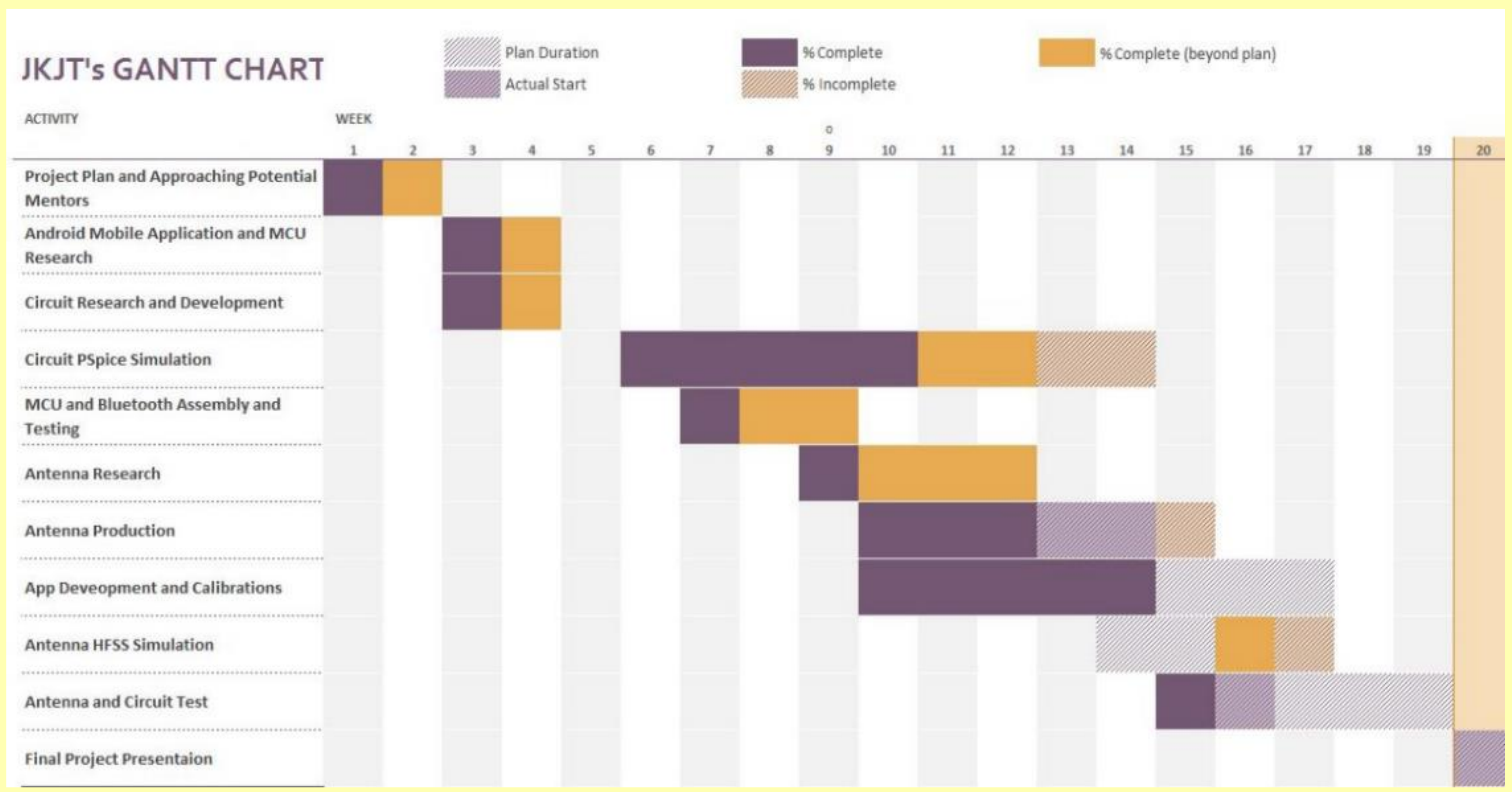


Figure 5: Progress Timeline

Approach

- Current radiation meters on the market today combine a detection device and display as a single unit. These products require the user to stand in front of a microwave and puts them at risk of radiation exposure.
- Our design implements Bluetooth communication between the detection device and the display of outputs to the user. This method of wireless communication allows the user and the meter to be in different vicinities while testing a microwave oven for radiation leakage.
- Our product takes into account the potential radiation exposure a user is subject to while testing.

Challenges

- There is possible interference between the Bluetooth module and antenna because both devices operate in the same 2.45-GHz range. By looking at other Bluetooth module radiation patterns, we can determine the best position to place our Bluetooth module relative to the antenna.
- Manufacturing the antenna proved to be another challenge in this project. An etching process is used to etch the antenna and circuit design onto a copper sheet. Transferring the ink onto the copper itself is difficult without losing detail.

Team Members

Judith Liem (EE - DSP):
- Team Captain, Logistics, Antenna
- jjliem@uci.edu

Jonathan Hoong (EE - Circuit Design):
- Circuit design, CAD design, Hardware assembly
- jhoong@uci.edu

Tri Chung (EE - DSP):
- Antenna, microcontroller unit
- trihc@uci.edu

Kevin Wang (CSE):
- Mobile application development, microcontroller unit programmer
- kfwang1@uci.edu

Filippo Capolino (EE):
- Professor, Senior Design Advisor
- f.capolino@uci.edu

Team 17

Single Controller, Multi-Robot System

Team Members: Jeff Berhow, Carla Contreras, Yuji Dornberg, Anurag Vaddi Reddy
Team Advisors: Dr. Lee Swindlehurst, Dr. Jeffrey Krichmar, Dr. Michael Green
Department of Electrical Engineering and Computer Science

Group Website
http://srproj.eecs.uci.edu/projects/single-controller-multi-robot-system-scmr
Contact Information
Anurag Vaddi Reddy: avaddire@uci.edu Yuji Dornberg: ydornber@uci.edu
Jeffrey Berhow: jberhow@uci.edu Carla Contreras: carlac2@uci.edu

Goal

The goal of this project is to determine how to best control a group of robots to perform certain simple tasks using a single point of control.

Introduction

The project will involve developing methods for helping a group of robots to navigate through obstacles, such as through narrow passages or around objects in their path, while avoiding collisions and when possible maintaining certain formations.

Approach

The robots need to be aware of each other's positions to avoid collisions and maintain the desired formation. Using a 360 lens in conjunction with the raspberry pi camera will allow the robots to detect each other in any direction without relying on mechanical rotation or multiple cameras. The robots will also be equipped with IR sensors.

Timeline

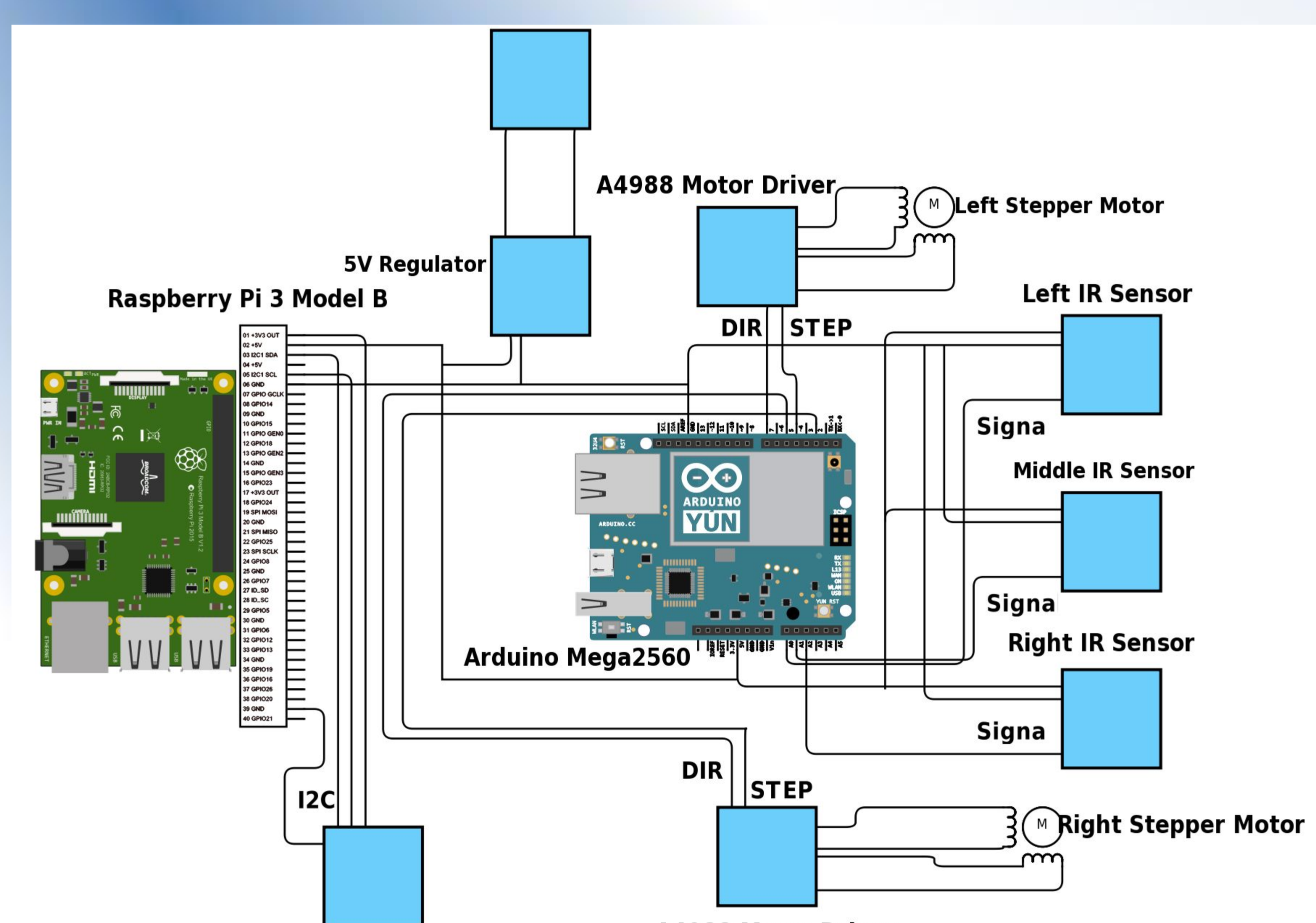
Simulation:
- Creating a framework for a simulation engine (1 week)
- Creating 2D models using SDL (1 weeks)
- Creating sensor nodes for each sensor (2 weeks)

Developing and adjusting algorithms for collision detection, communication, etc.:
- Preliminary algorithms (4-5 weeks)
- Heuristics for adjusting values (1 week)

Sensor testing:
- Initial tests of power, distance, sensitivity (2 weeks)
- Optimal placement on chassis (1 week)

OpenCV:
- Familiarity with library (1 week)
- Research of multiple solutions for tracking (2 weeks)
- Algorithm design (3 weeks)
- Heuristics for adjusting values (1 week)

Circuit Design:
- CAD Design (2 weeks)
- Part ordering (4 weeks)
- Testing of design (1 week)



Circuit Diagram

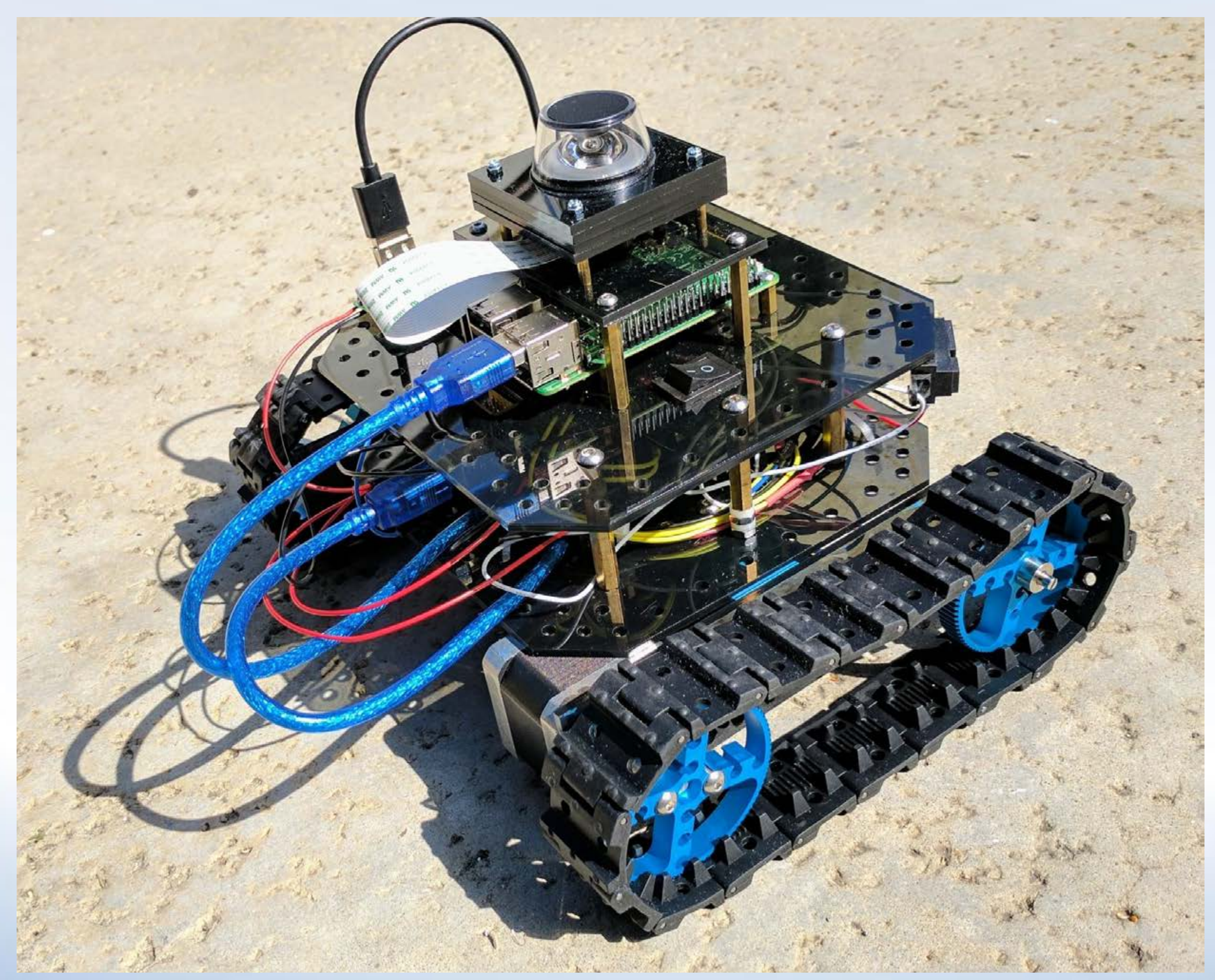
Progress and Future Projection

Progress

- Motors, sensors and MCU are fully powered by 4 lithium ion batteries via voltage regulators
- Magnetometers provide each robot with directional data that is packetized for transmission for better control
- A4988 allows for directional control of motors for locomotion and single step control allows for more precise control of speed and translational distance
- Using ROS to transmit via TCP/IP control data to all robots

Future Projection

- Working with OpenCV to process images taken by the raspberry pi camera through the 360 lens to detect beacons
- Working with ROS to develop underlying framework
- Using camera data and algorithms to bring robots into better coordination with each other



Steve One

Advisor: Electrical Engineering Computer Science
Dr. Michael Green

Advisor: Cognitive Sciences
Dr. Jeffrey Krichmar

Advisor: Electrical Engineering Computer Science
Dr. Lee Swindlehurst

Electrical Engineering
Jeffrey Berhow

Learning the Robot Operating System (ROS) environment for simulation and distribution to robots.
Developing algorithms in a simulated environment to avoid obstacles and relay pertinent messages to each of the robots.

Computer Engineering
Yuji Dornberg

Managing and curating software database needed for each Raspberry Pi on the robots.
Knowledge management of each robotic system (data encoding, data storage).
Working on using the OpenCV library to detect other robots in vicinity.

Electrical Engineering
Carla Contreras

Researching sensors and weighing their benefits and drawbacks for provided constraints i.e. power consumption.
Testing different classes of sensors for a particular situation such as collision detection (IR vs. whisker), odometry (accelerometer/gyroscope vs. motor encoding), etc.

Computer Engineering, Electrical Engineering
Anurag Vaddi Reddy

Creating algorithms for the detection and processing of raw camera data from each Raspberry Pi.
Circuit design to reduce footprint of multiple sensors and driver/regulator on the chassis of each robot.
Working on using the OpenCV library to detect other robots in vicinity.

The Henry Samueli School of Engineering
University of California · Irvine

Planetary Colonization with Swarm Robotics

Yebraksi Kouzoukian, Dyann Oreas, Tyler Stevens
Professor Aparna Chandramowlishwaran
Department of Electrical Engineering and Computer Science

Goal Statement: Using a robotics simulation engine, we designed algorithms to solve group-coordination problems associated with building a settlement on another planet: foraging for resources and building simple structures. We hope to tie these behaviors together to simulate a fully-automated Mars mission.

Introduction

Swarm robotics is becoming an increasingly popular solution to certain problems, and the colonization of other planets is growing in importance as Earth's population increases and as space travel becomes cheaper. It is likely that we will rely on robotic systems to build the structures we will need to survive on other planets.

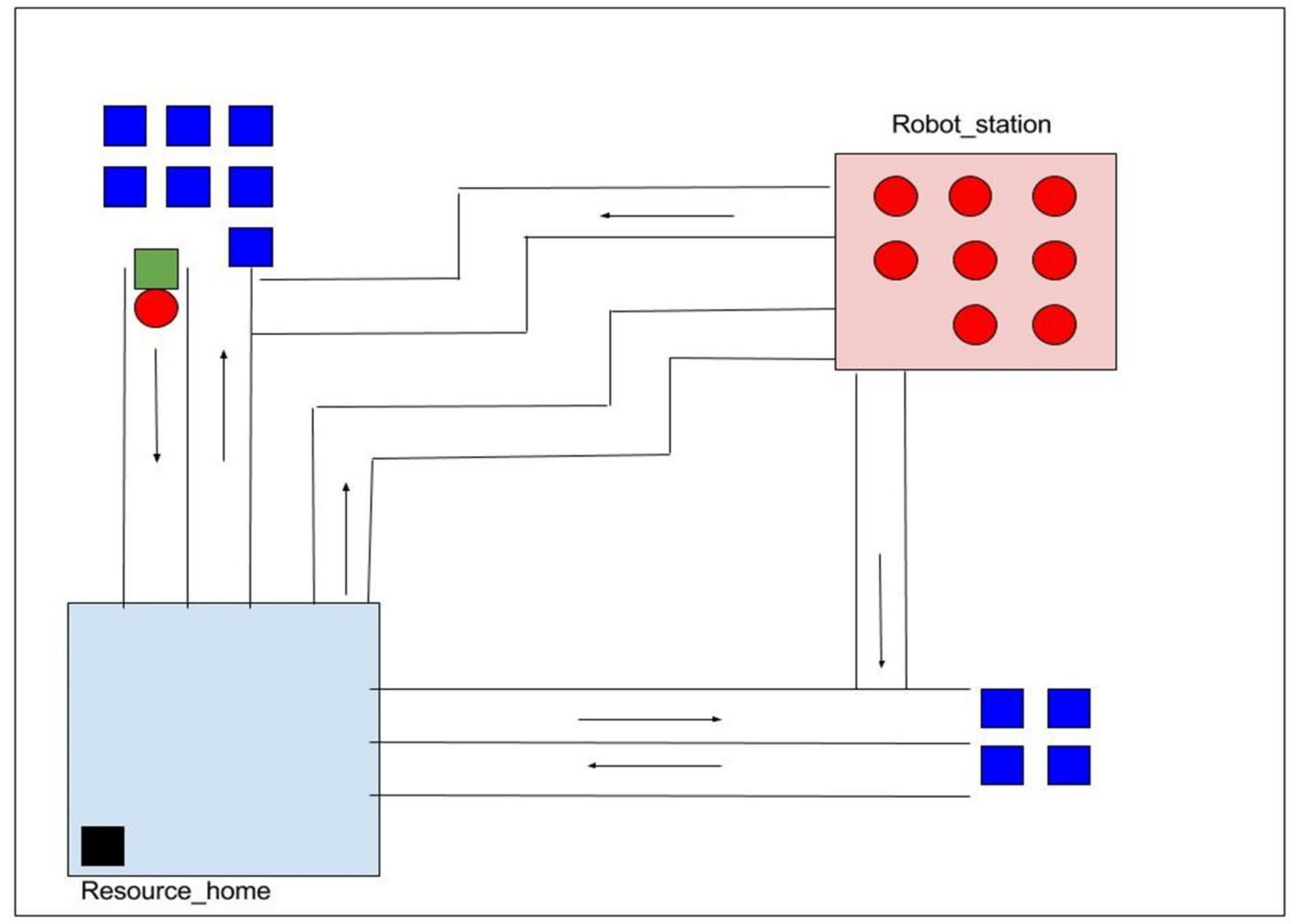
Simulation Design

To simulate our algorithms, we built a custom robotics framework using the Unity3D game engine. Each robot is functionally identical: they can pick up and carry objects, communicate with other robots over a variety of broadcast and point-to-point channels, and follow other robots in a queue.

We use a simulated satellite object to handle high-level group assignment and task switching. Once the satellite broadcasts a task to waiting robots, one robot is selected to be the master and guides the others through the task. Though this is not a traditional design, we found that directing robot behavior at a high level helps resolve inefficiencies in path-finding and construction. In the future, our algorithms could be enhanced with a master-slave feedback loop in order to evaluate path efficiencies, react to unforeseen obstacles, and recover missing/damaged robots.

Team Members

Tyler Stevens (CpE)	Team Leader Construction Algorithm Simulation Engine Design
Yebraksi Kouzoukian (CpE)	Foraging Algorithm Finite State Machine Research
Dyann Oreas (CpE)	Foraging Algorithm Robot Movement
Dr. Aparna Chandramowlishwaran	Faculty Advisor



Foraging Algorithm

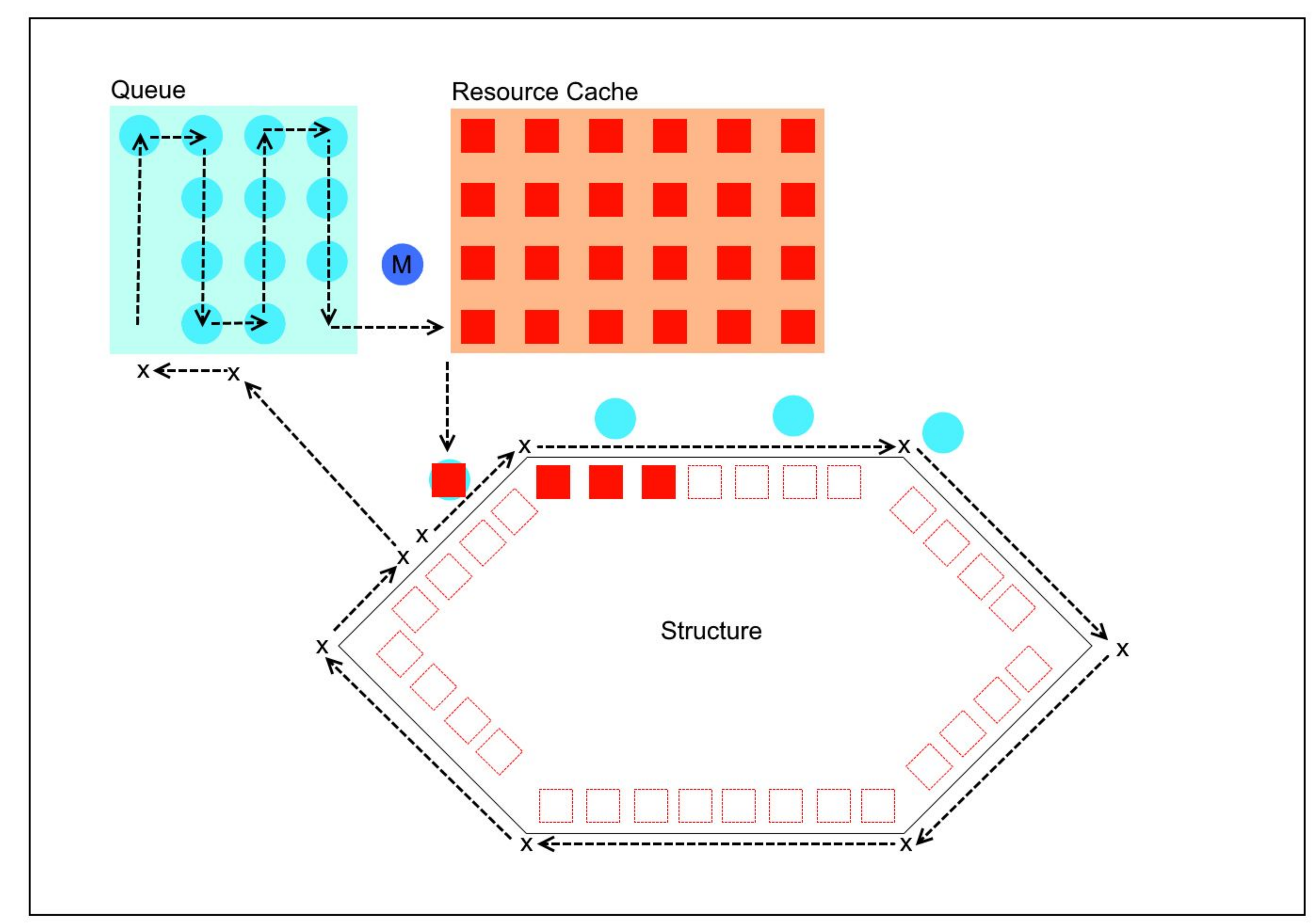
Foraging proceeds as follows (see diagram above):

- Resources will be scattered in patches (RP) randomly.
- The satellite will broadcast the Resource_Home (RH) and location of RPs to the designated master robot (M).
- M will divide and assign other robots to specific RPs, specifying lanes of travel between each RP and RH.
- After each robot gets its assignment, it will travel back and forth between its assigned RP and RH until the RP is empty
- When finished, robots return to their start location.
- In the simulation, each resource is initially blue. Once picked up, it turns green. After being dropped off, it will turn black.

Construction Algorithm

Construction proceeds as follows (see diagram below):

- Satellite (S) broadcasts construction start message to all robots, including the range of robot IDs that will be joining the group, the ID of the master, and the slave queue area.
- Master (M) sends acknowledgement to S, waits for schematics
- M and slaves travel to queue area.
- S sends M coordinates of the resource cache and schematics
- M broadcasts waypoints to waiting slaves.
- Once all slaves have registered with M in queue, M sends message to first slave where to place first resource.
- Slave travels along waypoints to pick up a resource, place in the correct position, and return to the back of the queue.
- As M assigns more tasks, waiting slaves move up in the queue
- If the schematic contains multiple layers, M broadcasts new set of waypoints and begins assigning tasks.



Visit our website at http://srproj.eecs.uci.edu/projects/planetary-colonization-swarm-robotics for more information, and feel free to email Tyler at tpsteven@uci.edu if you have further questions.

The Henry Samueli School of Engineering
University of California · Irvine

Smart Lock

Team#: 19

Team Name: Team Hodor

Advisor: Ian Harris

Derek Zhang (CPE) - Kent Lam (EE) - Marvie Solis (EE) - Michael Tseng (CPE)

INTRODUCTION:

Electronic locks have been prevalent in the consumer space for many years. These locks can utilize various security measures such as keypads, NFC cards, and Bluetooth®. In 2015, an IHS report found that the electronic lock market will exceed $1 billion. This market segment has achieved rapid growth in the access control industry. This field includes companies such as ADT and Vivint, who both provide smart home security products and services. With the development and evolution of wireless device communication, the integration of this progress has been implemented in home security and continues to advance, finding new and innovative ways to provide security through the use of wireless device communication.

With our Smart Lock, users should be able to select an unlock method via smartphone application. Users will be able to unlock a door using a QR code, fingerprint scanner, or NFC card.

For more information, please visit:
http://srproj.eecs.uci.edu/projects/multi-level-security-smart-door

GOAL STATEMENT:

Our goal is to create a multilayer lock that provides multiple methods of locking and unlocking at the user's disposal.

This "smart lock" gives the user a certain level of convenience by allowing multiple ways to unlock a door.

This project also allows us to simulate the experience in the actual work industry.

APPROACH:

We would like people to notice of the ease of use of our device. The consumer is able to choose the most convenient method for their lifestyle. Consumers would not need to be as concerned about losing or forgetting a key due to having multiple methods of locking and unlocking their smart door.

TEAM MEMBERS:

Ian Harris: A current UCI professor in the department of Computer Science, he has participated in research areas such as Embedded Systems Security and Social Engineering Attack Detection. He will be our team's mentor in developing the smart lock.

Derek Zhang: A Computer Engineering major who will focus on circuit design and programming the phone application.

Kent Lam: An Electrical Engineering major who will be focusing on hardware and ensuring the multiple components will be able to communicate with each other.

Michael Tseng: A Computer Engineering major, who is currently our team lead, will focus on programming and developing the code for our device's operation

Marvie Solis: An Electrical Engineering major who will be focusing on manufacturing and assembly of our device, ensuring that it can operate correctly, safely, and efficiently.

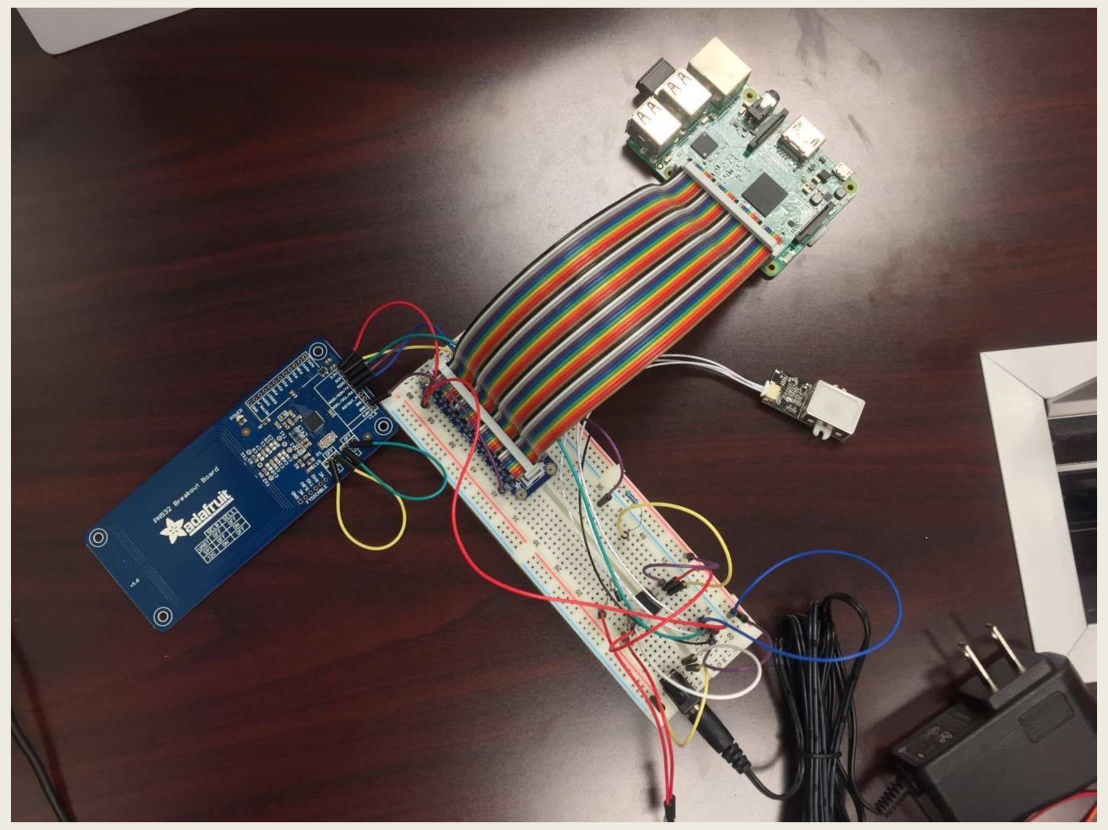
CURRENT STATUS:

Software:

- We currently have a working basic GUI/Android application that properly communicates with the Raspberry PI through bluetooth. It generates the QR code.
- We also have a functioning NFC card reader implemented and its firmware implemented.

Hardware:

- We currently have the Adafruit NFC scanner and fingerprint scanner connected to the circuit board and Raspberry Pi. We have yet to connect the solenoid as our initial one broke.
- The NFC scanner and camera components currently respond to the Raspberry Pi. The fingerprint scanner responds as well, but we have yet to connect the two different components cohesively.



SCHEDULE:

Dec. 16, 2016:
Finish Initial Mechanical Design Schematics

Dec. 18:
Finish Application/Firmware Designs

Dec. 23:
Finish ordering necessary hardware

Jan. 23, 2017:
Finish version 1 of application

Feb. 6-10:
Test bluetooth connection

Feb. 13:
Finish version 2 of application

Feb. 13-17:
Test QR code generation and reading

Feb. 20-24:
Test NFC connection

Feb. 27-Mar. 3:
Test fingerprint scanner

Mar. 6-15:
Integration and final testing

Mar 17:
Deliver final product. Winter Review.

Smart Bin: Environment Friendly Auto-classifying System

Zirui Fu(Electrical Engineering, B.S.), Yanlin Lu(Computer Science & Engineering, B.S.),
Chenglin Wu(Electrical Engineering, B.S.),Jiawei Yao(Electrical Engineering, B.S.)
Project Group 20: TBD
Project Advisors: Nader Bagherzadeh

March 2017

Background

During our daily observation, we find that sometimes recyclable trashes are dropped into wrong recycle bin. In that situation, janitor will have to classify them again before recycle. So we come up the idea to make a automatic recyclable trash classification system. Then, we find it more useful if trash bin can tell janitor it's status like it's full or not. Janitor can save some time if trash bin can tell them their status.

For this project, we want to focus on identifying three different types of material of recyclable trash: plastic bottle, metal containers and glass bottles. Since the sound made by these three materials are significantly different when drop out or collide, we want to make a sound recognition device and build it into the trash bin to identify the material type of recyclable trash and place it into different bins. The trash bin can also monitor its capacity (empty, half-full, full) and tell cleaners to dump the trash when it is full through mobile app.

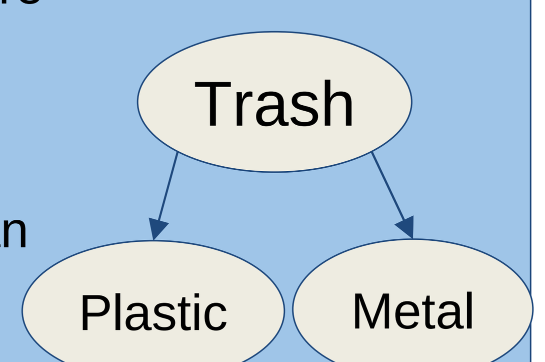
Goal Statement

The goal of the Smart Bin is to intelligently classify the operation that used to be done manually, in order to significantly boost the efficiency, decrease energy consumption and eventually upgrade our environment.

To achieve this goal, we designed a container that is integrated with multiple sensors, actuators and control systems in order to identify thrown-in objects and classify objects automatically into corresponding categories. Buttons and switches are integrated on its shell in order to expand its functionalities as well.

The ultimate goal is to create a multi-function integrated smart container system that not only can be used in trash classifying but also other categorized object classifying. Beside the contamination of other objects, the container itself could also have flexibilities to be expanded to fit more tasks.

A Traditional Three-bin System

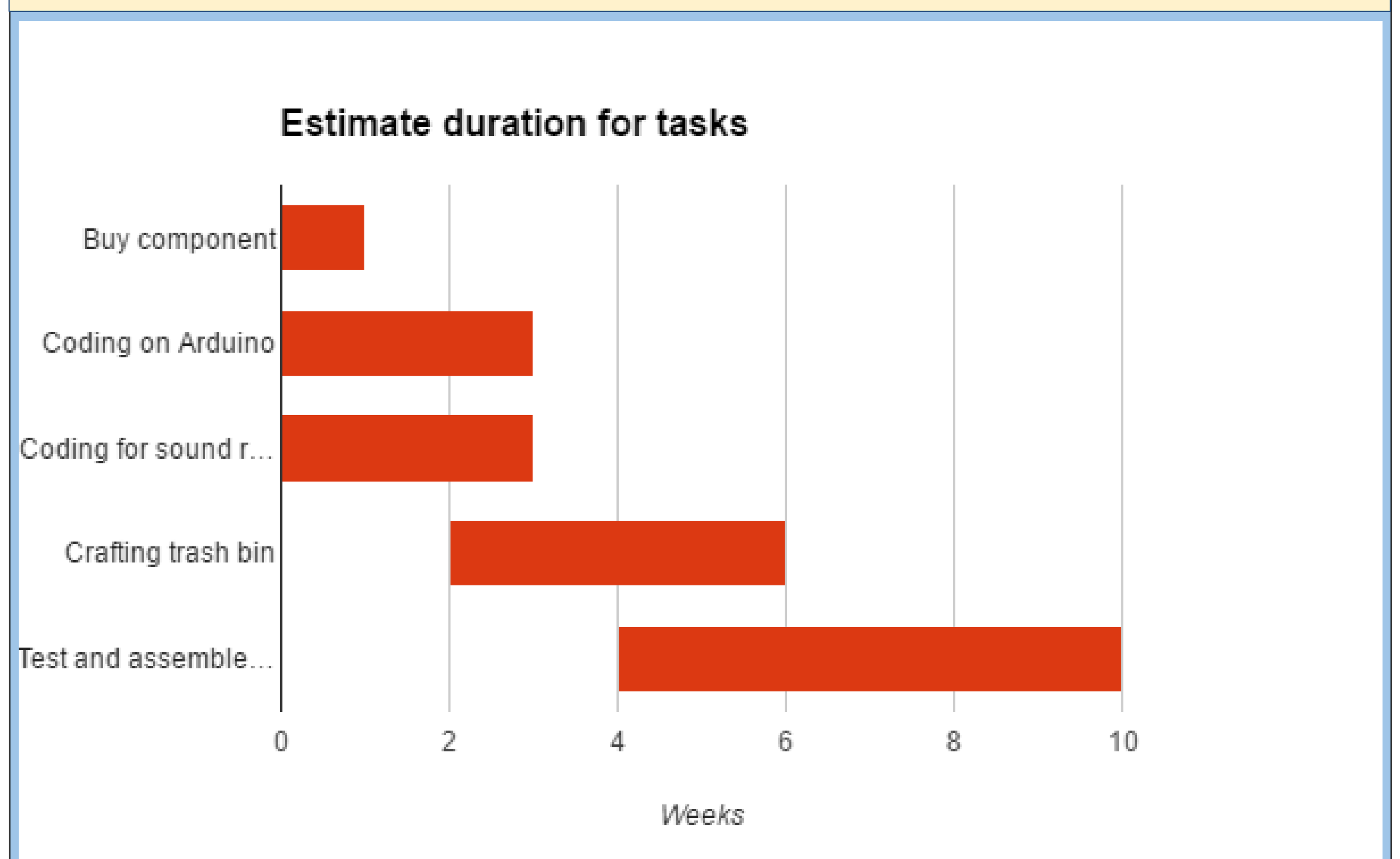


Approach, Design & Implementation

In order to user smart bin, cleaning staff will have to turn on the master switch. Then, smart bin will turn on wireless component itselves and use wireless component to connect to internet and access the server we have. Then, trash bin will start to use sensors equipped in each trash can to detect the current level of trash in each trash bin. If any of the trash bin is full, smart bin will lock the trash bin door so people will not be able to throw any trash to it. If all trash bins are not full, smart bin will output 'open' so people can keep throwing trash. No matter trash bins are full or not, smart bin will report its trash level and its location every 10 minutes.

If trash bins are not full, it will accept the trash and capture the sound that trash makes when it dropped on a plane. Then, the sound will be sent to sound recognition system to figure out the material type of the trash and the trash will be sent to corresponding bin.

Schedule



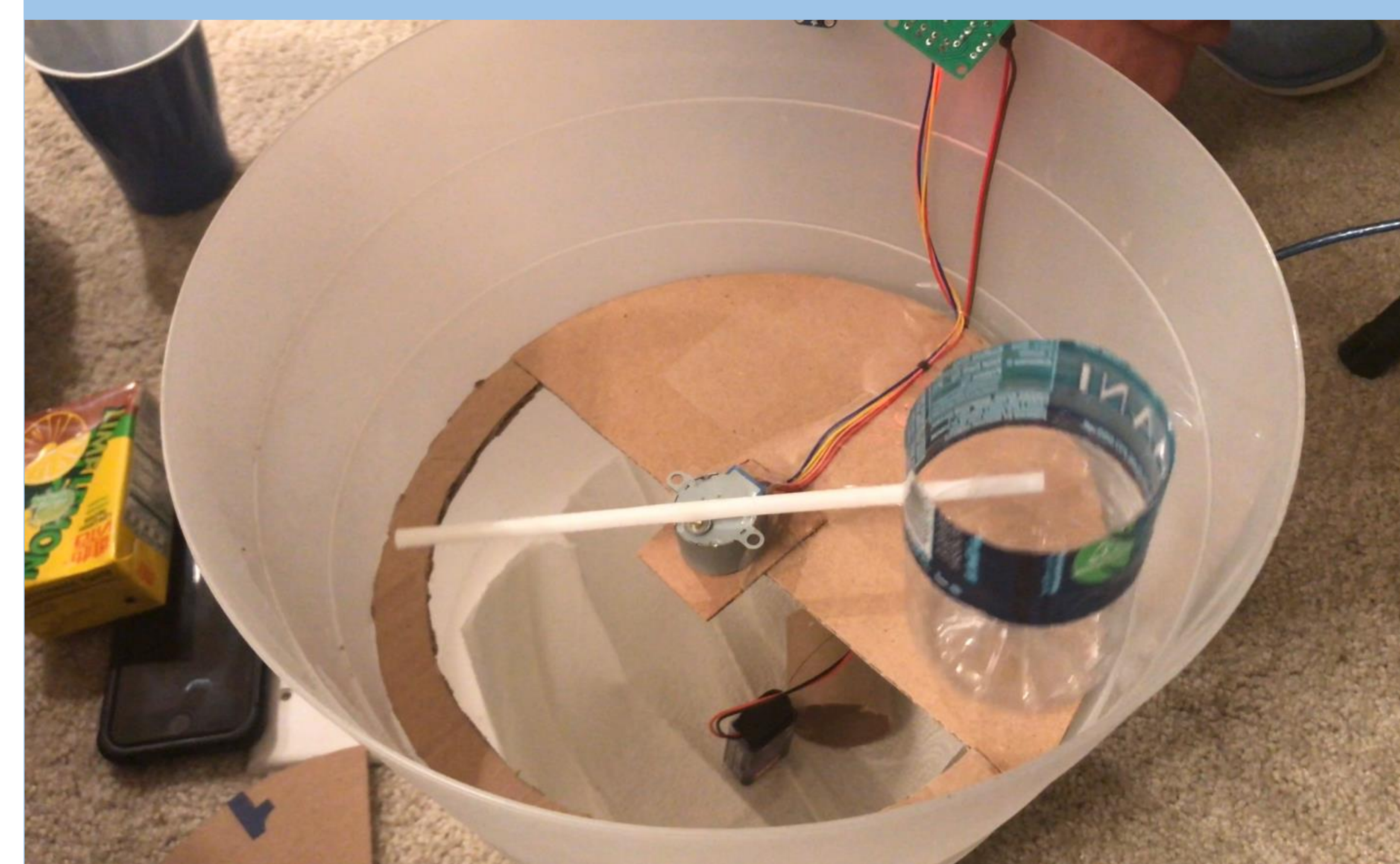
Progress & Current Status

Sound Recognition System:

The code will be write onto board UNO R3. Then train the system by dropping different types of bottles many times. Set them as the reference sound for each type. When a bottle throw into the bin, it will make sound because of collision. A microphone implement to the board will collect the sound and the board will process the sound information and control the motor based on different value that gathered by the microphone.

Level Sensor System:

The level sensor system will monitor the level of tsmart bin and show the status using LED lights. The goal can be approached by using multiple ultrasonic sensors. The LED will be on if the bin is full. For cleaning staff, they can know which bin need to be clean and which bin does not by simply looking the LED status light.



The Prototype of Classifying System

Link to our Project

http://srproj.eecs.uci.edu/projects/project-group-20-tbd

THE HENRY SAMUELI SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA · IRVINE

Object Recognition Robot

Team members: Shiqi Wei, Shuo Chen, Xiaofan Chen, Yuchen Fan
Mentor: Professor Nader Bagherzadeh
Department of Electrical Engineering and Computer Science

Goal Statement:

The idea of the project is to design an intelligent robot which can identify objects and display relevant information of the object. When walking, it can also avoid obstacles and choose the safest way by algorithm. This type of objects recognition robots can be developed to undertake some routine jobs, like guide robots in museums, or find certain things in a particular area.

Introduction:

Object recognition is not something new. However, most of the object recognition technique is used in apps or some laboratories, and not many people apply it to practical use. Our object recognition robots can be used to guide the tourists in museum or detect things in the wild where researchers are hard to reach. For now, few similar robots have appeared in the market, but what we want to do is to combine some certain functions together to make the robot become more useful. There are some programmable prototypes available for us to use.

Our team has rich experience in image process and motion control. We have a deep cooperation in research for a long time.

Team members' information:

Participator	Name	Major	Responsibility
Mentor	Nader Bagherzadeh	Computer Science and Engineering	Give professional supports
Team Members	Shiqi Wei	Electrical Engineering	Program the codes of robot motion parts
	Shuo Chen	Electrical Engineering	Contribute additional identification codes and test this function
	Xiaofan Chen	Computer Science and Engineering	In charge of writing the core codes of the identification part
	Yuchen Fan	Electrical Engineering	Modify and develop the robot prototype and test moving function

Approach

- Use the programmable robot as a prototype and add the sensors to avoid obstacles;
- Storage audio files in SD card and use a speaker to display relevant information;
- Optimize the photo process algorithm to fasten the response to users.

Innovations

Object recognition robot can not only identify the objects in its sight, but also avoid obstacles and go to other directions when it is too close to the objects. Information of the objects can be displayed to users through a speaker.

Process & Schedule

Winter Quarter

- Build the Prototype — End of Week 1

(Milestone 1)

- Motion Control & Obstacle Avoidance — End of Week 4

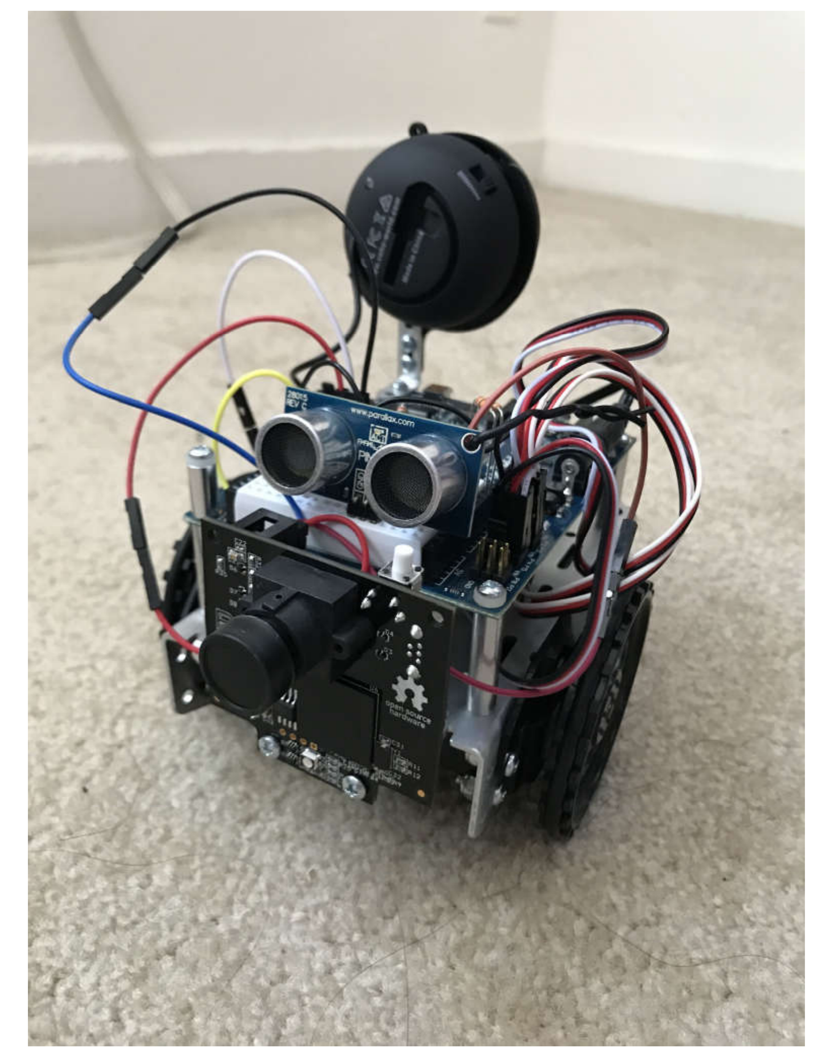
(Mile stone 2)

- Data Transmission — End of Week 6
- Object Recognition & Function Test — End of Week 8

(Milestone 3)

- Algorithm Optimization — End of Week 9
- Project Completion — End of Week 10

Accomplishment



Basic Parts

- Camera sensor: CMU cam5 Pixy
  Capture objects in the picture and send the data back
- Motherboard: Propeller Activity Board
- Distance sensor: PING))) Ultrasonic Distance Sensor
  Measure the distance between the obstacle and the robot
- Motor: Parallax's High Speed Continuous Rotation Servo
  Bi-directional, rotation speed controlled by PWM wave
- Speaker: Veho 360 Speaker
  Play the introduction audio file

Demo on Youtube: https://youtu.be/xfpUDIdcvLA

Contact Information:

Project Page:

http://srproj.eecs.uci.edu/projects/project-group-21-objects-recognition-robot

Email address:

yuchenf3@uci.edu

THE HENRY SAMUELI SCHOOL OF ENGINEERING
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Assistive Vision Wearables

Team Members: Kyle Lam (CpE), Elliot Rhee (CpE), Kent Pluntze (CpE), John Efseaff (CpE)
Advisor: Kwei-Jay Lin
University of California, Irvine

Goal Statement

We are creating an assistive wearable vest that is intended for improving navigation capability in low-vision environments. We have designed a prototype that will successfully navigate the user through a cardboard maze using vibration indicators, but our ultimate goal is to be able to successfully and safely navigate a varied sample of real-world environments.

Responsibilities

Mentor: Kwei-Jay Lin

Members	Responsibilities
Elliot Rhee (CpE)	• Ultrasonic sensor data (gathering and interpreting) • Write Arduino code to aggregate sensor data + output response
John Efseaff (CpE)	• Ultrasonic sensor data (gathering and interpreting) • Write Arduino code to aggregate sensor data + output response
Kent Pluntze (CpE)	• Activating vibration actuators with gathered/interpreted data • Schematics + integrate hardware
Kyle Lam (CpE)	• Soldering materials, switching circuit design • Schematics + integrate hardware

Schedule

Task\Week Of	1/9	1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/13
1. Hardware										
1.1 Schematic	■	■								
1.3 Circuit Diagram			■	■	■					
1.4 Power supply layout		■	■							
2. Software										
2.1 Read data from longer range sonar sensor	■	■								
2.3 Read data from closer range sonar sensor		■	■							
2.4 Interpret long range sonar data		■								
2.5 Interpret short range sonar data			■							
2.7 Integrate data interpretations into one obstacle avoidance algorithm						■	■	■	■	
3. Fabrication										
3.1 Plan physical placement of sensors			■	■						
3.2 Plan physical placement of vibration motors				■	■					
3.3 Attach and wire sensors to vest							■	■		
3.4 Attach and wire vibration motors on vest							■	■		
4. Testing										
4.1 Test inputs to vibration modules					■	■				
4.2 Test ability to walk blind with vest								■	■	■

Introduction

We have created a chest piece mounted on a vest that will notify the wearer of incoming obstacles. These notifications will come in forms of vibrations that will vary in strength and pulse that will scale with the detected object's distance from the user. The active vibration motors will be aligned in the direction of the obstacle detected by the sensors. This functioning prototype was designed to be used to help detect objects and obstacles in dark environments.

Progress and Project Status

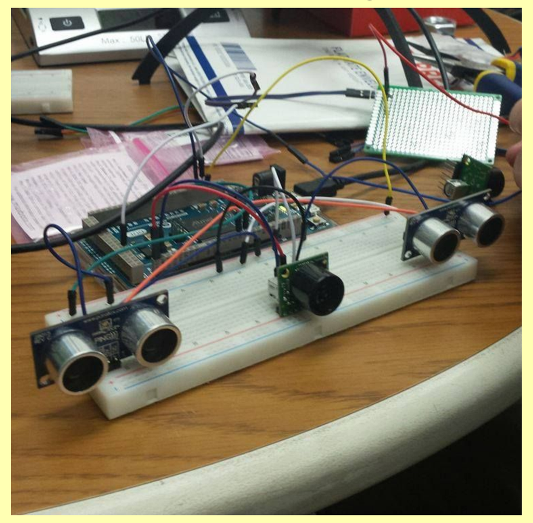
We immediately began ordering parts and testing and verifying the functionality of the sensors at the beginning of the quarter (delayed by UROP funding). As parts continued to arrive, we began integrating the sensors into an array as shown on the right, and designed a MOSFET switching circuit to control the array of vibration motors using the Arduino Due digital out pins. We arranged the motor array as shown on the right, and began combining the separate parts into the complete prototype. This prototype has been successfully tested to navigate the Engineering buildings area.

I2CXL-MaxSonar-EZ4
Ultrasonic/sonar sensor

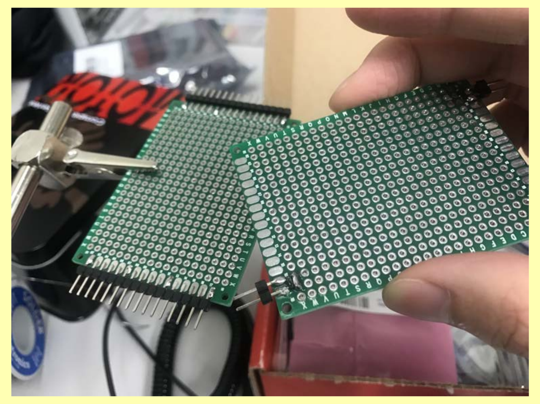
Parallax PING Ultrasonic Sensor

Vibrating Motor Array on Vest

Sensor Testing



Switching circuit for motor control testing



Approach

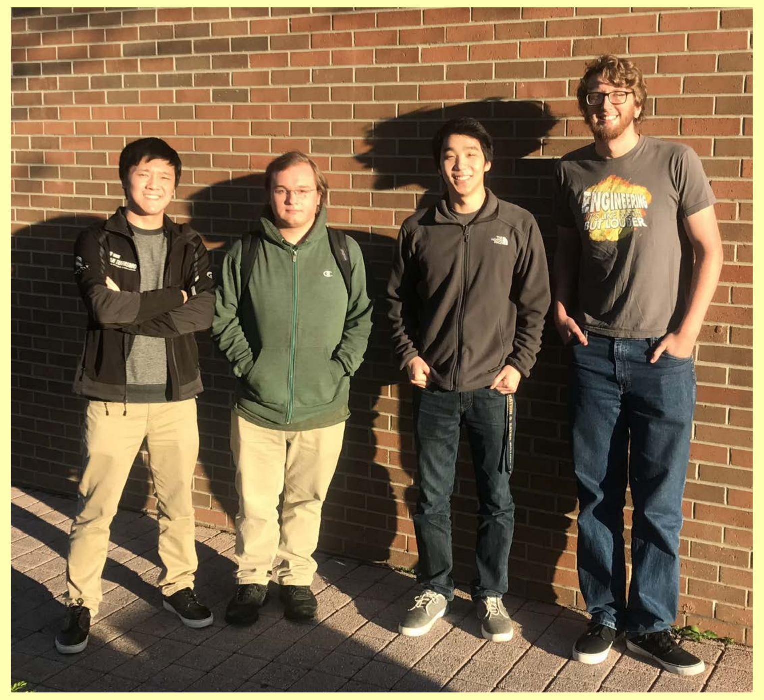
Chestpiece will work to provide warnings about obstacles to the user in the form of vibrations. It will contain Arduino Due as the central processing unit and will take input from sonar/ultrasonic sensors mounted at various points on the vest. If there is object detection from any of the sensors then it will issue vibrations to the vibration nodes that are closest to the direction the threat is in. Vibration nodes will be arranged in columns on the front side of the vest to indicate which direction the object is coming from. Sensors are able to detect flat and wide surfaces reliably but struggle to detect smaller rounded objects.

Contact Information

Website:
http://srproj.eecs.uci.edu/projects/project-group-22-vision-assistive-wearables

Advisor:
Professor Kwei-Jay Lin (klin@uci.edu)

Members:
Kyle Lam (kylehl1@uci.edu)
Elliot Rhee (ejrhee@uci.edu)
Kent Pluntze (kpluntze@uci.edu)
John Efseaff (jefseaff@uci.edu)



Automated Brewing Using a Microcontroller

Andy Le, Anthony De La Rosa, Christopher Amaya, Cory Yun (Project Group #24)
Professor Pai H. Chou, Quoc Viet Dang
Department of Electrical Engineering and Computer Science

Goal

Our goal is to create an automated brewing product that is more affordable compared to a commercial product. We will also have an Android application to control our product, allowing for user customizable tea.

Introduction

Our group's project uses an Arduino Uno to control and automate a hot beverage brewing system. The system will be controlled through an Android application over a wireless internet server-client system. Our project will be entirely autonomous, where brews can be scheduled and ready without user interaction, other than final pouring.

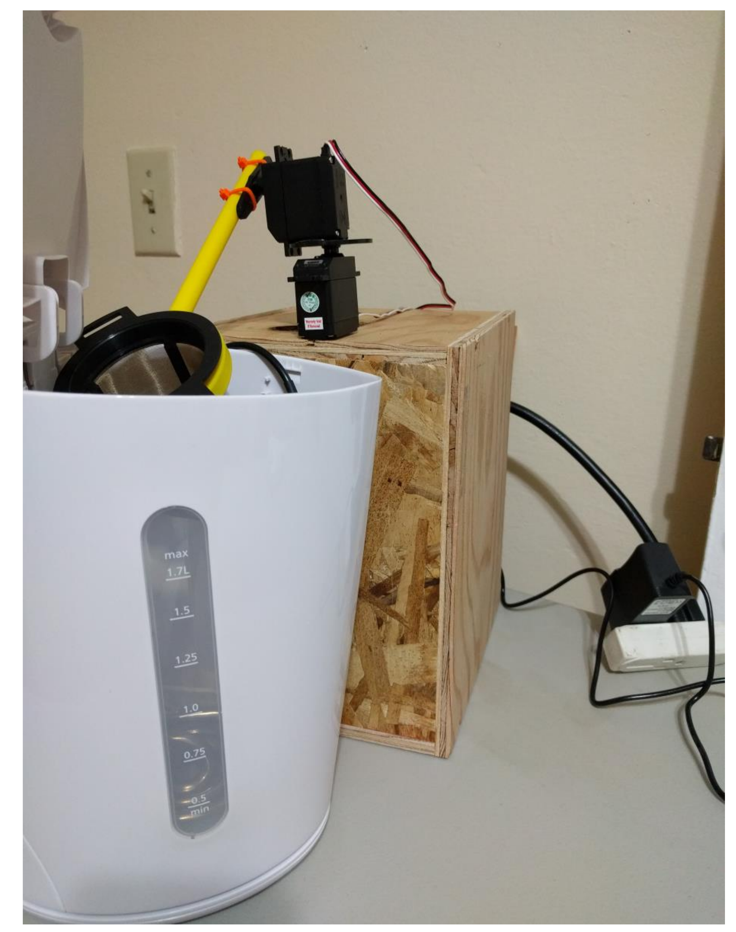
Commercial products similar to our project already exist as luxury items. We aim to create a comparable, yet more affordable product that also offers customizability to the user.

Team Members and Roles

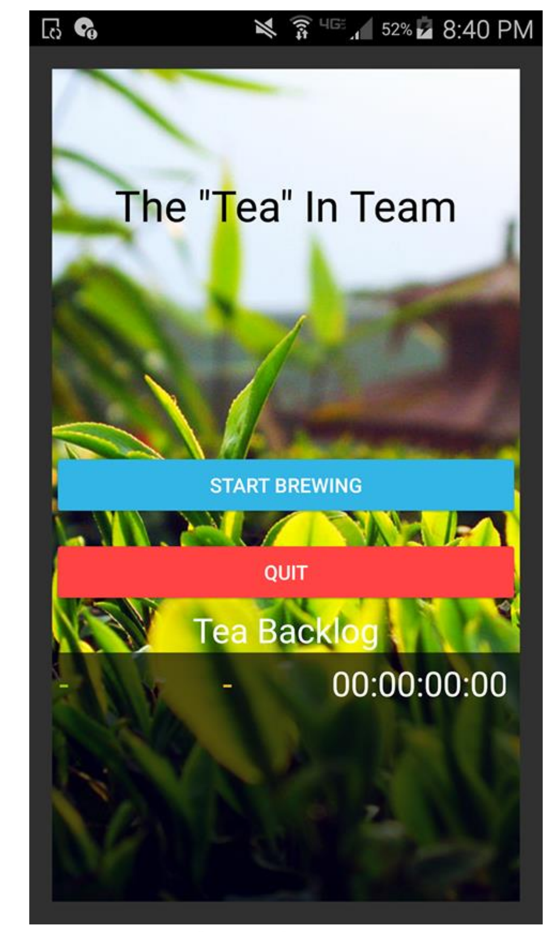
Members	Roles
Andy Le (CSE)	Team captain, program hardware in the system, application to hardware communications, integrate project subsystems
Anthony De La Rosa (CSE)	Program and test Android application, application to hardware communications, code management
Christopher Amaya (CSE)	Program and test Android application, application to hardware communications and implementation
Cory Yun (EE)	Hardware communication and circuit design, test and implement of hardware
Quoc Viet Dang (Mentor)	Guidance and goal-setting

Website: http://srproj.eecs.uci.edu/projects/project-group-24-automated-brewing-using-microcontrollers
Email: andyl8@uci.edu, Subject: Senior Project Inquiry

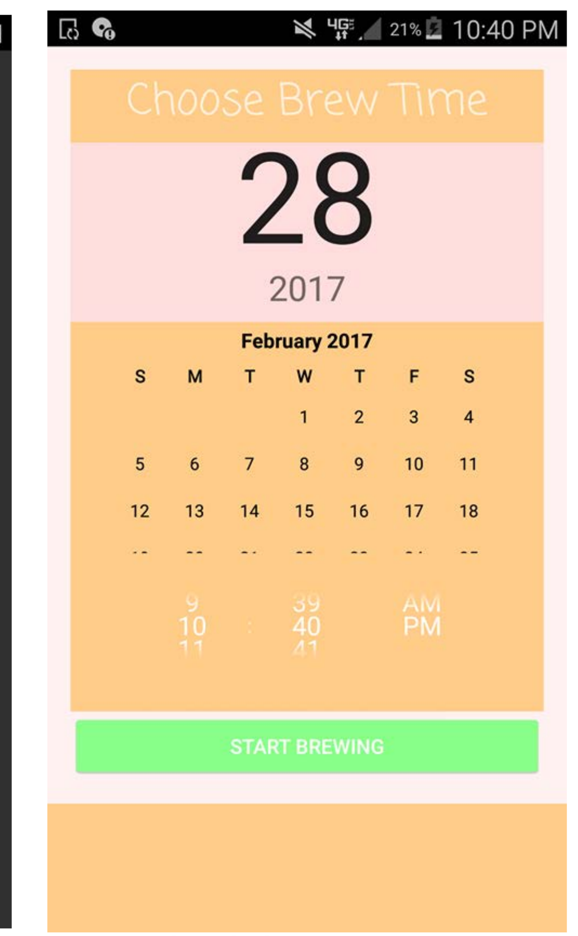
Hardware System



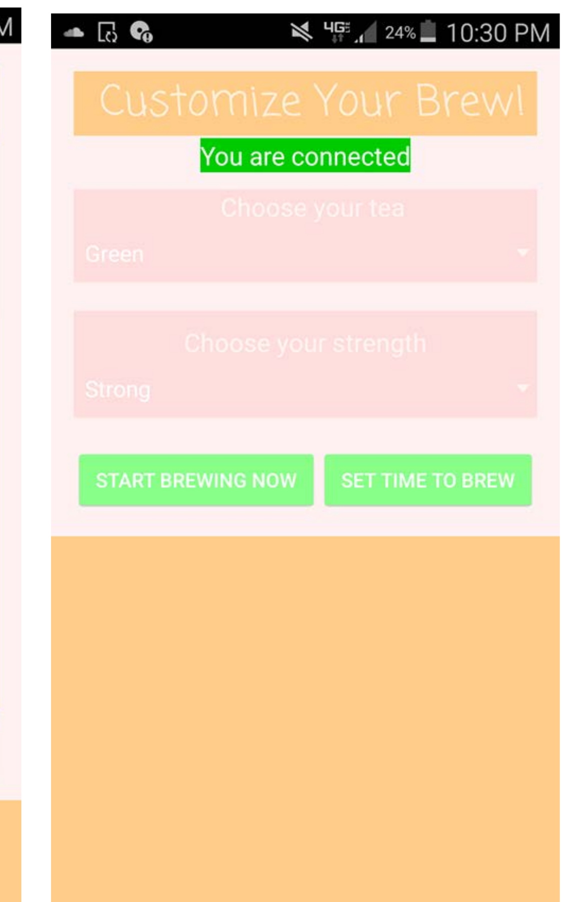
Application Screenshots



Before brewing



Scheduling screen



Customization screen

Progress and Current Status

As of the end of February, our group has created the initial prototype of the hardware system (above). We have also started connecting the software subsystem to our hardware. Both systems can communicate with each other to customize and schedule tea brewing.

Currently, we are making final touches for both of our subsystems, so that a final prototype version can be presented during Senior Design Review at the end of Week 10.

Approach and Innovations

The project can be automated with the push of a few buttons, where leaves are automatically lowered into a water kettle and, after brewing are removed from the kettle.

Our system's Android application, lets the user can program which tea will be brewed, when the brew will be finished, and how strong the beverage will be. This application will be downloadable through the Google Play Store.

Schedule

Major Milestone & Review Dates:
November 30^{th}, 2016
March 3^{rd}, 2017
March 17^{th}, 2017

The Henry Samueli School of Engineering
University of California · Irvine

Aircraft Noise Tracking System

Students: (Leader) Jianbo Liu (EE), Michelle Lai (EE), Yiqing Zhang (EE)
Advisor: Micheal J. Klopfer
University of California Irvine

Goal

The purpose of this project is to build an auditing system for aircraft noise over populations. The device tracks overhead aircraft via received ADS-B signals, while recording ambient audio determine aircraft noise contribution. A summary message is sent back to a database for later analysis for each sampling period.

Background

Noise is a big problem that decrease people's life quality, leading to complex task performance, modifies social behaviour and causes annoyance, one of the prominent one is traffic noise, including aircraft noise, harmful to children that chronic aircraft noise exposure impairs reading comprehension and long-term memory, to physical health including hairs, and may be associated with raised blood pressure[1]. Jet airplane noise is a major concern for many areas around the world, and especially in the metro LA/OC area. These cities are not alone. Newport beach has spent considerable resources combating this around SNA. Thus, a device that can sort out aircraft noises from other noises will be helpful to further reduce aircraft noises. Combining the information from ADS-B, which broadcasts nearby aircraft information including flight number, speed, altitude, position, and etc, with the analysis of received noise we will be able to pair the noise with an aircraft. For instance, When a plane is 5 seconds away the system starts sampling audio and comparing against a baseline while looking for the spectral characteristics of jet noise. This data is filtered and processed at the node and pushed up to the server. Building enough nodes makes our device can cover a huge area.

Configuration

A Smartfusion2 FPGA board is the processor of whole device. GPS, ADS-B receiver, VS1053 board and ESP8266 board are connected to Smartfusion2.

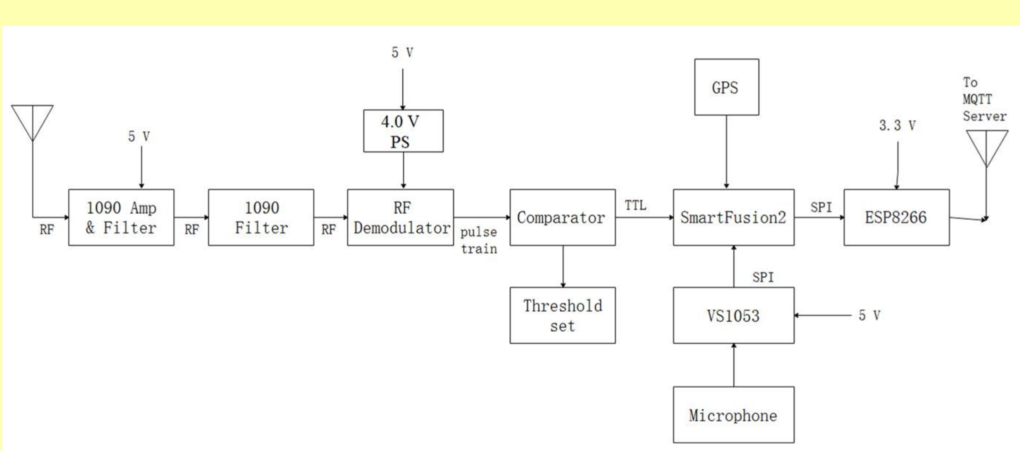


Fig 1. Hardware Configuration Schematic

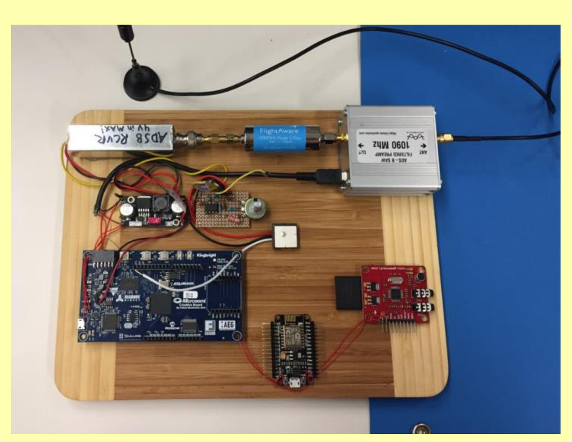


Fig 2. Hardware Configuration S

ADS-B

Automatic dependent surveillance – broadcast (ADS–B) is a surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked.[2 It broadcasts information such as altitude, longitude, latitude, speed and aircraft type in 1090MHz so our device uses it to determine position of nearby aircraft. The signal is encrypted using manchester code, the decoder is built via FPGA.

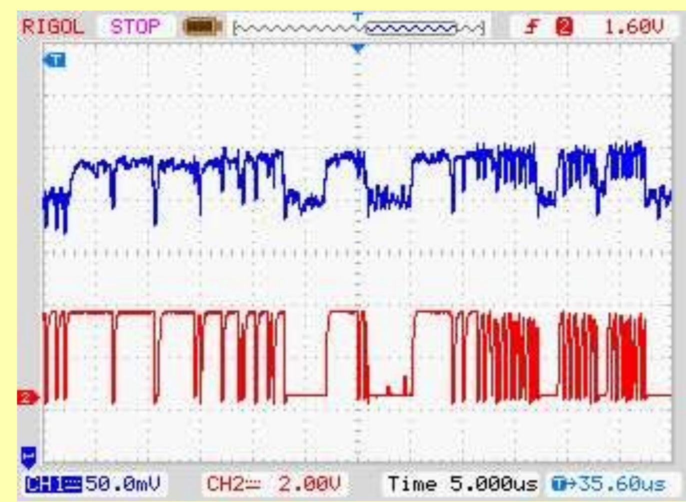


Fig 3. Received ADS-B signal on oscilloscope

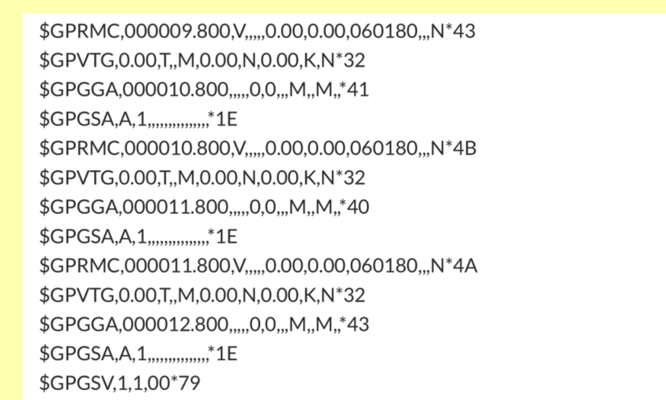


Fig 4. NMEA sentences received by GPS [3]

GPS

The GPS receiver provides position, velocity and time reading with tracking capabilities for the device, based on the position it decides whether recording of nearby aircrafts should start. The data coming out from GPS is NMEA sentences. SmartFusion2 decodes and implements GPS receiver via serial port.

VS1053

This board has a microphone built in which can record the sound as Ogg/MP3 format. The low-power DSP processor on VS1053 can perform real-time spectrum analysis. Our smartfusion 2 can control the board and get result via SPI. For simplicity, we will only calculate the fingerprint of noise and transmit the bitstream to Smartfusion2. The FPGA will then extract the feature of flight noise and combining them with timestamp and location.

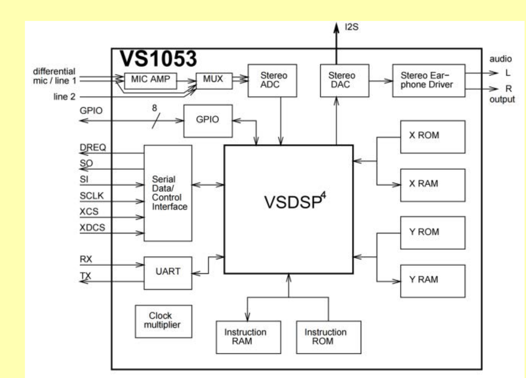


Fig 5. Schematic of VS1053

ESP8266

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. FPGA push the bitstream to the ESP8266 and a simple MQTT loop will push data to the remote server via Wi-Fi

Timeline

Week 1-2 Configuration design

Week 3 ADS-B decoder

Week 4 ADS-B decoder (continue)

Week 5 ADS-B receiver (expect comparator) implement

Week 6 VS1053 implement & noise samples recording

Week 7 GPS implement

Week 8 Wifi implement

Week 9 Test

Week 10 Test & demo

References

[1] Stephen A Stansfeld and Mark P Matheson (2003). *Noise pollution: non-auditory effects on health*. [online] Available at: http://www.kensingtonassociation.org.au/wp-content/uploads/2013/10/Noise+Pollution_non-auditory+effects+on+health.pdf [Accessed 28 Feb. 2017].

[2] En.wikipedia.org. (2016). *Automatic dependent surveillance – broadcast*. [online] Available at: https://en.wikipedia.org/wiki/Automatic_dependent_surveillance_%E2%80%93_broadcast [Accessed 28 Feb. 2017].

[3] http://www.toptechboy.com. (2014). *LESSON 24: Understanding GPS NMEA Sentences*

http://www.toptechboy.com/arduino/lesson-24-understanding-gps-nmea-sentences/ [Accessed 28 Feb. 2017].

Conttact Information

Project page:
http://srproj.eecs.uci.edu/projects/project-group-25-fpga-based-short-wave-sdr

Email:
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xslai@uci.edu Michelle Lai
yiqingz@uci.edu Yiqing Zhang

USRP Network Profiler

Jose Garcia Gabriel Sasson Hector Solano
Professor Yousefi'zadeh
Department of Electrical Engineering and Computer Science

Introduction: Universal Software Radio Peripherals are inexpensive hardware platforms for software defined radios. Some market applications of USRPs are cellular GSM base station, GPS receiver, FM radio receiver and transmitter, passive radar.

Project Goal: To develop the tools and profile the network bandwidth, latency, jitter and range of USRP radio networks.

Professor Yousefi'zadeh
Faculty Mentor

Hector Solano
Team Captain
Computer Science and Engineering
Responsibilities: Project management, documentation, testing methodology and software design

Gabriel Sasson
Team Member
Computer Science and Engineering
Responsibilities: Programming and embedded hardware

Jose Garcia
Team Member
Computer Science and Engineering
Responsibilities: Programming, software testing, network setup

Fall Quarter
- Become familiar with GNU Radio, Linux network stack, existing code
- Use TAP/TUN to connect layer 1/2 on network stack USRP to layer 3 on Linux
- Profile USRP point-to-point network

Winter Quarter
- Setup network nodes on embedded hardware
- Profile USRP point-to-point, multipoint network
- Measure network bandwidth, latency, jitter and range

Spring Quarter
- Produce network performance documentation
- Produce Software documentation

For more information, go to:
http://eecsproj.cello.eng.uci.edu/projects/ad-hoc-network-profiler

The Henry Samueli School of Engineering
University of California • Irvine

Switchable Car HUD Screen

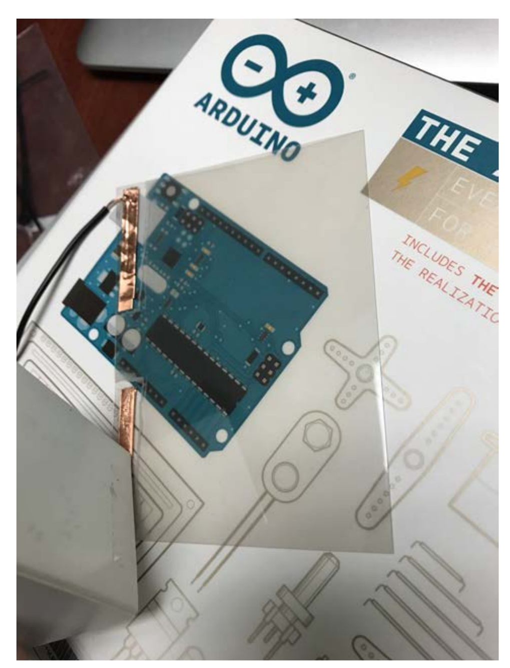
Guanting Hou, Haolin Wang, Xing Ji, Cheng Zhu
Advisor: Prof. Ardalan Amiri Sani
Department of Electrical Engineering and Computer Science

Introduction:

Nowadays all of the car HUDs in the market are only designed to display the vehicle speed, the engine speed and navigation, and use small screens which might not become obstacles when drivers are looking ahead. However, our project idea is much more outstanding. We would like to make a larger switchable screen which can display not only navigation or speed data but also the scenes monitored by cameras on car wing mirrors. Based on the research, about 36 per cent of vehicles were turning or crossing at intersections just prior to the crashes. Many drivers miss obstacles or vehicles ahead when they turned to see the wing mirrors. However, via our project devices, drivers can see back scenes during a turning of the vehicles, and they will not miss the potential danger ahead at the same time. Moreover, the screen will be made of PDLC film which makes it switchable. It is exactly a piece of common glass when the driver doesn't want to use it, so it won't become an obstacle while the driver is driving ahead.Therefore, our project will highly improve the driving security. Also, our car HUD is a multimedia screen as well. With a Arduino MCU as the microcontroller, drivers can watch videos, view images or even read books on the screen.

Goal statement:

Make a switchable screen on a car's windshield with a PDLC film. The screen will show scenes monitored by Arduino cameras (ArduCAM) placed on the wing mirrors of the car (wing cameras) via a Arduino MCU and a small projector, whenever the driver wants to turn left or turn right. Through our project devices, a driver can keep his head up and eyes looking straight ahead when he makes a turn.



Transparent when power on

Opaque when no power
(proper for projection)

Approach:

First, we need to have a switchable screen for our HUD. The screen will be made by the material, PDLC (Polymer dispersed liquid crystal) film. The PDLC film is opaque when there is no power supply, but when electric current passes it, the film will turn into transparent immediately. By connecting to power, the clarity of the screen can be changed so that it won't be an obstacle to the driver. When the driver is just driving straight ahead, there should be power supplied to the film and it is transparent just like normal glass. But once the driver turns on the left or right signal, the power will be cut off and the film becomes an opaque screen for a projector. The application part will mostly be image processing to make the screen show what is recorded by the cameras. In order to project videos on the screen, we need a Arduino MCU as the microcontroller and a high quality projector. The microcontroller receives video signals from two live cameras placed on both wing mirrors and plays the video in its Omxplayer. Then, by connected to the MCU, the projector can project the video onto the screen.

Team: Group 27

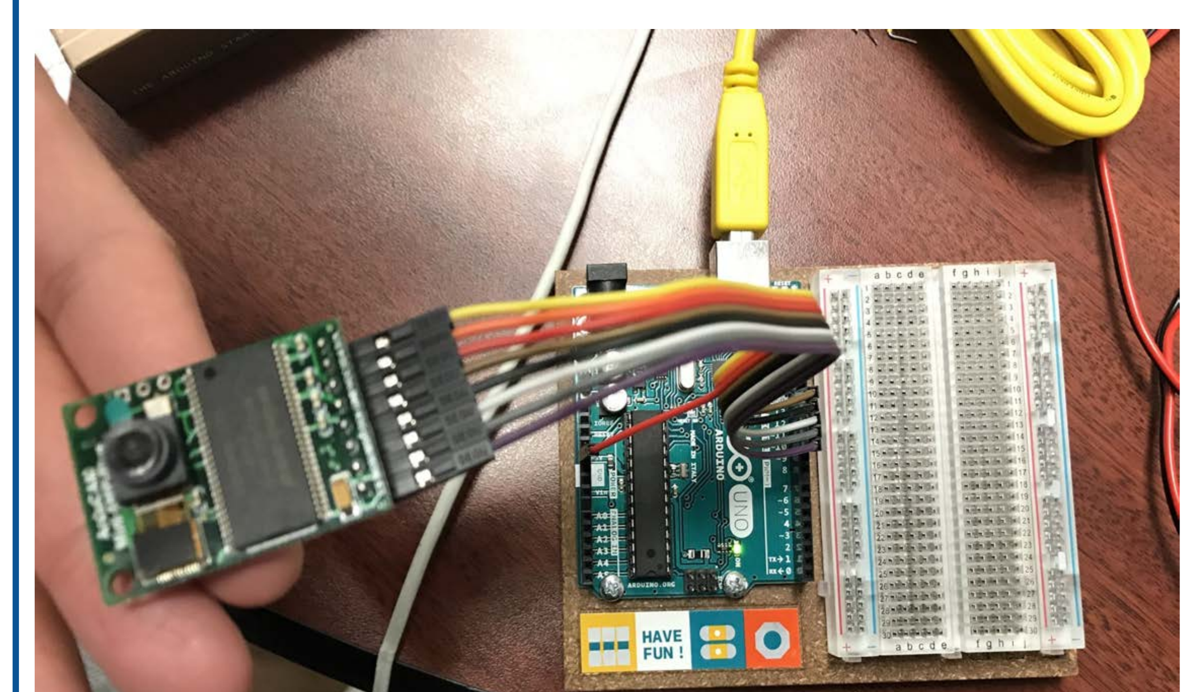
Team members:

Guanting Hou (guantinh@uci.edu)
- Major: Electrical Engineering
- Specialization: DSP(Digital Signal Processing), Communication
- Responsibility: Coding, Hardware, PCB, Firmware

Haolin Wang (haolinw@uci.edu)
- Major: Electrical Engineering
- Specialization: DSP(Digital Signal Processing), Communication
- Responsibility: Hardware, Firmware, Communication, Software assist

Cheng Zhu (czhu4@uci.edu)
- Major: Computer Engineering
- Specialization: Java/C/Python Programming, Database
- Responsibility: Software, Application

Xing Ji (xji3@uci.edu)
- Major: Electrical Engineering
- Specialization: DSP(Digital Signal Processing), Communication
- Responsibility: Communication, Testing, Hardware, Firmware



ArduCAM connected to Arduino MCU board

Senior Project Portal Link:
<http://srproj.eecs.uci.edu/projects/group-27>

THE HENRY SAMUELI SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA · IRVINE

Pulse: An Implementation of Emotionally-Aware VR Gaming

Andrew Tran, Reigan Alcaria, Jude Collins, Jong Seon "Sean" Lee
Advisors: Ahmed Eltawil, Ahmed Khorshid
Department of Electrical Engineering and Computer Science

Introduction and Goal

While virtual reality (VR) games offer players increased immersion over traditional games, they lack the ability to interface with a key driver behind human perception and reasoning: emotions. This inability presents a barrier to maximizing the immersive potential of VR interactive media.

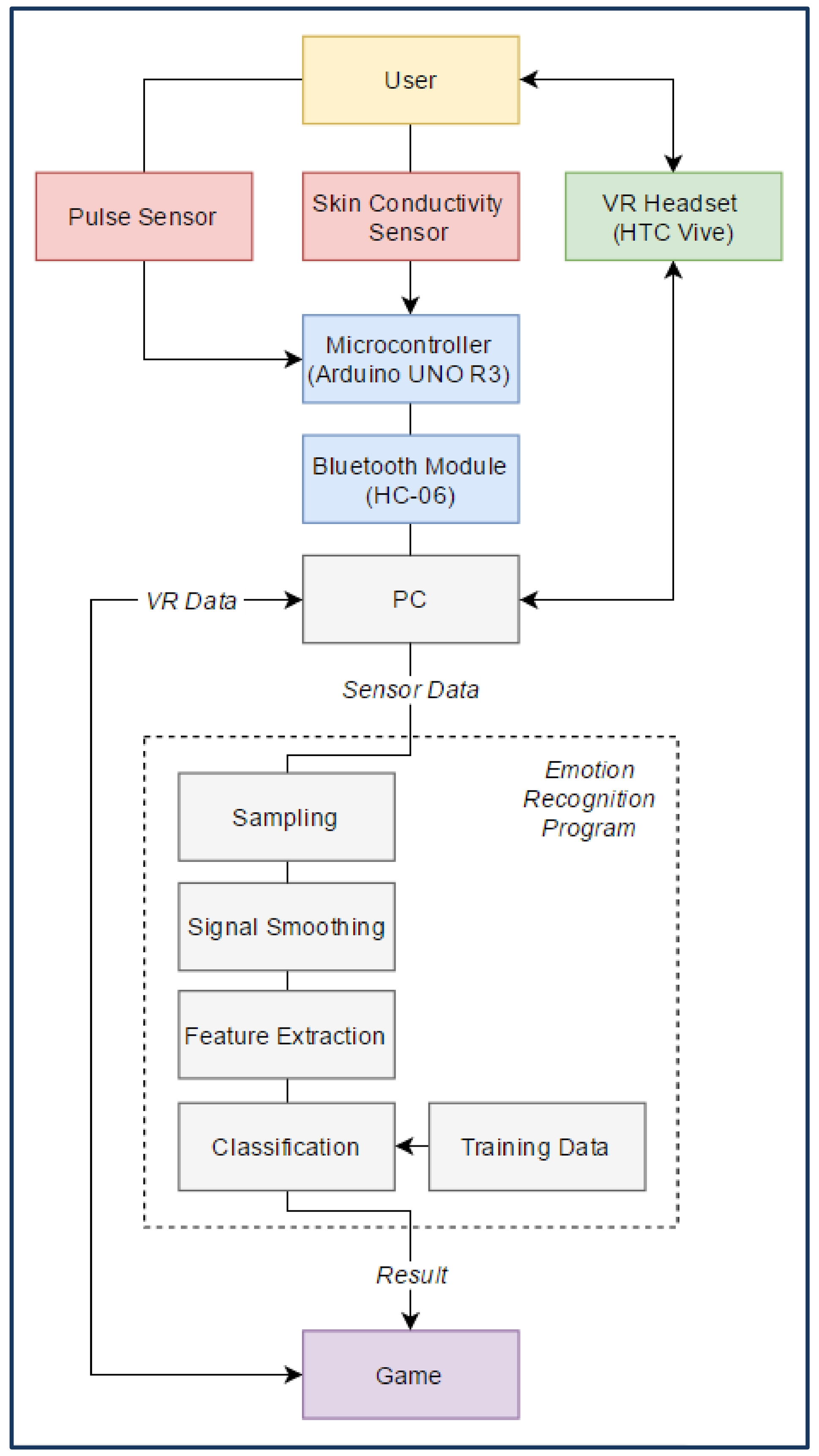
We sought to solve this issue by developing a biofeedback-enabled emotion recognition system that empowers users to create and experience emotionally-aware VR games.

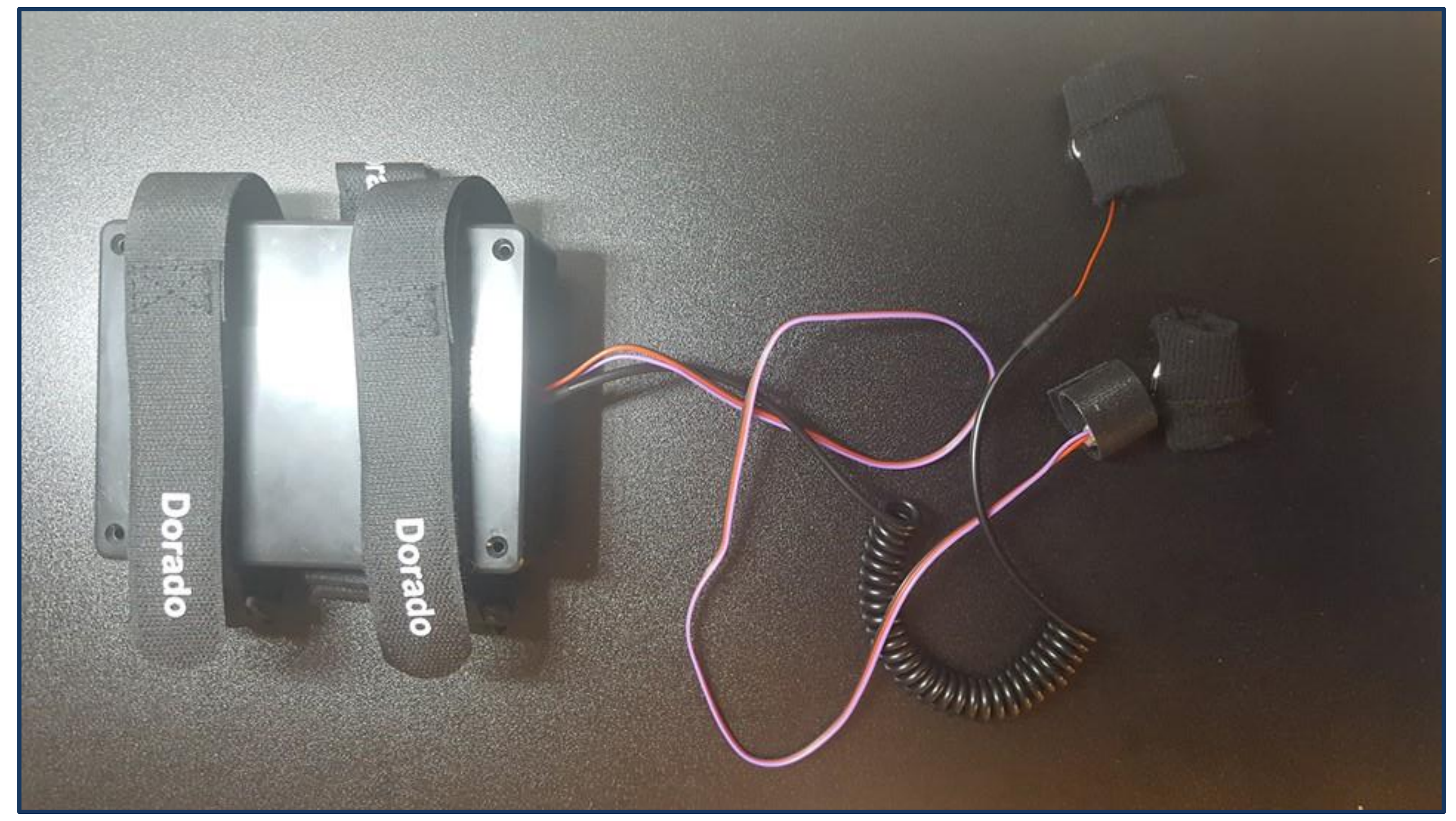
Methodology

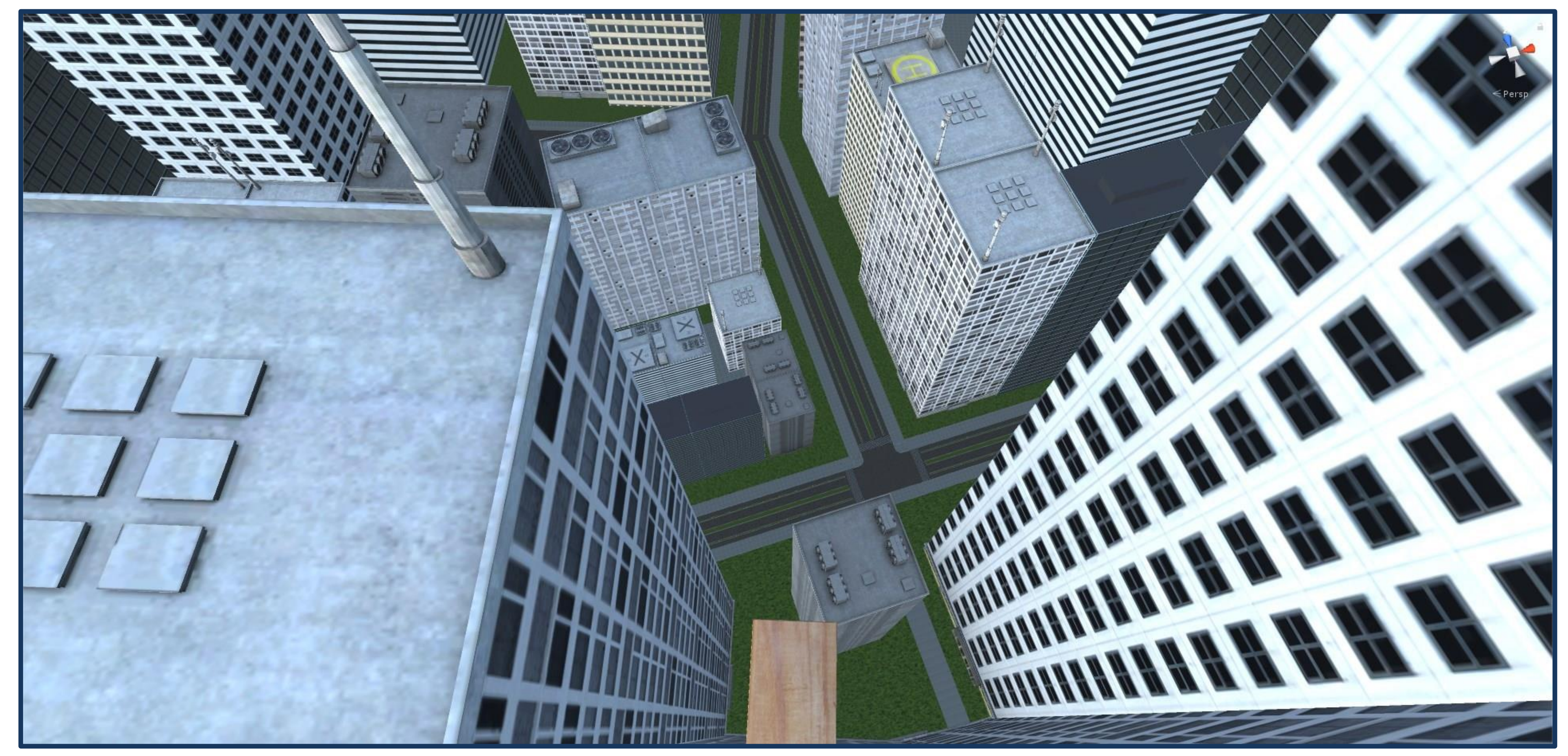
Our approach revolves around the observation of changes in biosignals, which correlate to changes in emotional states.

We use pulse and skin conductivity sensors to collect data from a user and apply digital signal processing and machine learning to it on a PC in real time to analyze changes in the data and predict the user's emotions, which can be used as game input.

For the scale of our project, we focused primarily on two emotions: fear and calmness. In order to showcase our system, we designed a small-scale, emotionally-adaptive VR game.





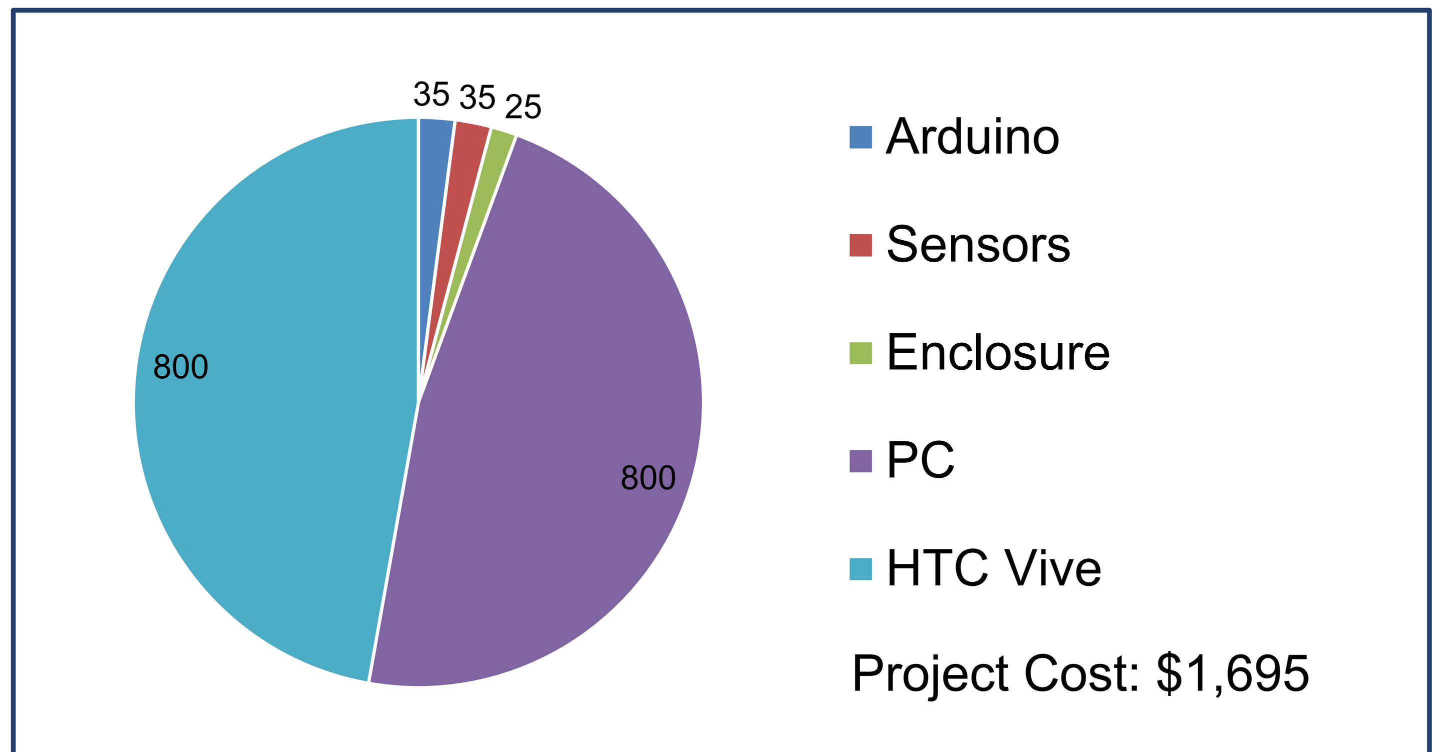


Clockwise from left:

1. *System block diagram. Sensors collect data from the user, which is sent to a PC using a Bluetooth-enabled microcontroller. A Python program on the PC analyzes the data to predict emotions, with the result being relayed to the emotionally-adaptive game. A VR headset immerses the player in the game to facilitate emotional connections.*
2. *System hardware. The electronics of the system are stored in a case strapped to the user's arm. The sensors are routed out of a port in the case and attach to the user's fingers.*
3. *Emotionally-adaptive VR game. A game like the one shown here hones in on and adapts to the player's emotions.*

Team

Name (Major)	Roles
Andrew Tran (EE)	Hardware, digital signal processing, machine learning, game design
Reigan Alcaria (EE)	Hardware, digital signal processing, machine learning, game design
Jude Collins (CSE)	Digital signal processing, machine learning, game design
Sean Lee (EE)	Hardware, digital signal processing, game design



Budget breakdown of the project.

Acknowledgements

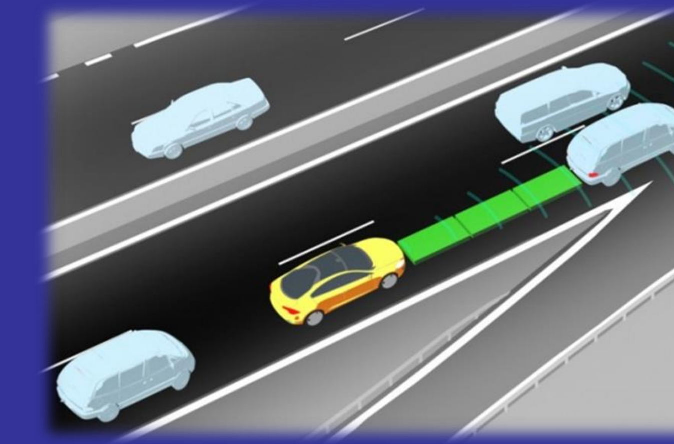
Our team would like to thank Brandon Pieterouiski, an Electronic Production and Design student from the Berklee College of Music in Boston, Massachusetts, who was kind enough to serve as the audio director of our VR game. You can find out more about him through our website.

We would also like to thank the Blend Swap users who created the models we used in our VR game. Once again, more information about them is available on our website.

For more information, visit our website at pulseuci.wordpress.com or through the QR code in the corner. Questions or comments? Send an email to aitran@uci.edu or ralcaria@uci.edu.

UCI Samueli School of Engineering
Department of Electrical Engineering and Computer Science

Retrofittable Forward Collision Warning System



Gabriel Iya (EE), Daniel Tayag (EE), Daniel Lozano (EE), Shanka Udugampola (CpE / CE)

Dr. Zhiying Wang (PhD)

University of California Irvine

http://srproj.eecs.uci.edu/projects/project-group-29-vehicle-safety-enhancement

PROJECT GOAL:

The goal of this project is to develop a forward collision warning system that can be retrofitted onto passenger vehicles that do not currently have the technology.

PURPOSE, BACKGROUND, AND SIGNIFICANCE:

The main purpose of this project is the prevention of rear-end collisions.

Rear-end crashes are the most prevalent type of collision on the road. About half of all collisions involving two vehicles are rear-end collisions and about every 1 in 1000 of these collisions involves a fatality. In 2012 alone, there were 1.7 million rear-end crashes, resulting in more than 1,700 deaths and 547,000 injuries. This averages to more than 4,500 rear-end collisions a day with 4.5 resulting fatalities in the United States [1]. The many causes to rear-end crashes include: unsafe speed and following distance, fatigue, and reduced visibility [1]. The most common cause of collisions in general by far, however, is driver inattentiveness. In a 100-car study, the National Highway Traffic Safety Administration found that 78% of all vehicle collisions and 87% of all rear-end collisions were due to driver inattentiveness [1]. The National Transportation Safety Board has conducted predicted-benefits research on forward collision warning systems and has concluded that 63% of all fatalities and 93.7% of all injuries due to rear-end collisions could be prevented by just a simple warning system [1]. If the prevention of a vast majority of these accidents falls mostly on alerting the driver to an imminent crash, then why hasn't a forward collision warning system been implemented? The simple answer is they have been developed and implemented, but the cost and availability are a massive deterrent to implementation.

There is a significant price tag attached to the current technologies involved in an accurate and reliable collision warning system. Systems that used cameras and digital signal processing. For a greater degree of accuracy and reliability, lidar and radar systems must be used in combination which greatly drives up the cost. For comparison, the Delphi Adaptive Cruise Control system uses a radar and costs about $2,000 and the SICK LMS511-10100 is a 2D lidar system and that costs $7,000.The cheapest camera, the SV-625B, sells for $160, but it comes with many disadvantages like poor quality of detection in bad lighting and weather and the algorithms required for image processing require more computational power [2].

As of 2014, only 4.4% of new cars came standard with a collision warning system. The vast majority of cars either do not offer it at all or offer it in an optional package [1].

TASK	Gabriel Iya (giya@uci.edu)	Daniel Tayag (dtayag@uci.edu)	Daniel Lozano (dclozano@uci.edu)	Shanka Udugampola (sudugamp@uci.edu)
Algorithm Development				X
Misc. Programming	X	X	X	X
Documentation		X		
Team Leader	X			
Presentation Material	X	X		
Hardware Configuration	X	X	X	
Casing Design and Fabrication	X	X		
Component Procurement			X	

CURRENT STATUS:

- Sensor mount completed
- Implementation of algorithms
- Vehicle test trials

ITEMIZED BUDGET		
ITEM	JUSTIFICATION	PRICE
Raspberry Pi 3	The main microcontroller that will interface with the sensor	$316.79
15 ft micro-usb cable	Interface between sensor and Raspberry Pi 3	$10.76
OBD2 Bluetooth	To accurately measure the speed fo the vehicle	$9.09
RF Transmitter and Receiver	Wireless communication	$5.92
Circuit components	Required to build the circuit which includes the LEDs and warning buzzer	$20.00
	TOTAL:	$362.56

TIMELINE:

Fall Quarter 2016

- Acquire components in itemized budget
- Complete research and initial study of laser rangefinders and microcontrollers—focusing specifically on Raspberry Pi 3 and custom software included with sensor
- Begin preliminary build / interface with Windows

Winter Quarter 2017

- Build sensor unit / interface with the Raspberry Pi 3
- Construct mount for the sensor
- Run test trials starting with small-scale then gradually moving up to large-scale

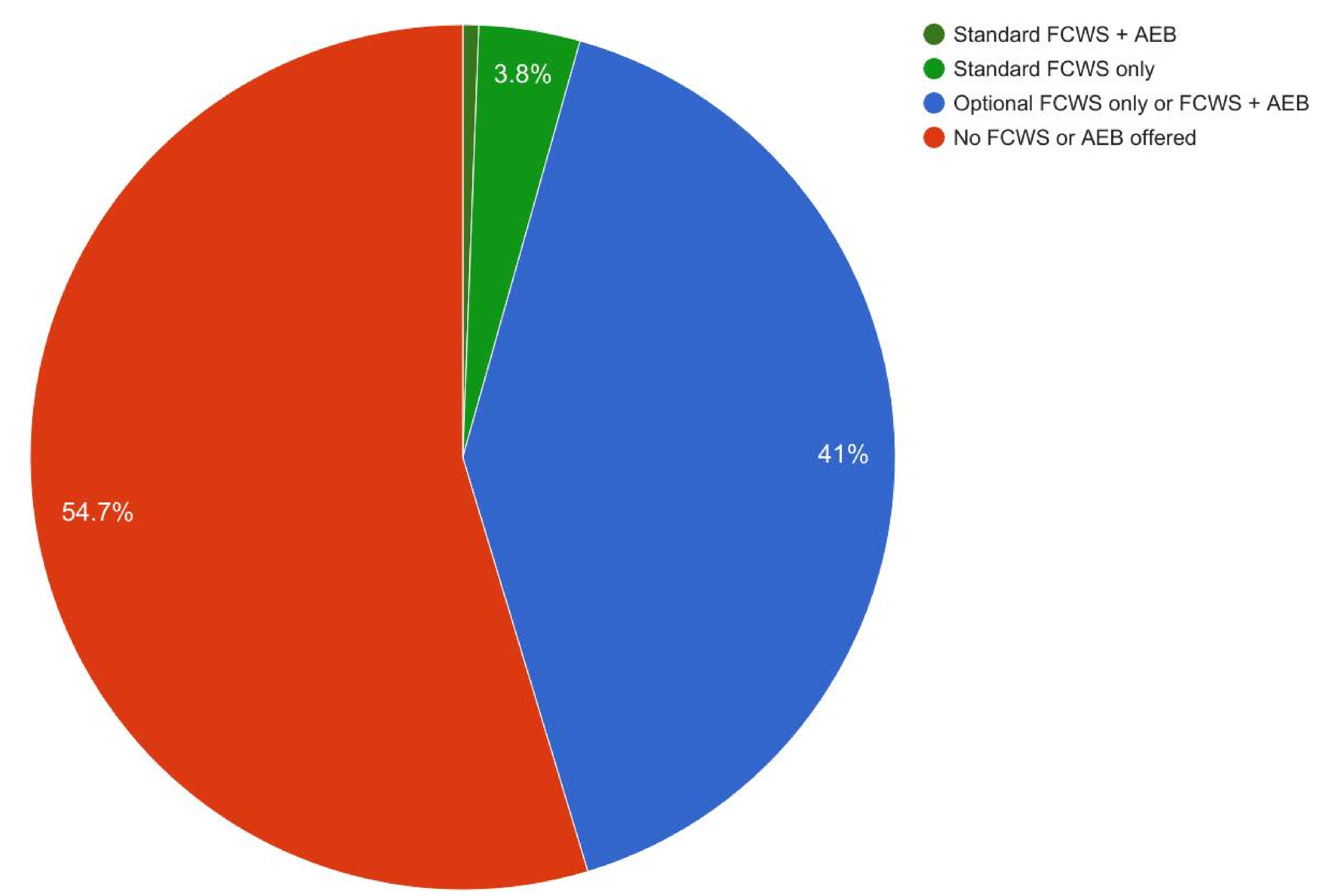
APPROACH:

The sensor we are using is the SFC11-C Laser Rangefinder which can detect objects from up to 120m away. This lidar was chosen because texture or color of the object, background light, wind, noise, and angle of incidence have little to no effect on its effectiveness. It interfaces with the Raspberry Pi 3 over USB, using a serial communication. The lidar is also packaged with proprietary LightWare Terminal software that can be used for configuration of properties such as baud rate or output voltage to distance correspondence.

With our current configuration of the rangefinder, it is able to interface with a Windows system using USB to conduct tests before it is ready to interface with the Raspberry Pi 3. Safe following distance and needed brake distance algorithms have already been researched and implemented. During the next phase of our project, we will implement the code with the sensor and Raspberry Pi 3. The speed of the vehicle can be determined using bluetooth and the car's onboard diagnostics. Communication between these two will be bridged using an OBD-II bluetooth adapter as it is the standard on-board diagnostics system for cars sold in America after 1996 [3]. If the following distance is unsafe, a warning light will appear and a soft audio alert will sound to alert the driver increase following distance. If the following distance is determined to be critically unsafe, a red light will flash, hard alert will sound, and wristband will vibrate. The mounting of the sensor was fashioned out of metal brackets to fit over a standard license plate.

We are currently conducting small-scale, low speed tests, and we will gradually move up to a real-scale, high speed test utilizing a group member's vehicle. All progress will be documented in progress reports and individual documentation of the process. Upon completion, all documentation will be collected in preparation for the Undergraduate Research Symposium.

Availability of 2014 Model Passenger Cars with at least a Forward Collision Warning System



REFERENCES:

[1]National Transportation Safety Board, "The use of forward collision avoidance systems to prevent and mitigate rear-end crashes," in *National Transportation Safety Board*, 2015. [Online]. Available: http://www.ntsb.gov/safety/safety-studies/Documents/SIR1501.pdf. Accessed: Oct. 11, 2016.

[2]A. Mukhtar, L. Xia, and T. B. Tang, "IEEE Xplore document - vehicle detection techniques for collision avoidance systems: A review," in *IEEE Xplore: Digital Library*, 2015. [Online]. Available: http://ieeexplore.ieee.org/document/7066891/. Accessed: Oct. 11, 2016.

[3]"OBD-II background information," in *OBD-II Background*, 2011. [Online]. Available: http://www.obdii.com/background.html. Accessed: Nov. 2, 2016.

Voice Activated Light System

Jeremiah Baca, Coco Gao, Garineh Shamirian, Amir Saman Safari
Professor Glenn Healey
Department of Electrical Engineering and Computer Science

Goal

Our purpose is to design a light system with speech recognition capabilities. The light will understand simple voice commands such as: "on," "off," "first," "second," "third", and display these commands in LED display. These commands are activated through a microphone that communicates with a microcontroller.

Introduction

Background: Speech recognition takes voice input, through a microphone or other devices, and it interprets the meaning of the word said. The idea is that the computer knows what kind of specific acoustic each word should have which it has learned during the process of training. There is a list of words which the speech recognition should recognize. Therefore, all the words willing to be used must be initially saved in the program.

Procedure : In order to achieve this, using the microcontroller, arduino Mega, connects a circuit with LED and LED display, and writes the code about opening the light and displaying the commands on the LED display. Then the analog signal is converted to digital. Next, the input signal is sampled using different filters, and the Fourier transformation will be applied on the sampled data. The Fourier transform has specific coefficients that were obtained during the training process. The Fourier Transform coefficients of each input signal is obtained and compared to the coefficients saved as reference during training process. Based on this comparison the meaning of each word will be recognized. The application we chose is to build a speech activated light system. The perspective of this project is to have applications in military/defense, entertainment and media industry.

Market :Speech recognition has a growing market where the demand is increasing rapidly. Different applications, where speech recognition can be used, become more demanding as the technology advances. Smart car manufacturer, healthcare equipment, mobile manufacturers, TV industry, defense industry, etc. are some examples of applications where speech recognition can be used.

Group Members

Advisor : Professor Glenn Healey (EE) /
Professor A. Lee Swindlehusrt (EE)

Group Members and responsibilities :
Jeremiah Baca (EE) : Team Captain, supervising on group members' work, software, hardware

Coco Gao (EE) : Updating project schedule, software, hardware

Garineh Shamirian (EE) : Scheduling meetings, software, hardware

Amir Saman Safari (EE) : Drone research, Circuit design, hardware

Approach

Applying speech recognition to a light system is forward thinking and progressive. A speech activated light system has many applications, including entertainment, military/defense, automotive, aerospace, and personal assistance, especially in SmartHome. People can control everything in the room by just saying it. Digital Signal Processing is on the rise in the tech industry, and our project is on the cutting edge of this technology.

Schedule and Milestones

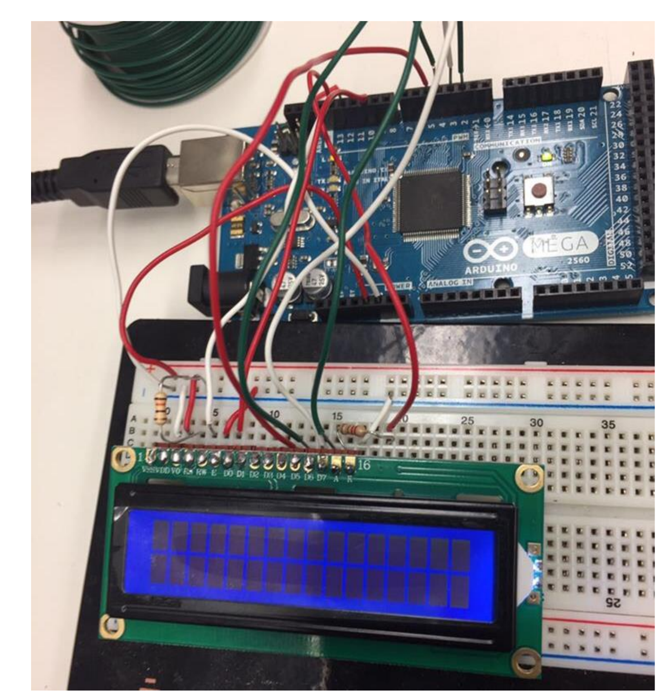
Process	Expected date
Initial research of mathematical theorems and needed devices	10/15/2016
Initial implementation of Fourier Transform in Matlab	10/30/2016
Training process of the signal in Matlab	11/10/2016
Testing Process of speech recognition in MatLab	11/20/2016
Implementing the software code from MatLab to microcontroller language ©	12/15/2016
Training Process of the microcontroller	01/07/2017
Designing a circuit for software to light Connections	01/20/2017
Software and hardware connection	02/05/2017
Trouble Shoot and Improvement	03/05/2017

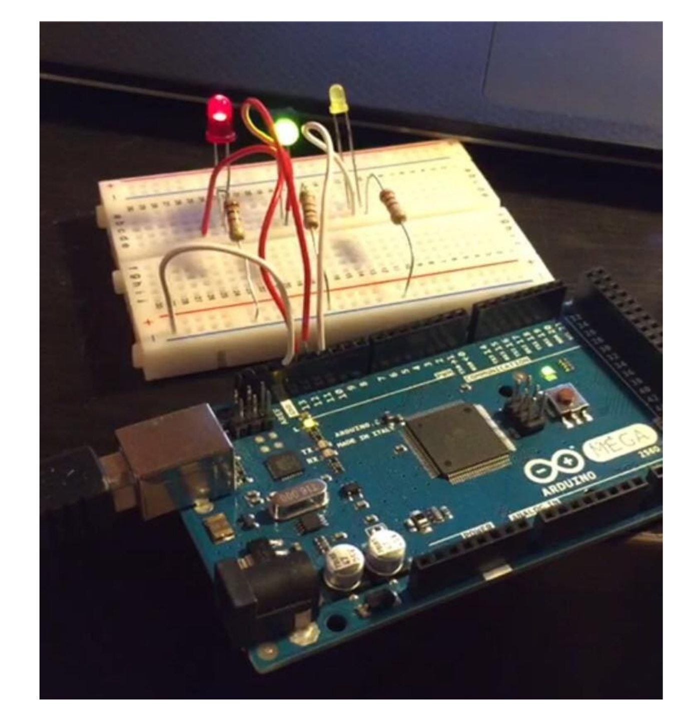
Progress and Current Status

We are working on the code for the speech recognition in Arduino IDE. This is our priority as of now.
The software has been researched first, and we have started working on the software development in the speech recognition which is our main part. In this part, we will apply the Fourier Transform into our project. In this case, if the microphone receives spoken words, it will convert it into a signal. The signal it receives will be the command to allow the lights on and off and display the command in the LED display. After that, we will test it and develop it more.

$$g(t) = \int_{-\infty}^{\infty} G(f) e^{i2\pi ft}\, df$$

$$g(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} G(\omega) e^{i\omega t}\, d\omega$$





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MYKV DRONE RACING

Villiami Vunipola, Jack Melcher, Taeyup Kim, Tyler Young
Electrical Engineering and Computer Science
Advisor: Professor Nadar Bagherzadeh
University of California Irvine

Mission Statement: An inexpensive drone design for optimal flight duration with a compatible tracking feature across different multicopter platforms .

Introduction

- Drone racing is an entertainment market on the rise.
- However market is still small, so there is opportunity for market expansion .
- Inexpensive drones with built-in compatible features across multi-platforms means user-friendly and bigger market

Team Members

- Jack Melcher (CpE) #67574625: Create Schematic and manages the hardware
- Tyler Young (CSE) #81654869: Programming software and developing it.
- Taeyup Kim (EE) #40403908: Managing power control system
- Viliami Vunipola (EE) #88365817: Design Electronic speed controller to reduce power consumption of motor and therefore increase flight time

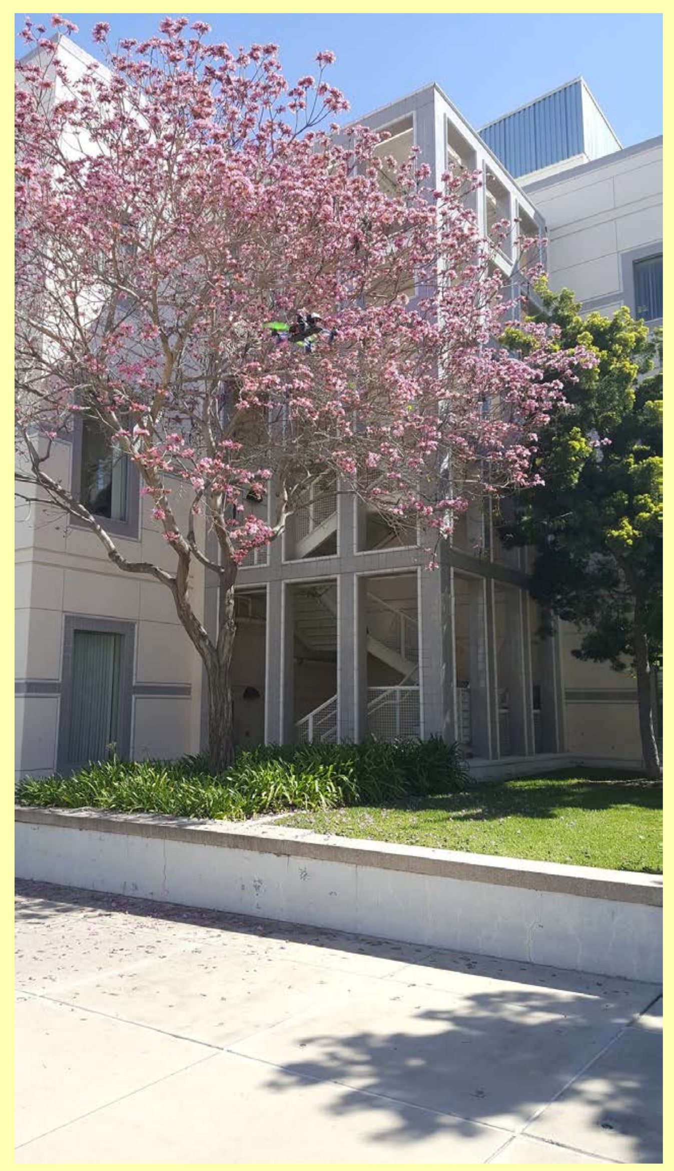
Website

http://srproj.eecs.uci.edu/projects/mykv-drone-racing

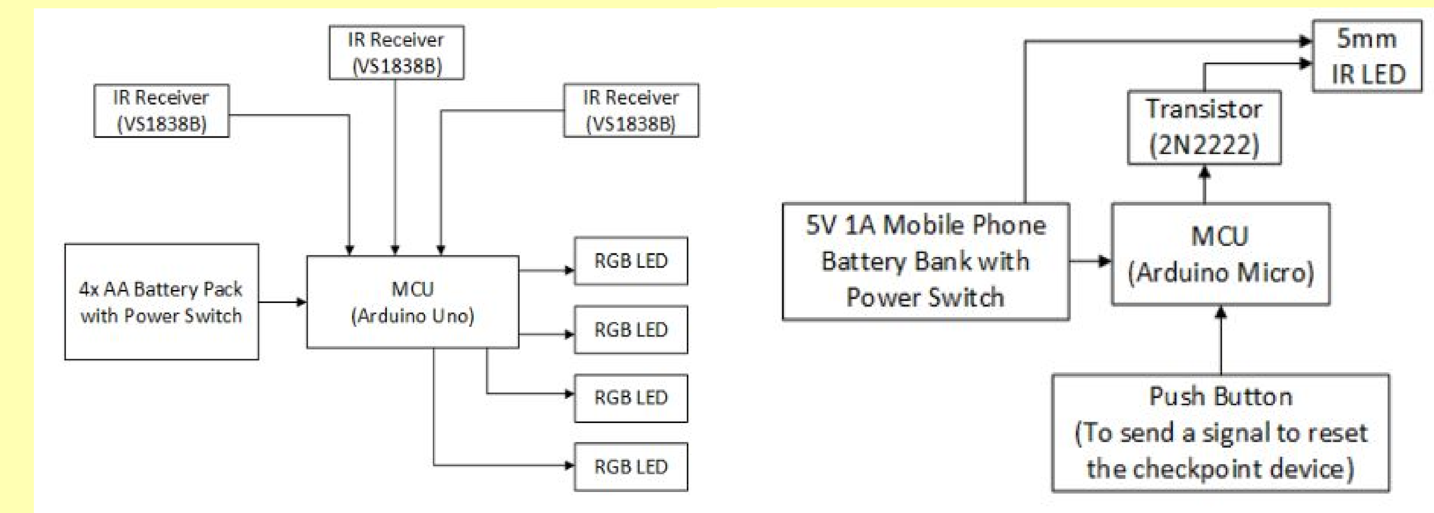
Approach

Using Arduino microcontrollers to power a checkpoint of infrared communication system. An infrared receiver attaches to the racing drone and track from a checkpoint on the ground using LEDs.

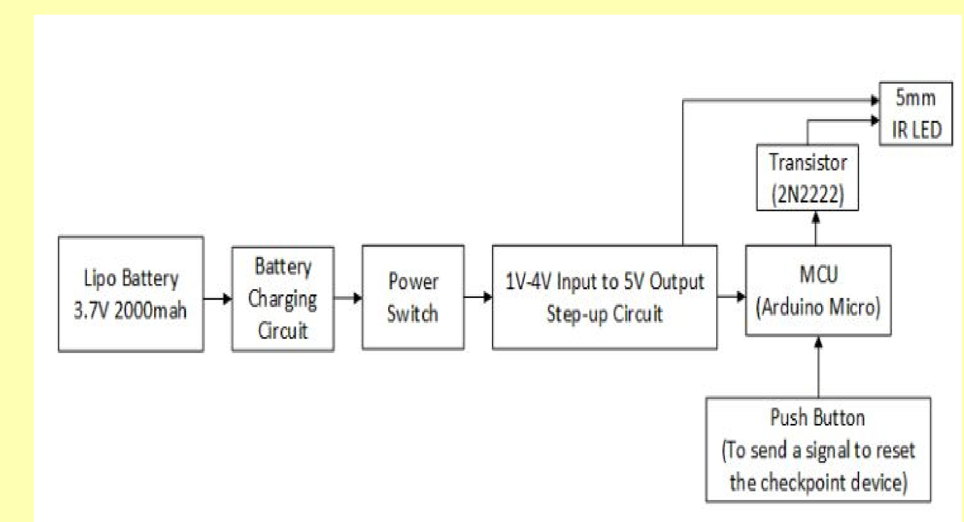
Pictures of Drone, Checkpoint system




Block Diagram of Checkpoint System

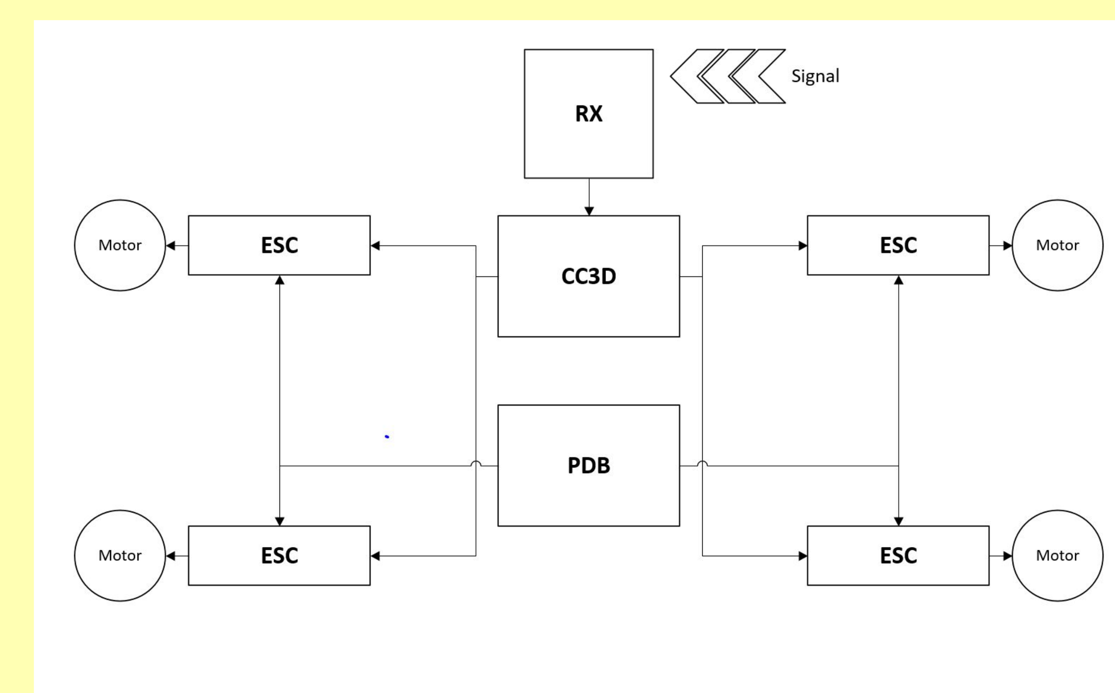


Block Diagram Checkpoint Device
Block Diagram Player Device B



Block Diagram Player Device A

Block Diagram of Drone



Block Diagram of Drone

Autonomous Personal Assistant (APA)

Cesar Hernandez (EE), Dominic Dong (EE), Jesse Inouye (EE), Tamir Hershko (EE)
Professor Henry Lee
Department of Electrical Engineering and Computer Science

Background:

The development and use of autonomous vehicles has become increasingly prevalent in society. While many of the popular applications focus on large scale transportation vehicles, less research has been performed in the applications for small scale autonomous movement. This project focuses on such applications, developing an autonomous platform with movement capabilities using Simultaneous Localization and Mapping (SLAM). This platform is able to navigate to any specified point within an enclosed area, while avoiding objects, mapping the space, and determining the most efficient paths. Creating a base of this type allows for upgrades and expandability only limited by the imagination.

Design Goals

- Autonomous movement from point A to B
- Object detection and avoidance
- Area mapping based on movement

Stretch Goals

- Higher weight bearing frame
- Web-app / IoT integration
- Information display (weather, schedule, etc.)
- Robotic arm attachment

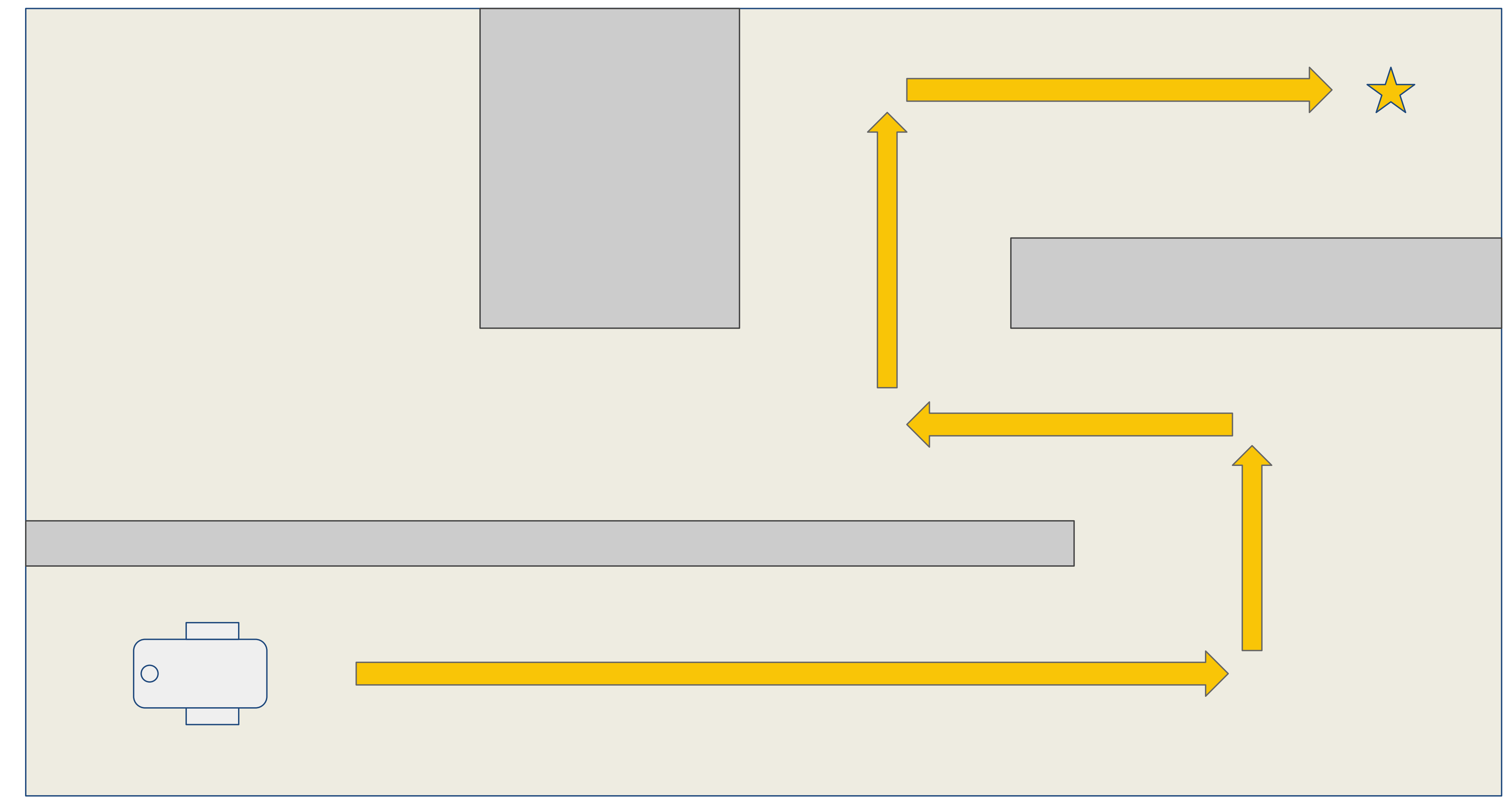
Approach

This project is segmented into three separate systems: movement, object detection / avoidance, and navigation.

Movement:
The platform utilizes a three wheeled design, with two forward motorized wheels (one on each side) powered by continuous rotation servos, and one passive caster wheel in the back center with the ability to rotate 360 degrees. This design allows the platform to turn 360 degrees while remaining in one place.

Object detection / avoidance:
Detection is implemented using a set of ultrasonic distance sensors, placed on all four sides of the platform. These sensors detect nearby objects as the platform draws closer, providing a general idea of the space around it.

Navigation:
By far the most complex system, navigation to a specified point is accomplished through signal trilateration using DecaWave DWM1000 wireless transceivers. Multiple transceiver nodes are placed throughout the room, with one on the platform, measuring the time between signal transmission and reception between each node. From the measured time, the distance from each node is calculated, and the vehicle's position is determined. Dead reckoning is used to map the navigated area upon movement.



Timeline

Fall 2016
- Design rover platform
- Create movement system
- Implement object avoidance

Winter 2017
- Signal trilateration
- Area and point navigation
- Dead reckoning mapping

Components used

- Arduino MCU
- Ultrasonic distance sensors
- Continuous rotation servos
- IR reflective sensors
- DecaWave DWM1000 wireless transceiver

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http://srproj.eecs.uci.edu/projects/group-32-robot-mobile-assistance

Alternative Tactile Display Using Granular Jamming

Leon Cao, Paul Dao, Niraj Patel, Kevin Truong
Professor Gillian Hayes, Mark Baldwin
Donald Bren School of Information and Computer Sciences

Goal: Produce an affordable, scalable, and DIY-able tactile display leveraging concepts of granular jamming

Introduction

Computers have opened up a whole new world of learning for students. For blind students, however, these advances have not improved their learning opportunities. In fact, in many ways, they have broadened the educational gaps between them and sighted students. To access the growing mounds of content and exercises required of them, they must first learn to use complex tools like braille keyboards and screen readers. To engage with learning materials in classes, special braille-based textbooks or e-readers that perform text-to-speech translation must be purchased. The visual aids that teachers commonly display on a whiteboard or screen for sighted students must be translated in some way for the children who cannot access them.

Translation of visual information to visually impaired individuals has been an ongoing challenge in research and industry for over thirty years. While audio (via speech recognition and text-to-speech) and tactile representations (via Braille Displays) of visual information work at acceptable levels for text, they are not suitable for graphics. Furthermore, graphical tactile displays, to the extent that they exist, are both expensive and complex, making them unattainable for all but a few classrooms.

The relative ease of communicating via text to speech combined with the high costs of refreshable braille displays has steered the blind and low-vision community away from tactile forms of digital communication. This in turn has had a profound effect on braille literacy. Recent estimates indicate that, among legally blind children in the United States, only 10 percent use Braille as their primary reading medium. Furthermore, low braille literacy has been shown to have a direct correlation with employment in adulthood. Just as the maker community has opened new markets for products like Arduino and 3D printers, we believe new, low-cost mechanisms through which tactile communication can be encouraged and enjoyed in childhood will have a lasting effect on the blind and low-vision community into adulthood.

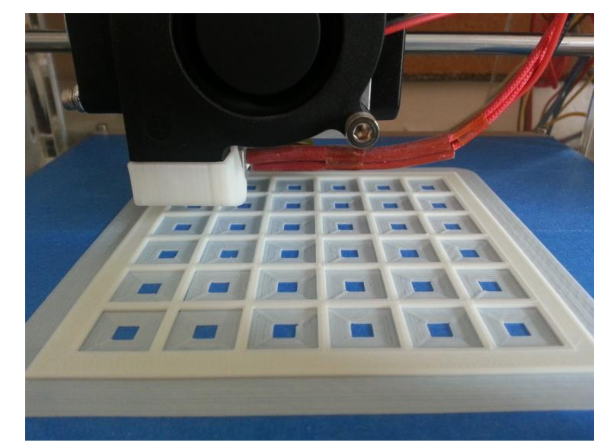
Team 33: General Tactile

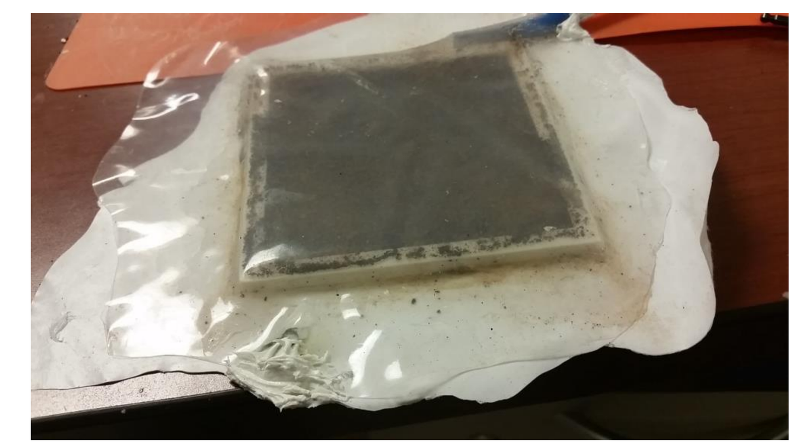
Member	Major	Responsibilities
Mark Baldwin (Advisor)	Informatics	Inspiration for original project idea. Provide materials and lab space to build prototypes.
Leon Trinh Cao	CSE	Research and develop mechanical structure. Design and program control systems for display and XY platform.
Paul Vinh Dao	CSE	Work on embedded programming to control XY platform. Work on image processing software.
Niraj Patel	CSE	Work on software for XY platform and air flow control system. Work on image processing software.
Kevin Truong	Engr. EE	Assist in implementation of XY platform. Work on control system's circuitry.

Find us on http://srproj.eecs.uci.edu/projects/alternative-tactile-display-using-granular-jamming
Contact us at msbaldwin@gmail.com or gcao@uci.edu

Implementation

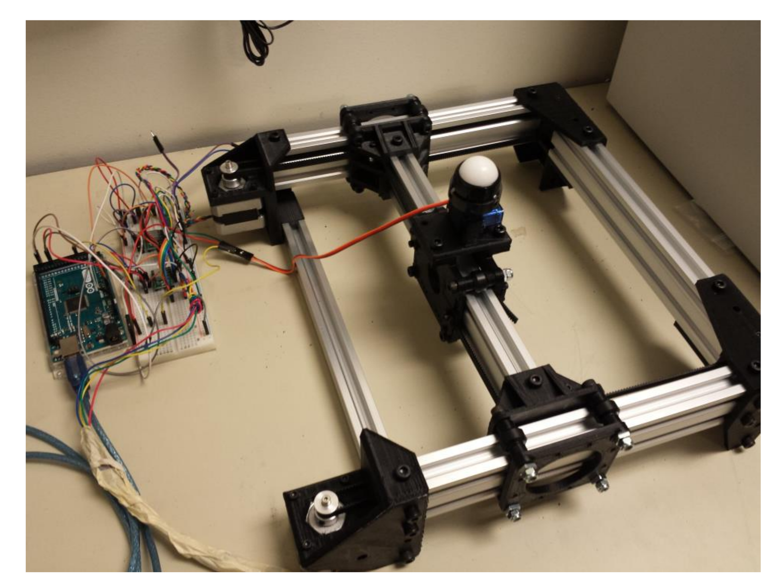
Affordability, scalability, and DIY-ability are the primary goals of this project, so all required components must be easily acquired or assembled via 3D printing and off-the-shelf parts from makerspaces or hardware stores. As such, the tactile display only consists of a simple 3D-printed frame as well as spent coffee grains, sealed airtight between sheets of silicone caulk.

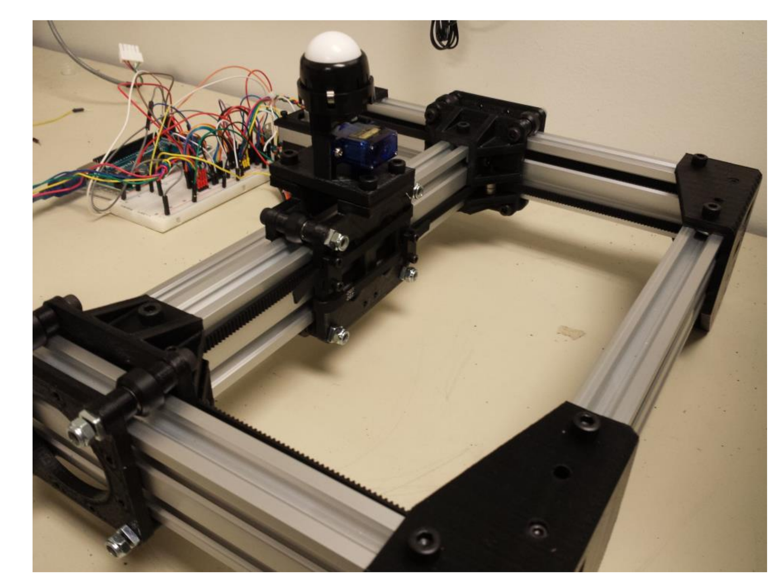

3D-printed support structure

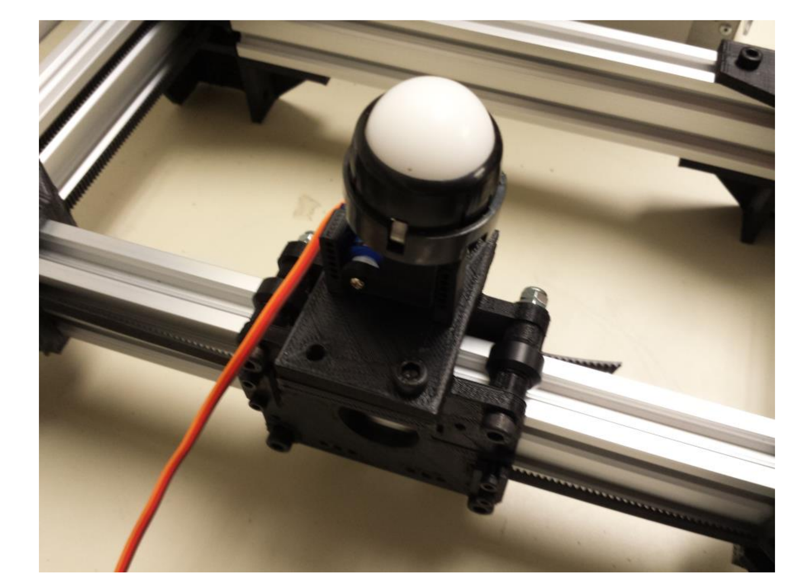

Unjammed display prototype


Jammed and imprinted display prototype

After every cell in the frame has been filled with coffee grains, raised surfaces are created by evacuating air from the display and externally pressing against the grains. Specifically, when jammed against each other due to the lack of air, the grains create sufficient friction with each other to overcome gravity. The durable and flexible silicone provides moving room for the grains in the jammed state, thus making it possible to create raised surfaces on the display. Additionally, any shape created in the jammed state stays until air is reintroduced. Furthermore, by its elasticity, the silicone restores the original display shape when air is reintroduced, un-jamming the grains and clearing any imprinted pattern.


Overview of XY platform prototype


Side view of XY platform prototype


Closer look at imprint trackball

A computer-controlled XY platform is used to automate the process of imprinting display cells. Before a tactile image is created, an air pump activates to evacuate air out of the display and jam the grains. To imprint a pattern, a ball caster is rolled against a layer of pinheads stationed directly below the silicone display, providing a contour of raised surfaces. To clear an imprinted pattern, another air pump activates to reintroduce air into the display, unjamming the grains and restoring the original flat display shape.

Ultra-High Energy Neutrino Detection System

Team Enginuity | Asif Mahmud | Brendon Salinas | Daniel Pedroza | Spielberg Michel | Adviser: Prof. Stuart Kleinfelder

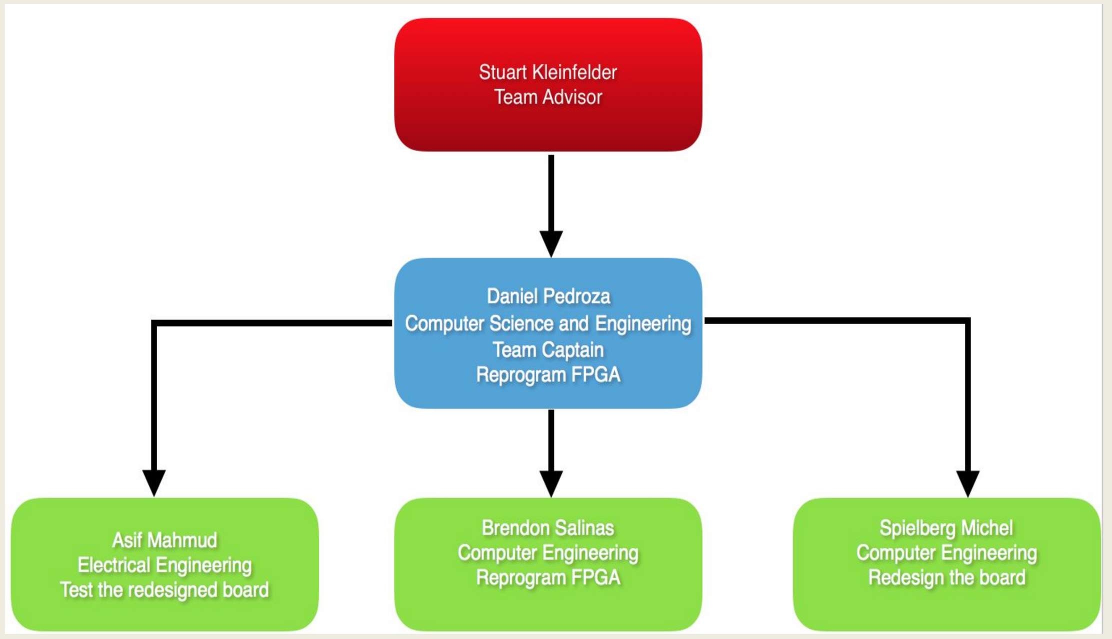
Project Goal

The primary goal of our project is to observe ultra-high energy cosmogenic neutrino signatures. It senses radio emissions of 100 MHz to 1 GHz and is used to detect radio waves originating from high energy neutrino interactions with the atoms in the ice.

Introduction

The neutrino detection system is part of larger hexagonal radio array comprised of seven stations. Each system in the array contains RF antennas with 4-channel receivers, amplifiers, an embedded CPU to process received data, 32GB SSD storage and a 20 Ah $LiFePO_4$ battery for power.

Team Members



Approach

The current board that is being used only supports 4 channels. Increasing the number of channels to 8 without exceeding a board size of 8.5 inches is the challenge with this project.Along with increasing the number of channels, the Spartan FPGA would be upgraded in order to have more processing power as well as more ram.

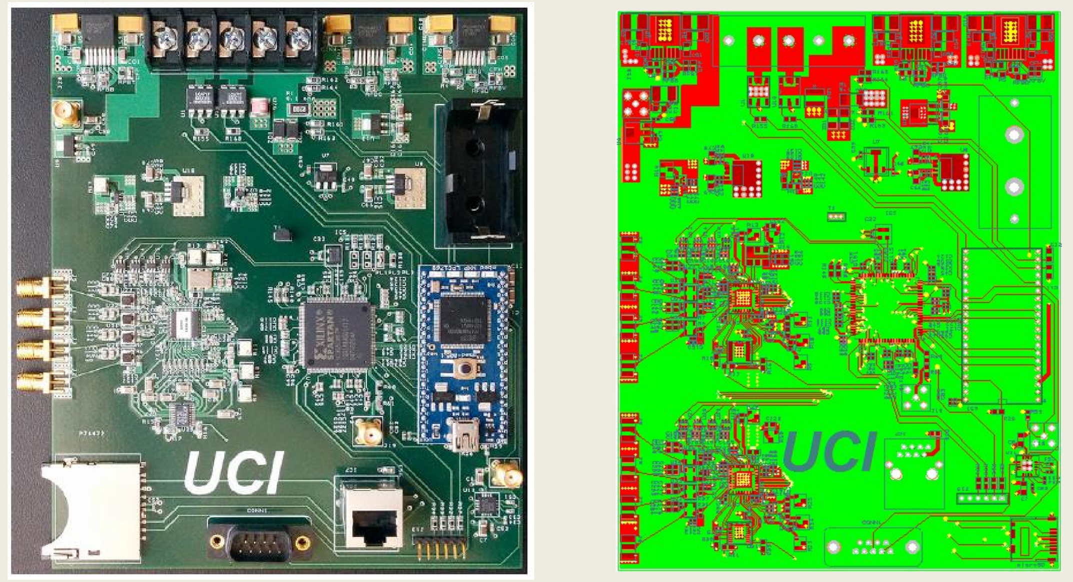
Schedule 1

The first goal of the project is to finalize the design of the new board with the additional FPGA and other adjustments. This is to be accomplished utilizing tools such as PCBArtist to map out the different components and their connections.

Schedule 2

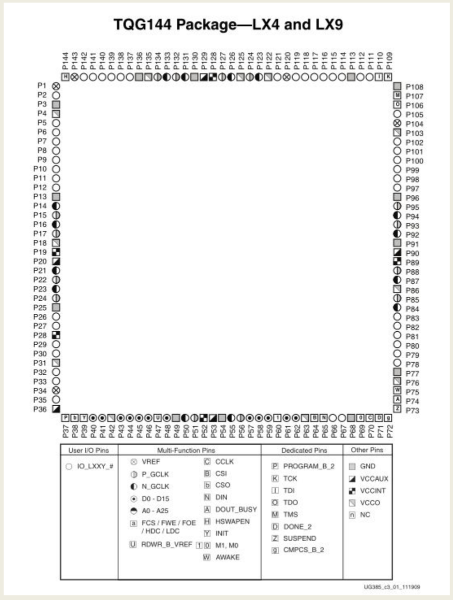
The second part of the project would be verification of the fabricated board designed after Schedule 1. This would involve detailed testing of the modified board to validate the design is functioning properly with the new FPGA and 8 channels added.

Progress & Current Status 1



The previous board (left) and the updated board layout (right) are shown side-by-side.

Progress & Current Status 2



The pin layout for the spartan 6, devices LX4 and LX9 using package TQG144. It is fully compatible with our current board design. We have decided to upgrade to the Spartan 6 XC6SLX9.

Progress & Current Status 3

After upgrading the board to 8-channels of data acquisition capability, we have made necessary adjustments to some components of the board in order to accommodate the increase in data processing volume. We have modified the width of the differential clock wires to maintain a 100Ω impedance. Thus, the clock would be able to drive the DACs at 1GHz.

Progress & Current Status 4

After extensive research of the different upgrades and datasheets available we have made some key decisions for components such as utilizing a MicroSD Slot and External Flash Memory as well. The next step is seeing that the board is properly fabricated.

Upgrades To Be Made

- Fully upgrade to Spartan 6 FPGA
  - Pinout compatibility has been finalized
- Add SPI Flash chip to handle data storage externally
- Upgrade to longer analog inputs
  - Allows easier access to the antenna inputs

For More Information

Website and qr code for url:
http://srproj.eecs.uci.edu/projects/group-34

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Daniel Pedroza daniel@thex1.com
Spielberg Michel spielbem@uci.edu

Garbage Processing Unit (GPU)

University of California Irvine

EECS Senior Design

Goal statement: The goal of this project is to design, fabricate, and program a fully automated trash collection robot.

Introduction – We aim to create a mobile autonomous robot arm that can help clean up our environment one can at a time. Our arm utilizes cameras to help detect and navigate toward an object of interest (soda can, bottles, etc). Once our arm reaches the object, it will proceed to collect and dispose of the item in question.

Team Members	Major	Responsibilities	Advisors
Steve Cho	Electrical Engineering	Project Manager Researcher (Materials) Robot Arm Mechanics (Arduino)	Dr. GP Li Linyi Xia
Takahiro Ishikawa	Information and Computer Science	Manufacturer (Laser Cutting + 3D Printing) Robot Arm Mechanics (Arduino)	
Michael Wegener	Electrical Engineering	Image Processing (Raspberry Pi) Communication	

Approach - This robot will be fully designed and built at UCI using lab resources available in Calit2. It will be autonomous and run off of battery power. The software will have the ability to scale, allowing for the robot to collect many different types of garbage. The robot arm will be controlled using an Arduino. The image processing will be done using Raspberry Pi and the OpenCV library. Communication between the mechanics (arm + mobility) and the image processing will be done using I2C.

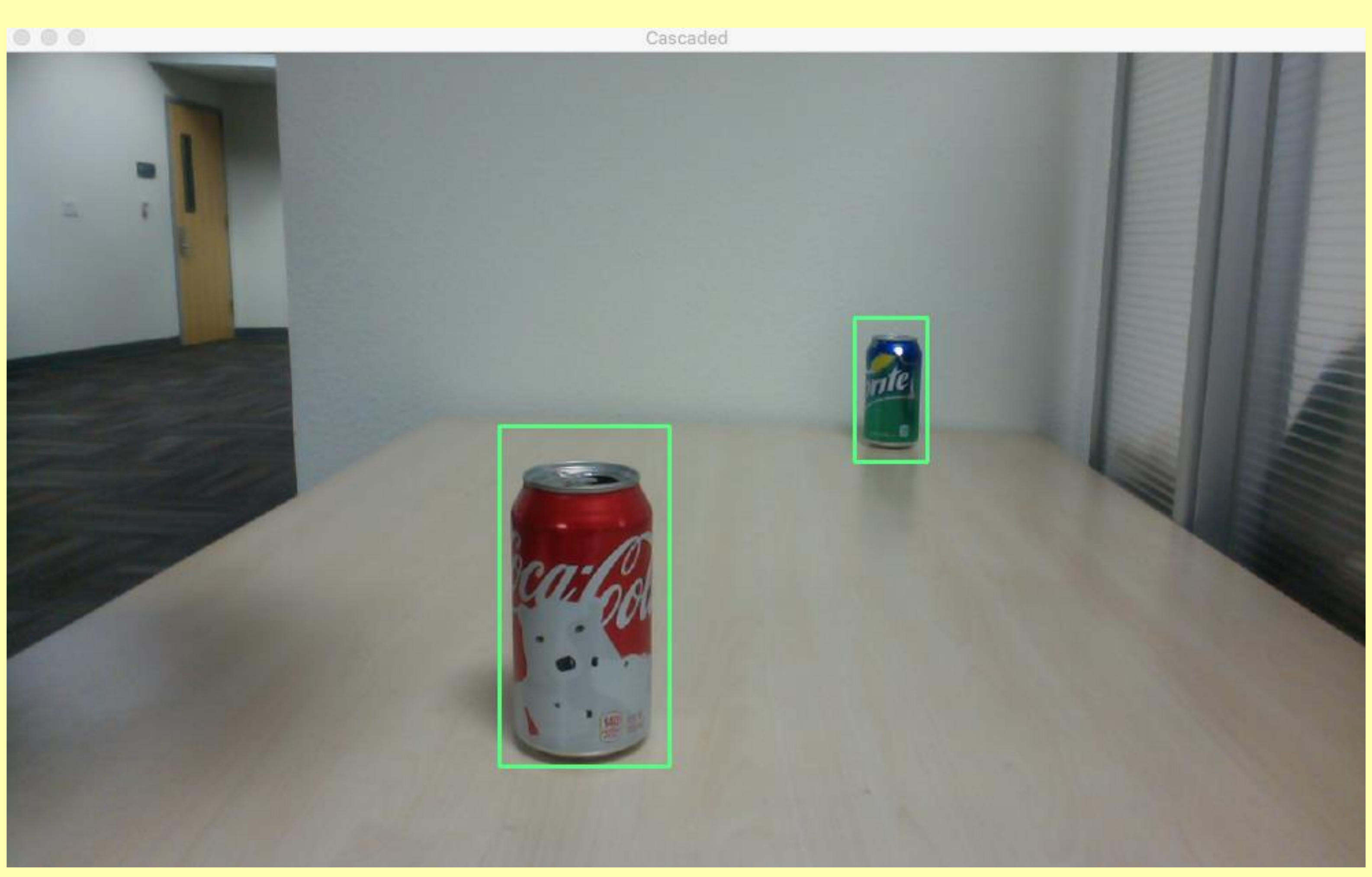
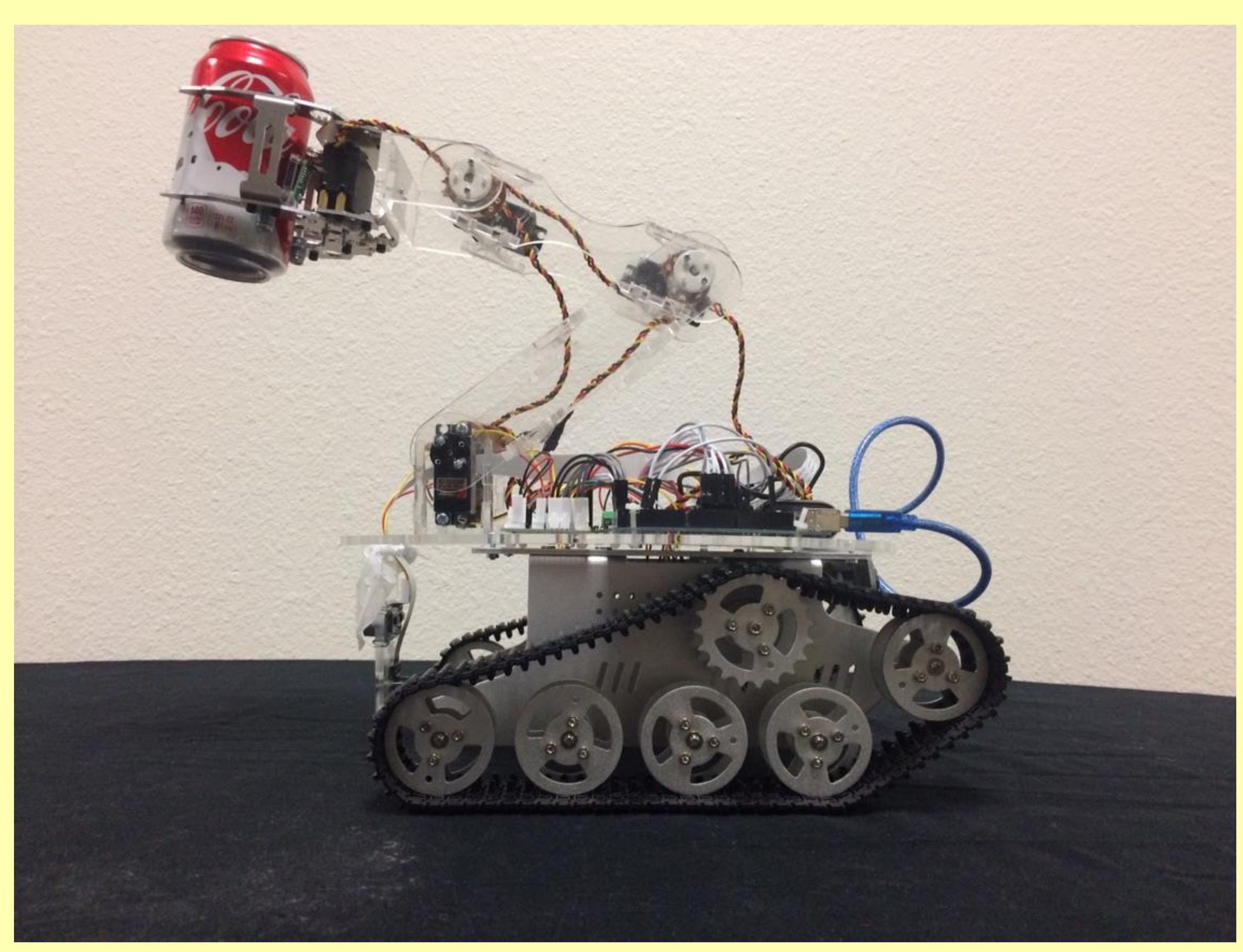


Image processing: Object detection



Garbage Processing Unit

http://srproj.eecs.uci.edu/projects/project-group-35-garbage-processing-unit-gpu

SCALE

Project # 36 - Tina Li (CSE), Karen Chu (CSE), Alejandro Bustelo (CSE)
Professor Nalini Venkatasubramanian (PhD)
Department of Electrical Engineering and Computer Science

Goal: To help communities leverage low cost Internet of Things (IoT) devices to increase the community's safety and convenience.

Background

Scale is an Internet of Things project being worked on by UCI faculty and PhD students along with other universities and organizations. The project involves using low cost computing with sensors to detect real world events and react in appropriate ways. This may be anything from calling the firefighter when a fire is detected to detecting an earthquake and alerting emergency response. This project is aimed at small and low income communities.

Work on our project predates our involvement. Past work by other project members has led to multiple sensors being implemented, different sensor combinations being tested in the field, and a large code base being developed. There are currently Scale boxes being field-tested.

Our contribution to the project is to use a combination of sensors to take air quality readings in areas affected by wildfires and present the collected information to end users via a web portal.

	Software/Programming	Hardware/Sensors	Provide Guidance
Tina Li (CSE)	X	X	
Karen Chu (CSE)	X	X	
Alejandro Bustelo (CSE)	X	X	
Nalini Venkatasubramania (PhD) and Qiuxi Zhu (PhD Candidate)			X

We all worked as a team on getting the sensors to take proper readings and as we got that done, we researched and got the web aspect working as well. Qiuxi Zhu helped us with issues relating to using the existing infrastructure (MQTT server, code base, etc.)

Milestones

- Familiarize ourselves with codebase
- Determine sensor to add - create SCALE boxes
- Write code for specific sensor application
- Create web interface to display collected data
- Deploy on ZotWheels and collect data

Major review dates: December 9, 2016, February 10, 2017, March 10, 2017

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Scale website: http://scale.ics.uci.edu/
Project website: http://srproj.eecs.uci.edu/projects/project-group-36-scale
Email: team7leaves@gmail.com

Cross-sensor Activated Data Processing for Urban IoT Systems

Team 37 - Tomohiro Ohkubo CSE, Krystopher Mandujano CSE,
Noah Correa CSE, Daniel Cheng CSE - Advisor: Prof. Marco Levorato

I. Goal Statement

Our objective is to demonstrate an architectural implementation of low-bandwidth, high quality audio-visual stream processing for the purpose of high-level data analysis in urban environments. Through this we aim to enable more efficient and effective metric collection for the better distribution and administration of public resources.

II. Introduction

Modern urban developments are making increasingly heavy utilization of technology to better manage and inform the usage of public resources, such as transportation infrastructure and mixed-use commercial spaces. With the growing needs, costs, and complexities of community resource administration, intelligence gathering and data surveillance will experience the growth to meet these demands for efficient and cost-effective urban planning initiatives. The primary market would thus be the public sector and other governmental agencies.

The project we propose aims to use energy efficient sensors to trigger video data collection in remote nodes. Computer vision/machine learning processing of the data can then occur locally and/or on the network edge servers to minimize power and bandwidth usage when conducting studies. This will allow urban planners to make better use of public resources, increasing the quality of services offered to citizens while also reducing the operational costs of public administration. This could be used for automated crime monitoring/reporting, and traffic/public space congestion monitoring,

III. Team Organization

Advisor Prof. Marco Levorato		
Student Name	**Major**	**Team Role & Responsiblities**
Tomohiro Ohkubo	CSE	Technical Documentation, Data Streaming/Analysis, OpenCV Research
Krystopher Mandujano	CSE	Hardware Integration, Data Streaming/Analysis, OpenCV Research
Noah Correa	CSE	Project Webmaster, Data Analysis, OpenCV C++ Research
Daniel Cheng	CSE	Task Delegation, Hardware Integration, Data Streaming/Analysis

IV. Approach

Our innovational focus is centered around real time data streaming, data analysis/mining, and exploring the applications of computer vision/machine learning in networked embedded systems.

V. Schedule

October 2016
- Webcam to internet livestream research begins
- 5fps/240p video streaming achieved using single Raspberry Pi 2 and HP webcam

November 2016
- 30fps/480p video streaming achieved using UV4L streaming server and Logitech C525 webcam/Raspebrry Pi Cam
- OpenCV research and integration begins

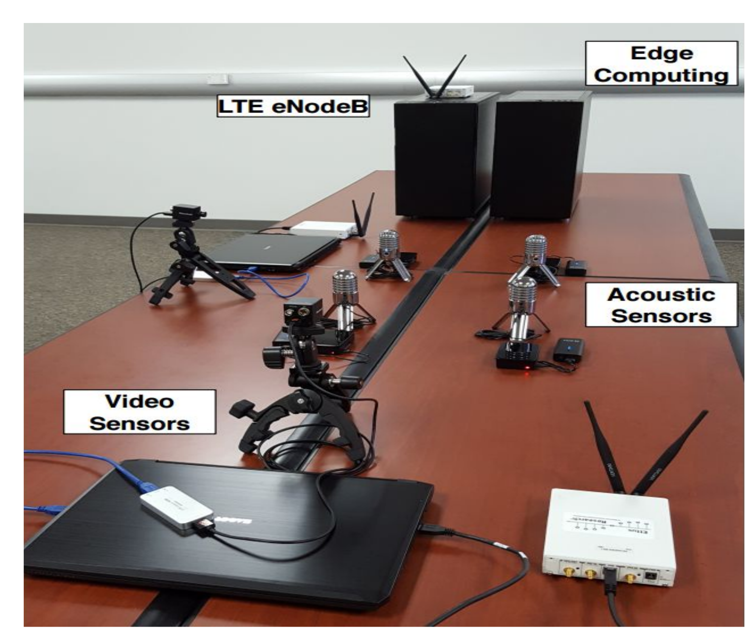
December 2016
- Networked streams research using teams' 4x Rapsberry Pi 3/webcam setups
- Complete audio/motion sensor trigger scripts for recording data streams

January 2016
- Start integration testing with Prof. Levorato for high definition audio/visual streams
- Investigate edge processing integration and network server communication with CV/ML data mining

February 2016
- Complete integration work on high defintion steams and build on edge processing capabilities

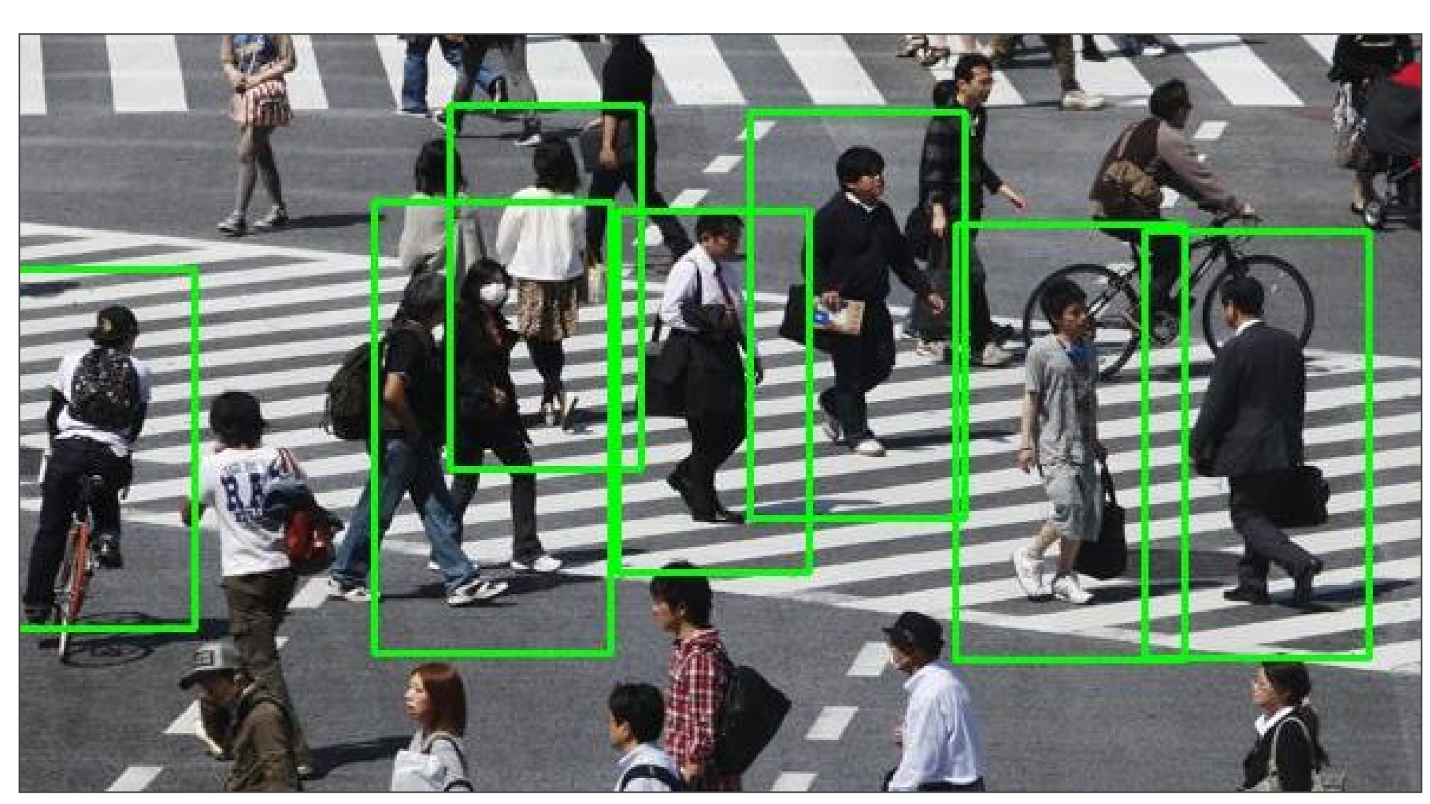
March 2016
- Finalize and generalize edge processing architecture with variable stream nodes

VI. Progress & Current Status



Our current video streaming implementation utilizes a Raspberry Pi 2, a Logitech C525 webcam, and a Raspberry Pi Cam for testing purposes. And can be interchanged with higher definition audio/video capture devices.

The software portion utilizes OpenCV and Haar cascades to identifiy and track pedestrians.



VII. Project Website

http://srproj.eecs.uci.edu/projects/cross-sensor-activated-data-processing-urban-iot-systems

Tennis Ball Collecting Toy Car

Jiajun Hu(EE) Yuxiang Zhao (EE & CPE) Miao Yu (CPE) Zunwen Li (CPE)
Advisor: Henry Lee
Department of Electrical Engineering and Computer Science

Introduction & Background

The purpose of our project is help tennis players with their training.
During tennis trainning, players may use many tennis balls, and it is tedious to recollect all the balls manually.
Therefore, we want to design a toy car to help players collect tennis balls.

The market should be considerable because although there are some similar product on the market, but all of them still requires manual operations. If we can collect the balls automatically, we should be able to sell for a better price.

Goal Statement

Our toy car can turn around to detect tennis balls on a tennis court, then, it will find an optimal path to approach the ball.
Then, the toy car will use its collecting apparatus to put the balls in its temporary box. After the box is full, it will put the balls back to a larger collecting box, so that the players can reuse the balls again

Team Organization and Tasks

Yuxiang Zhao (EE & CPE):
1. Build a toy car with basic move/rotate functions
2. Program to find optimal path to approach the balls/collecting box after detecting balls and collecting box.

Miao Yu (CPE):
1. Program to recognize balls and collecting box
2. Program to find optimal path to approach the balls/collecting box after detecting balls and collecting box.

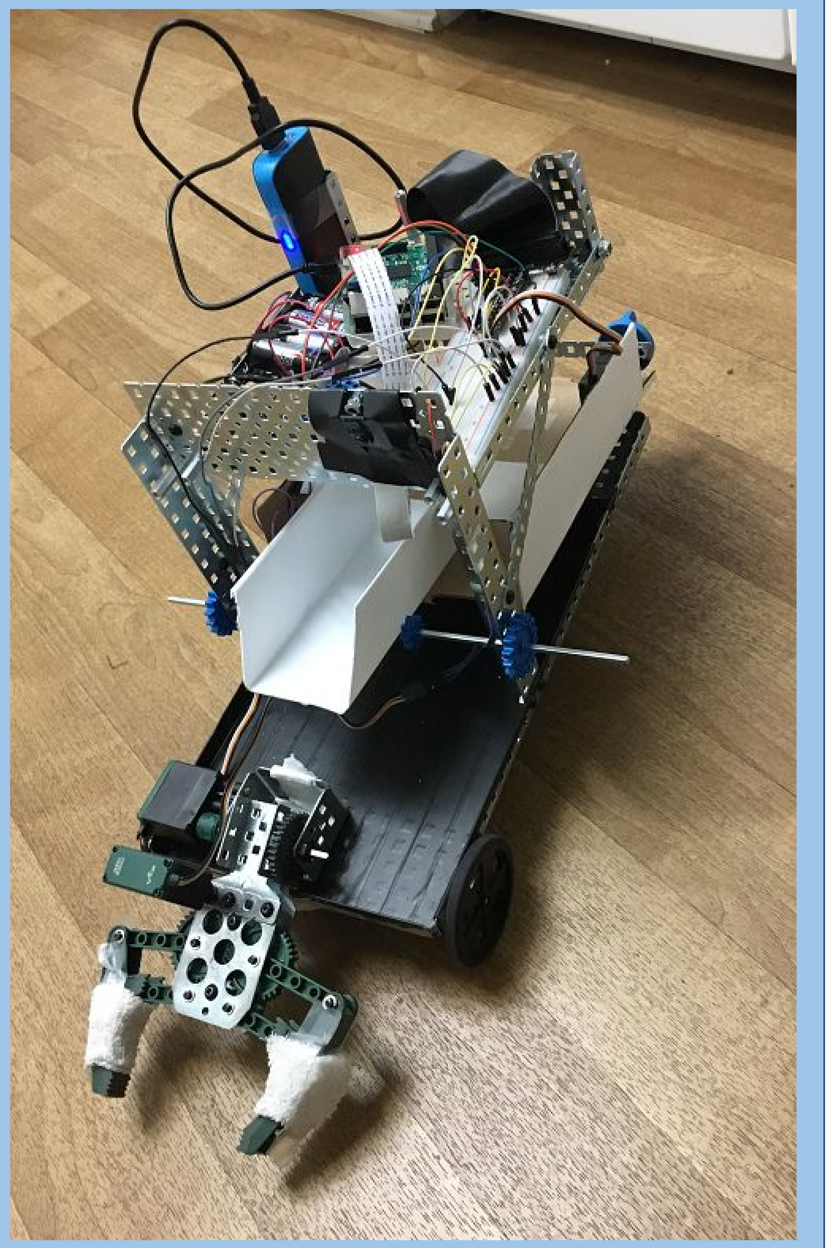
Zunwen Li (CPE):
1. Build an apparatus to put balls from temporary collecting box to a larger collect box and program it.
2. Solve any space, weight, and power issues

Jia Jun Hu (EE):
1. Build Ball collecting apparatus and program it.
2. Test and Optimize the project

Advisor: Henry Lee
Help us with technique problems, give suggestions.

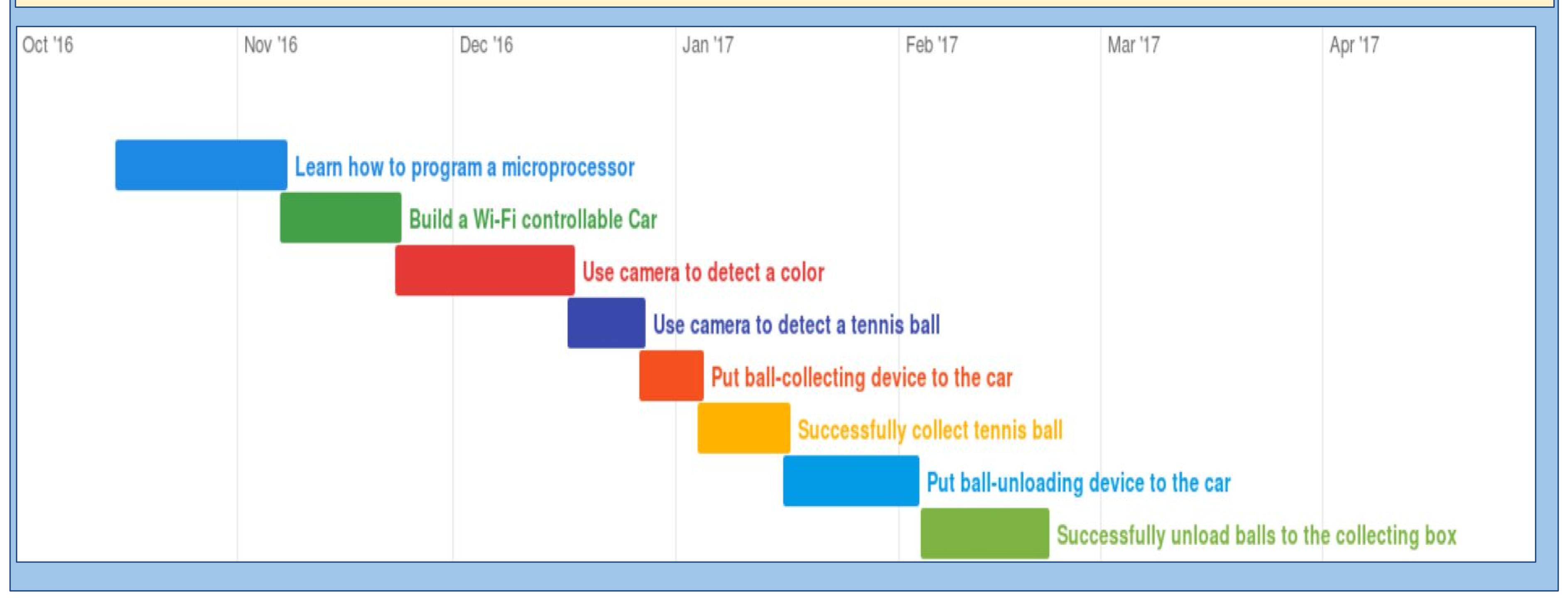
Approach

1. Purchase several steel plates and cut them into planned shapes
2. Purchase needed electronic components, like motors, servos, etc.
3. Connect electrical motors to a microprocessor(raspberry pi 2) for control
4. Write codes and program the microprocessor, so the car can move and turn
5. Connect a camera to the microprocessor
6. Use the data from the camera to detect balls
7. Program the car to move toward the ball
8. Add a ball-collecting apparatus(Vex Robotic Claw) to the car
9. Program to move the car near the ball and use the ball-collecting device to collect the ball
10. Add a ball-unloading apparatus to the car
11. Program to move the car near the large collecting box and unload all the balls



Product Image

Timeline



Progress

1. Established first stage ball detection application using the algorithm by F.Yan, W.Christmas and J.Kittler. We first modified the face detection code of one of our teammates for his EECS 113 project. Then we research online and find there is a OpenCV library that can help us train the application. Our application is able to detect balls using the compatible raspberry Pi camera. However, the accuracy and speed is not good enough. In addition, we are trying to increase the capture speed of our camera.

2. Building a Wi-Fi controllable car with several components bought from Microcenter. The goal of our control program to control the car making specific movement at an adequate speed. We get a L298N drive controller to do the job, which works well.

3. We upgrade the code to detect multi balls and select the nearest one to pick up. We also build the claw and the unloading track to build the whole pick up system.

4. We upgrade the code again along with several identification dots to detect the large collecting box, which contains color and figure identification and specific caring moving process.

Website & Contact Information

http://srproj.eecs.uci.edu/projects/group-38-project

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SmartHome

Jiawei Gu, Hao Tang, Le Yu, Yuting Tan
Marco Levorato
University of California Irvine

1. Goal statement & Introduction

Our senior design project is called Smart Home. The idea is that we designed an intelligent home **IoT** system which includes outlets, switches, front door camera and other sensors that can be connected to local network. On top of that, we build a chatbot running on the Facebook Messenger, serving as an exclusive home assistant who helps our users to take control of all the IoTs in their homes by talking directly to the chatbot through natural language. Moreover, we have our servers running on the cloud which aggregate all the information from home IoTs and based on the information, they can do facial recognition, automatically open the front door and data and user analysis.

2. Approach. innovations in the UCI design

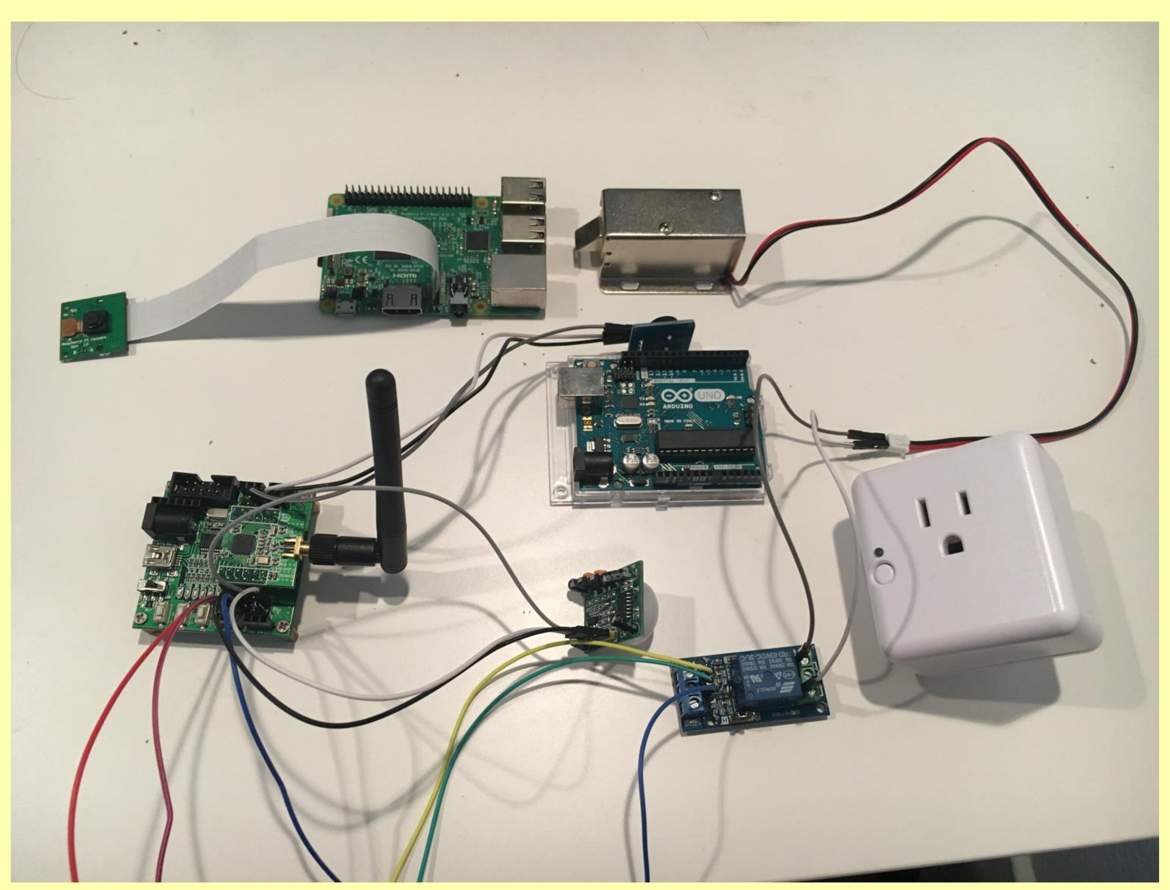
We integrate some of the most popular technologies now being widely used in the industry, **face recognition, natural language processing and machine learning** to provide people with all the conveniences these outstanding technologies can bring to their lives. The whole system is intelligent, user-friendly and the most important, the flexible machine learning mechanism enables it to develop with time when we gather more and more from the users. It is personalized and secure, for which we encrypt all the information where Internet communication happens.

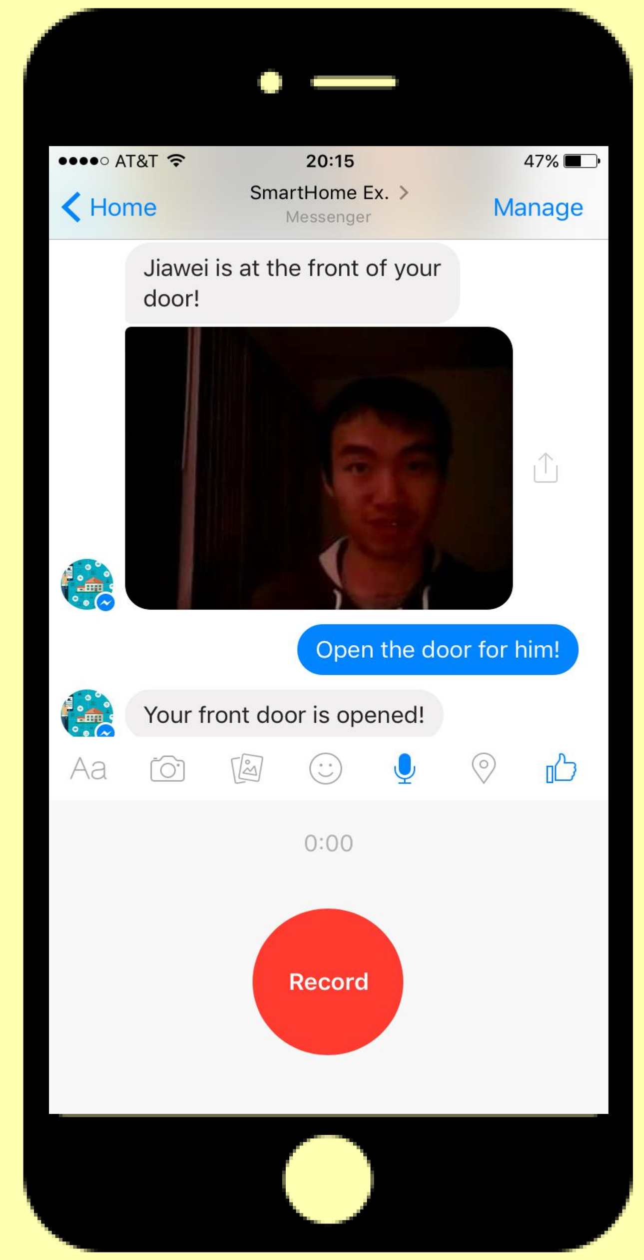
3. Conclusion

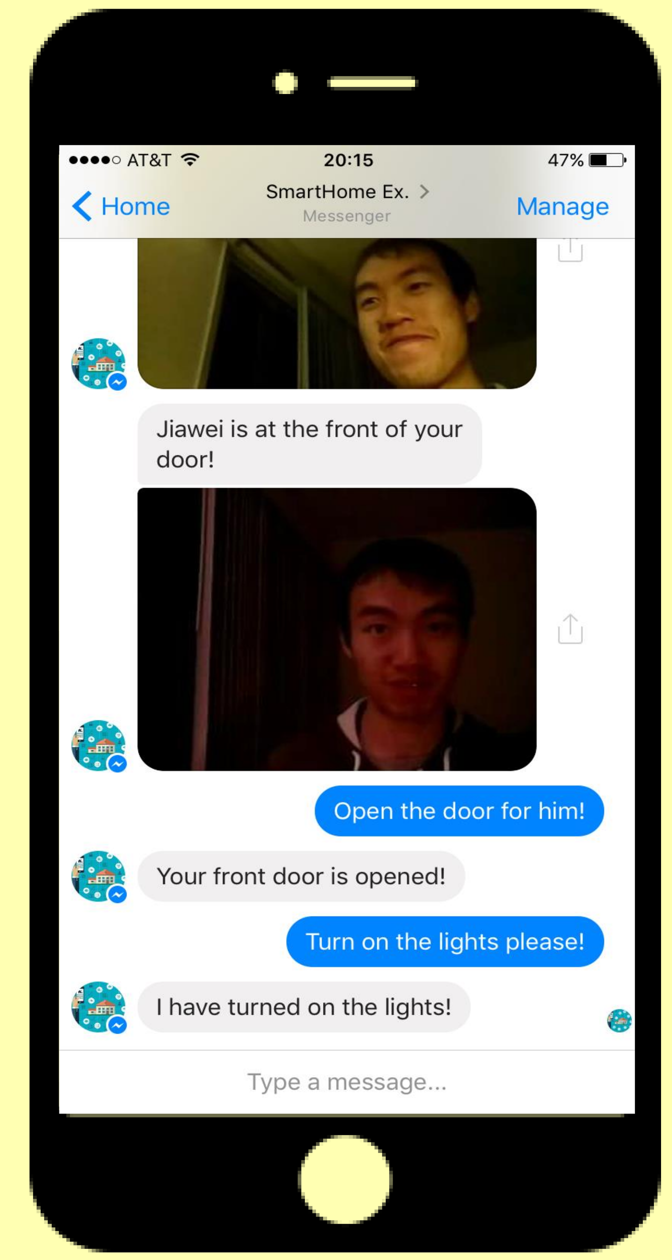
We have already finished building the server, application, and hardware. The whole system is ready to be used by our customer.

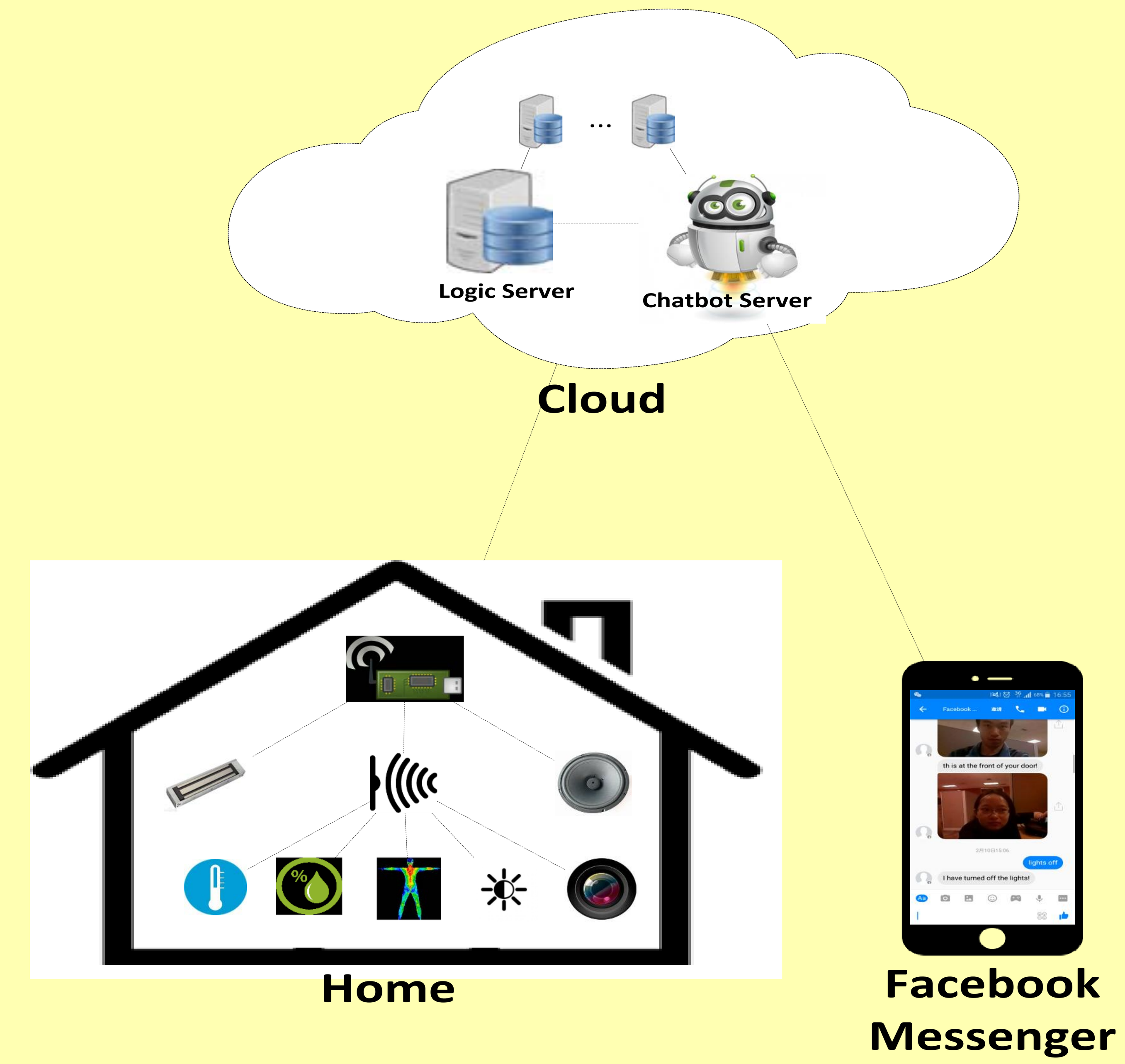
4. Include a website address and contact information for those seeking to learn more about the project.

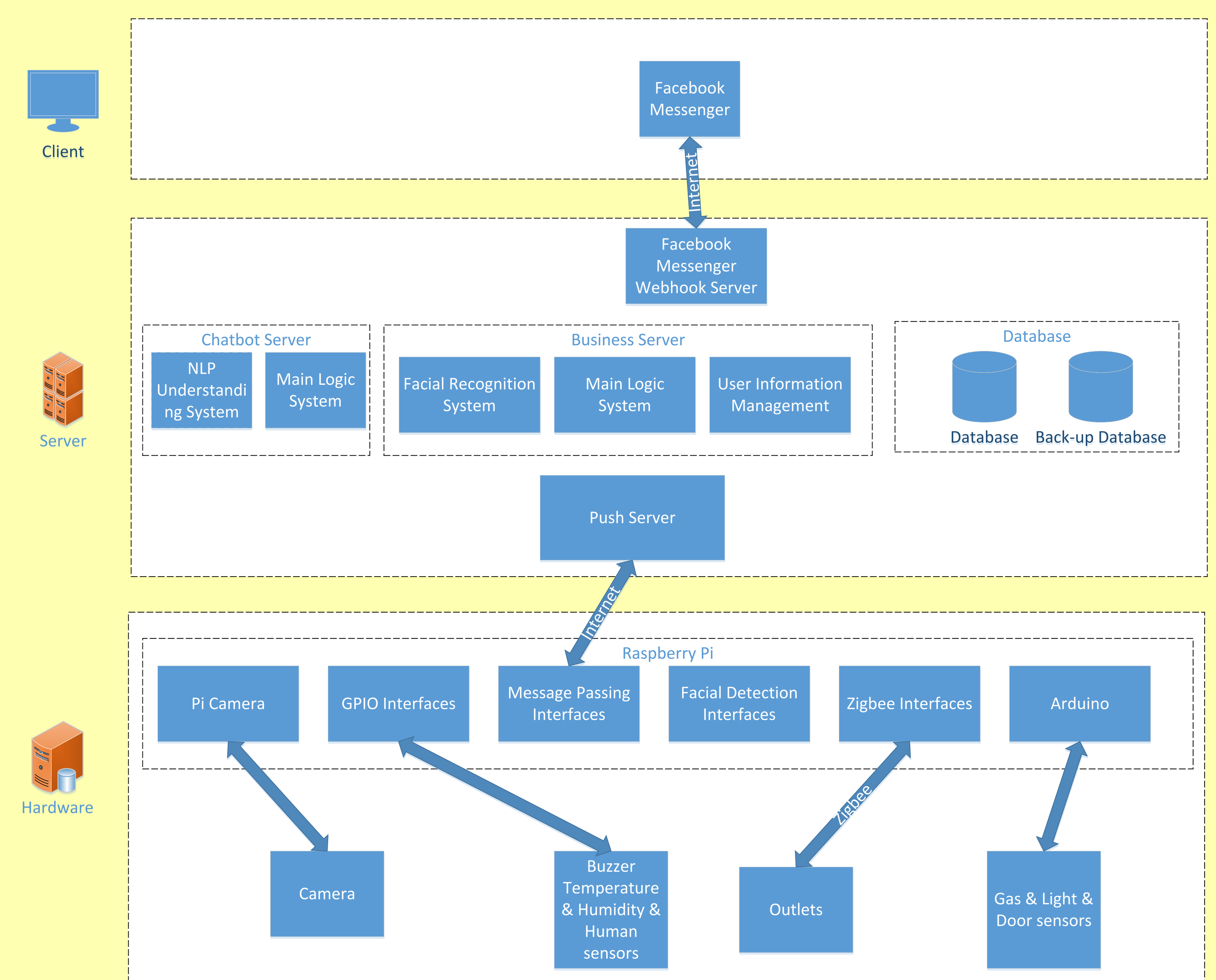
http://srproj.eecs.uci.edu/projects/project-39-smarthome











- The above figure shows the whole architecture of our whole system progress. Home IoTs collect data and information and securely send information to the cloud on which utilizes the powerful cloud computing resources, to make decision, and notify the users. The user interface is extremely simplified for users to use only text or voice message.

- The left figure is a vertical decomposition of our system which shows the communication between modules and the indispensable modules that makes up the intelligent system.

HyperXite Optical Position Tracking System

Team 40: Charleston Tran, Colton Christiansen, Zachary Rawlings, Arash Asgarinejad, Justin McKibben
Professor Ozdal Boyraz
Department of Electrical Engineering and Computer Science

Goal: To create an optical laser guidance system which allows the SpaceX Hyperloop pod to accurately detect its linear position in the tube. The data will then be used to initiate the braking system to slow the pod to a complete stop before reaching the end of the track.

Team Members:

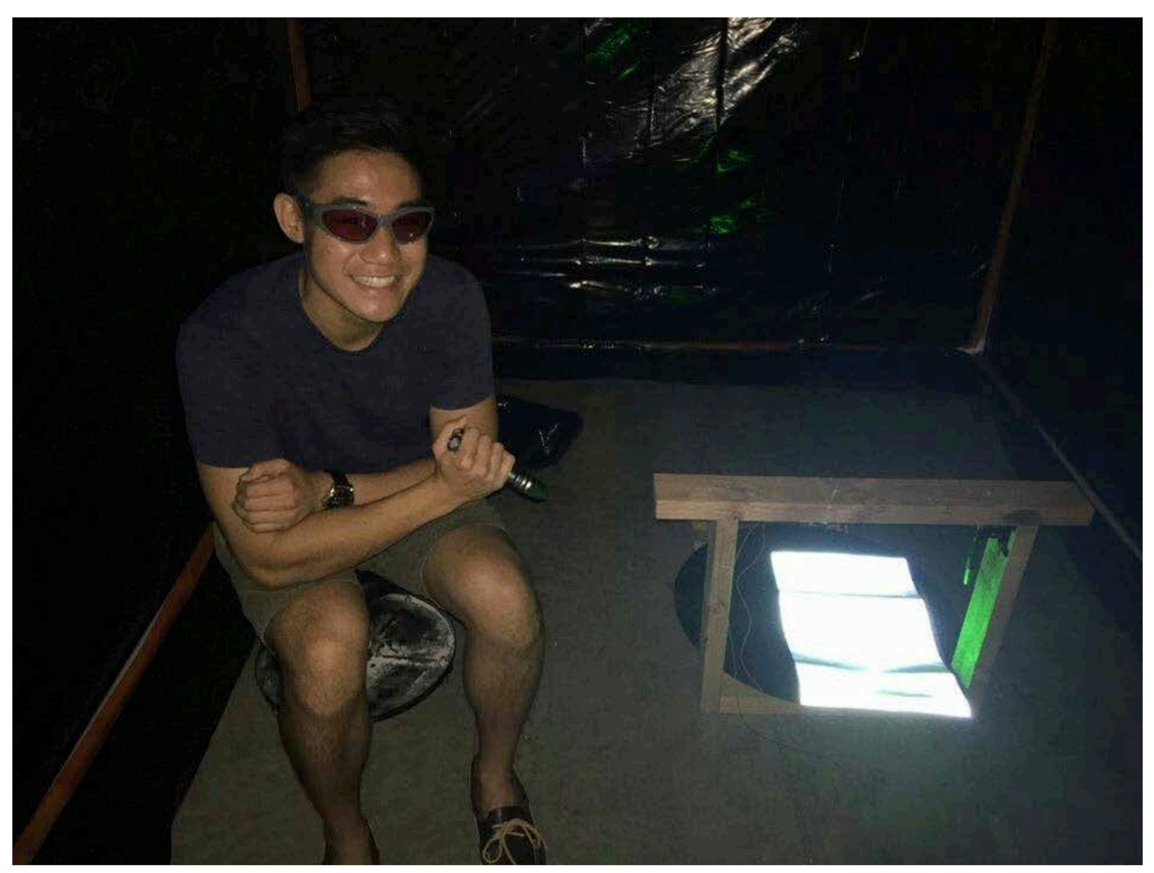
Team Lead: Charleston Tran (EE)
- Work with both subteams to unify hardware and software aspects
- Implement backup braking system in case of failures

Hardware: Colton Christiansen (EE), Zachary Rawlings (EE)
- Design and test optical transceiver circuit to meet necessary specifications
- Test different lasers and positions to ensure clean, distinctive readings

Software: Arash Asgarinejad (EE), Justin McKibben (CSE)
- Create laser detection system implemented using machine learning
- Create a website that displays data readings in real time

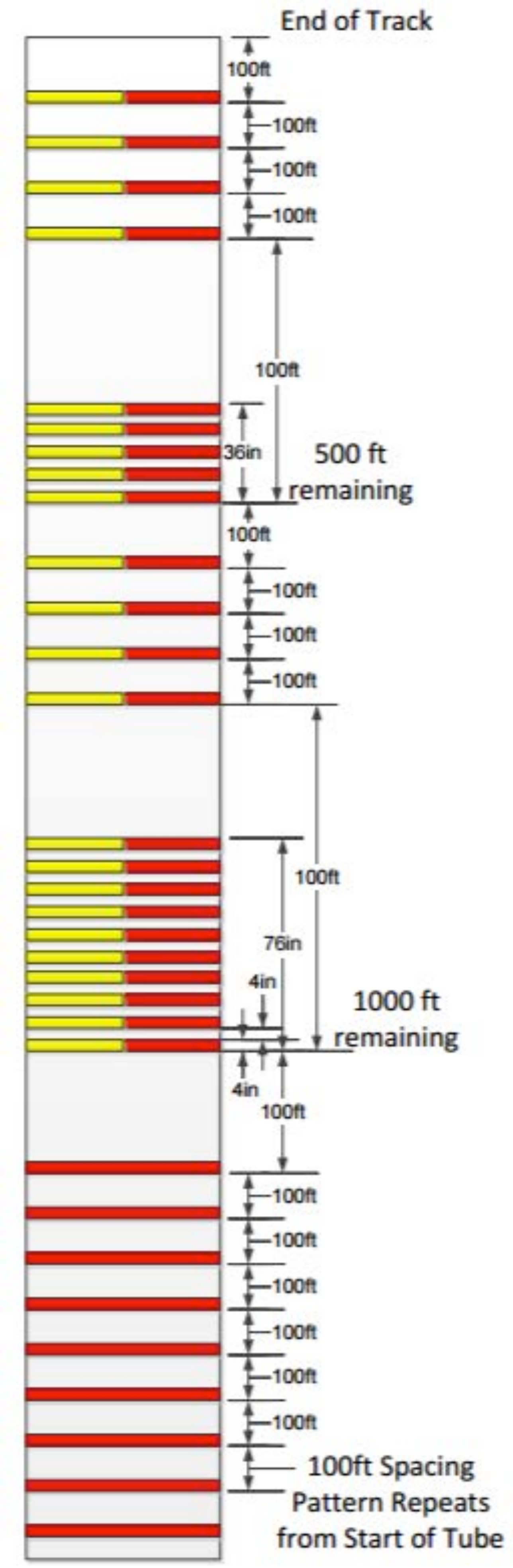
Advisor: Prof. Ozdal Boyraz

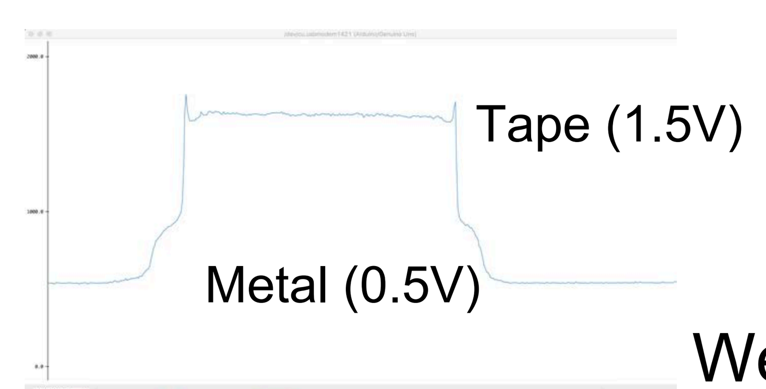
Background: The Hyperloop competition is a project led by SpaceX in an attempt to create more affordable and sustainable transportation that can traverse long distances faster than any existing ground transportation system. This new system should ideally be safer, faster, cheaper, and more convenient when compared to the proposed California high speed rail project. It will also be non-disruptive to the surrounding environment and self-sustaining.



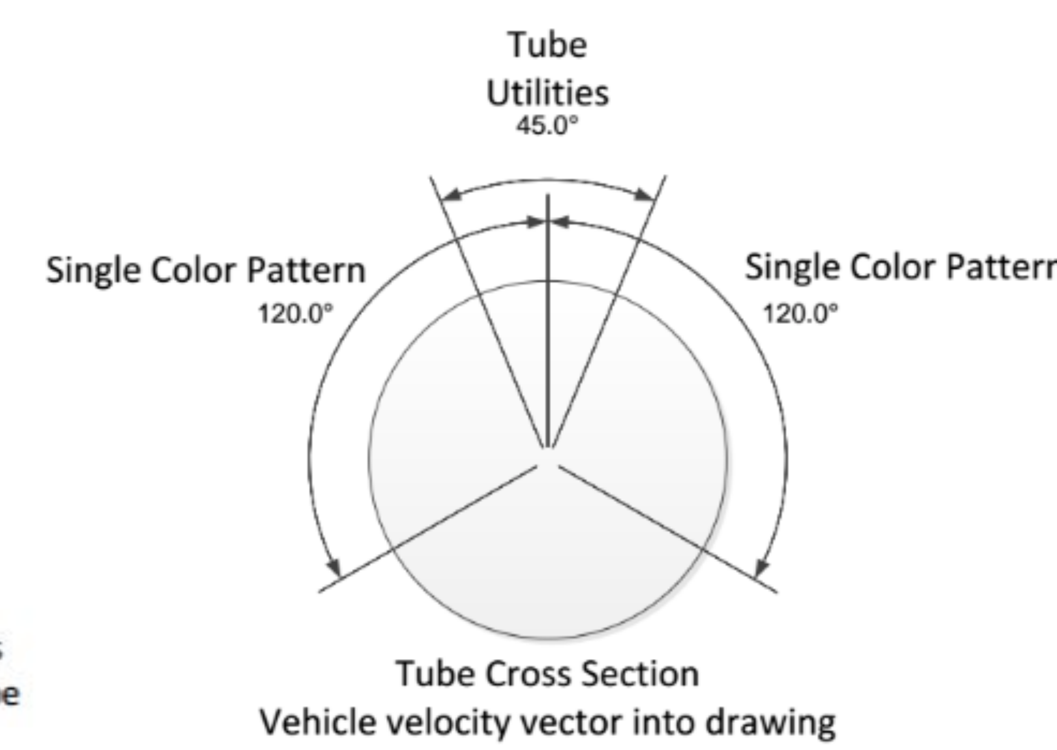
Pictured: Charleston Tran

Current Status: We have constructed a dark room as shown in the picture above in order to simulate the lighting conditions inside the SpaceX tunnel. The hardware team has settled on a circuit configuration that operates at the required speeds. Our team lead has implemented the backup braking system and our software team is finishing up the Arduino program and the website. The picture to the right is a preliminary waveform showing the difference in the output when the laser goes from the metal wall to a piece of reflective tape.





Our project is to create an optical transceiver circuit that will detect when light from a laser mounted on the Hyperloop pod makes contact with a piece of reflective tape on the interior tunnel wall. This circuit should be able to distinguish between the reflective tape and the reflective metal wall. We will then stabilize and amplify the signal to a clean, distinctive value while constantly feeding data to an Arduino. A robust program written by our software subteam will read all incoming data and calculate the location of the pod on the track at all times. Finally, when the pod reaches a certain point on the track, we will initiate the braking system to slow the pod to a full stop before we reach the end of the tunnel. The picture on the left shows the specifications of where the reflective tape will be placed inside the tunnel. The picture below shows the tape placement using a cross sectional view of the tube.



Schedule:

10/7 – 11/2:
- Begin building data collection applications with LabVIEW and Arduino.
- Build framework of website.
- Test initial circuit configurations.

11/3 – 12/1:
- Continue testing circuit under varying conditions.
- Implement backup design and test

12/2 – 1/30:
- Finalize website, data collection scripts, and transceiver circuit.
- Attach system to Hyperloop pod.

1/30:
- SpaceX Hyperloop Competition

Website for more information: http://srproj.eecs.uci.edu/projects/group-40-optical-laser-guidance-system
Contact info for any questions: zrawling@uci.edu

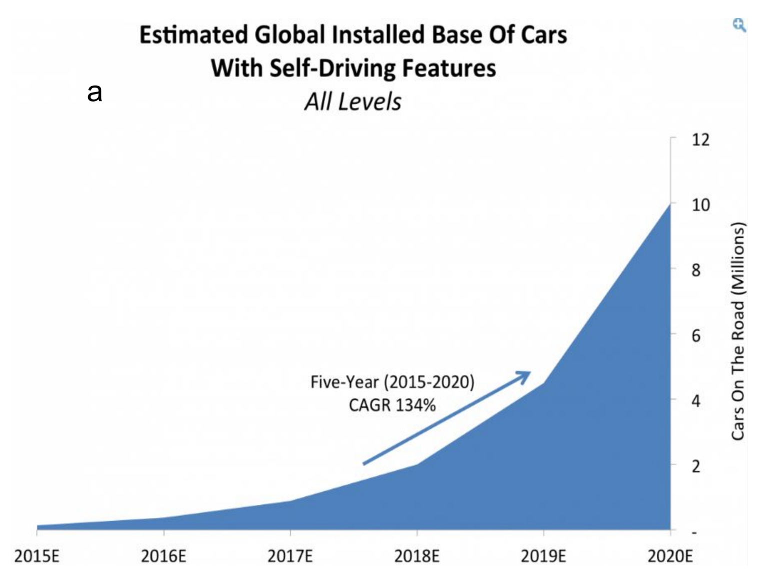
Unmanned Auto-driving Vehicle

Xiaoran Li, Zhilai Shen, Ningfeng Zhang, Yishan Ma
Professor Glenn Healey
Department of Electrical Engineering and Computer Science

UCI Samueli School of Engineering

Background

Autonomous cars are no longer a futuristic idea. In an in-depth report from BI Intelligence, there will be nearly 10 million cars with self-driving car features in 2020[1]. Beyond the practical benefit, autonomous cars also can contribute $1.3 trillion in annual savings to the US economy alone, with global savings estimated at over $5.6 trillion[2].



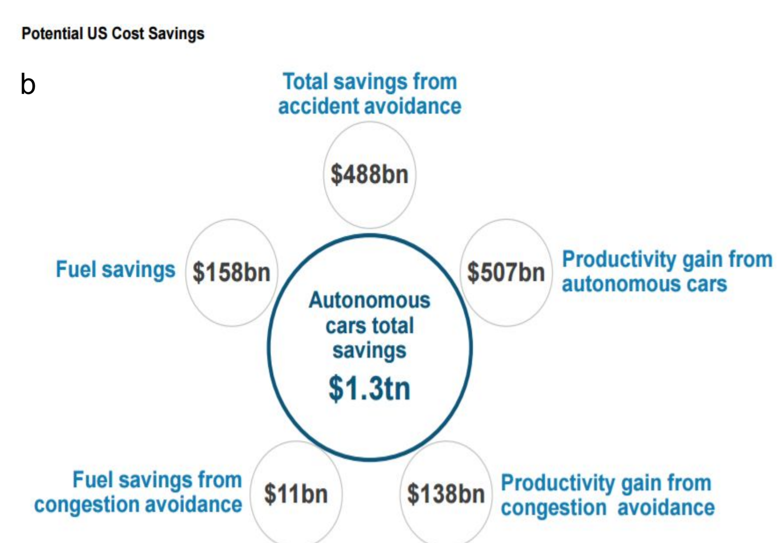


Fig 1a. Estimated Global Installed Base of Cars with Self-Driving Features
Fig 1b. Total Savings from Accident Avoidance

Goal

We develop a self-driving car with two functions: **distance detection** with **ultrasonic sensor** and **signal light recognition** by pixy camera.

Overview

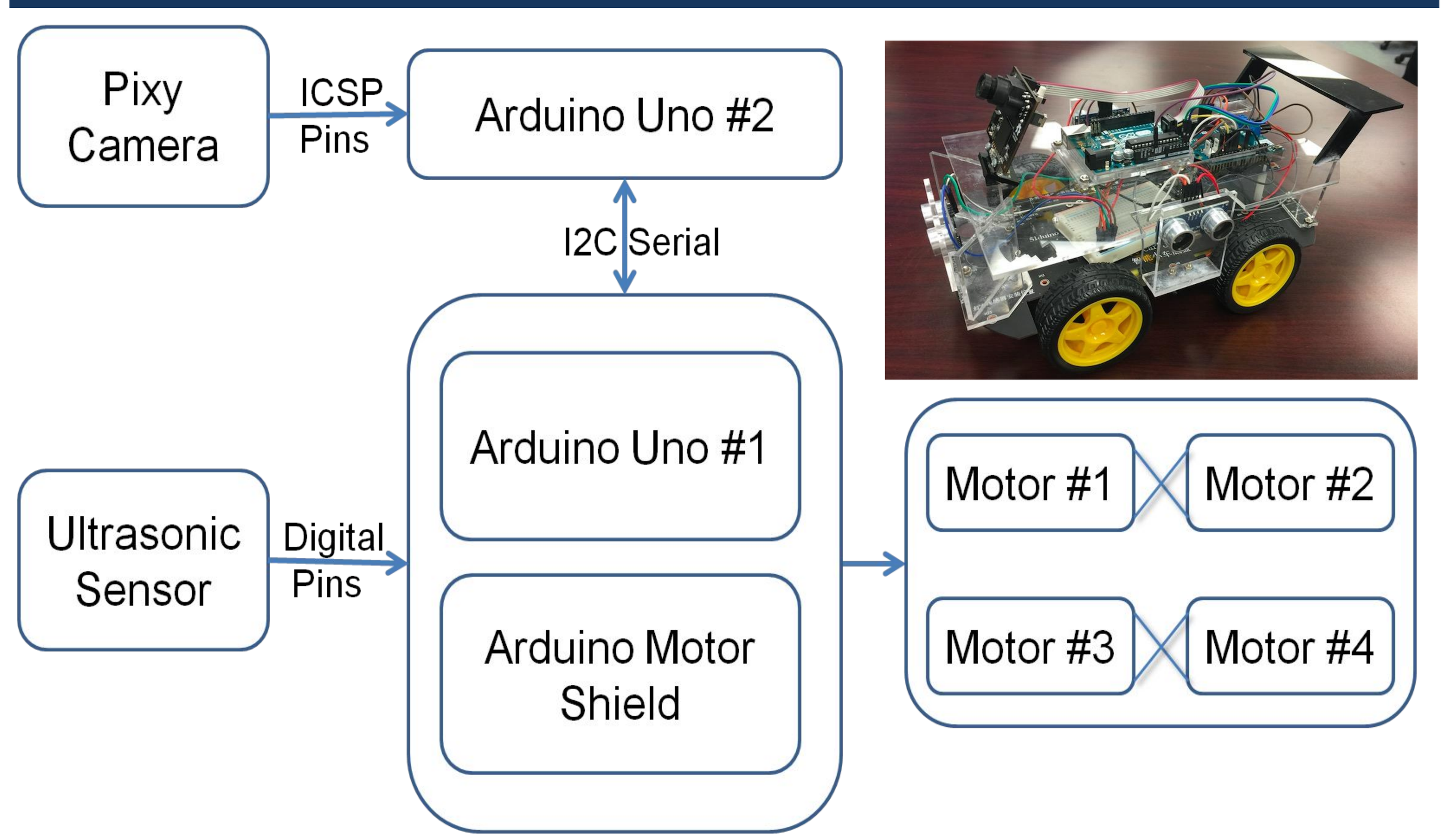


Fig 2. Structure Design of the Autonomous Car

Ultrasonic Sensor

To achieve the function of distance detection, ultrasonic sensors are chosen and placed on the front, the left and the right sides of the car.

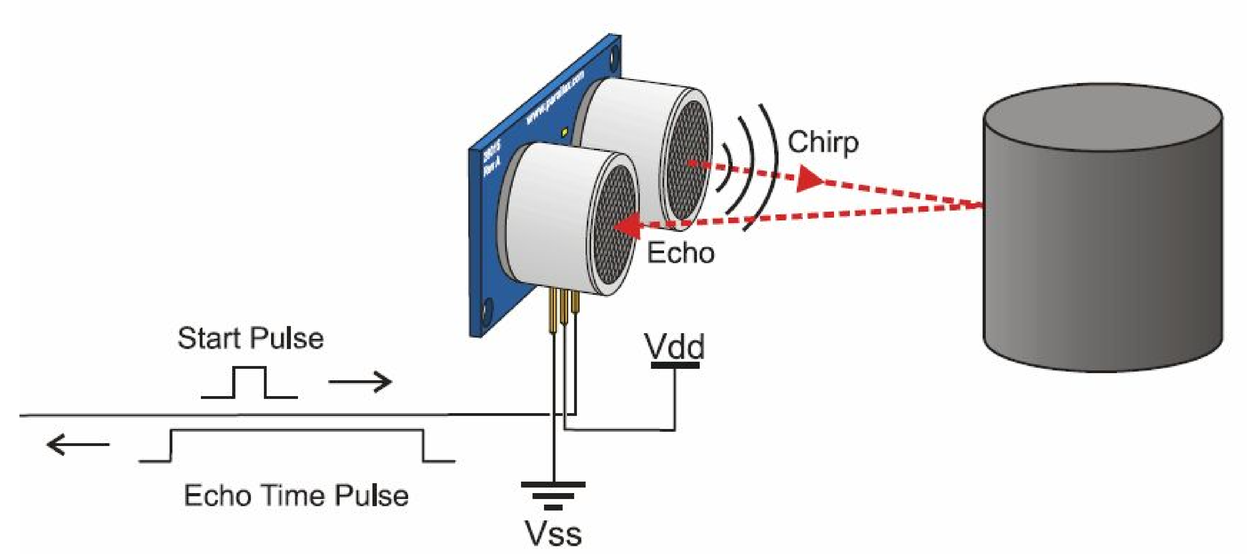


Fig 3.Chirp Port: send signals of low voltage for 2 μs → high voltage for 10 μs → low voltage
Echo Port: detect reflected high voltage signals
Board: calculate distance through time difference [3]

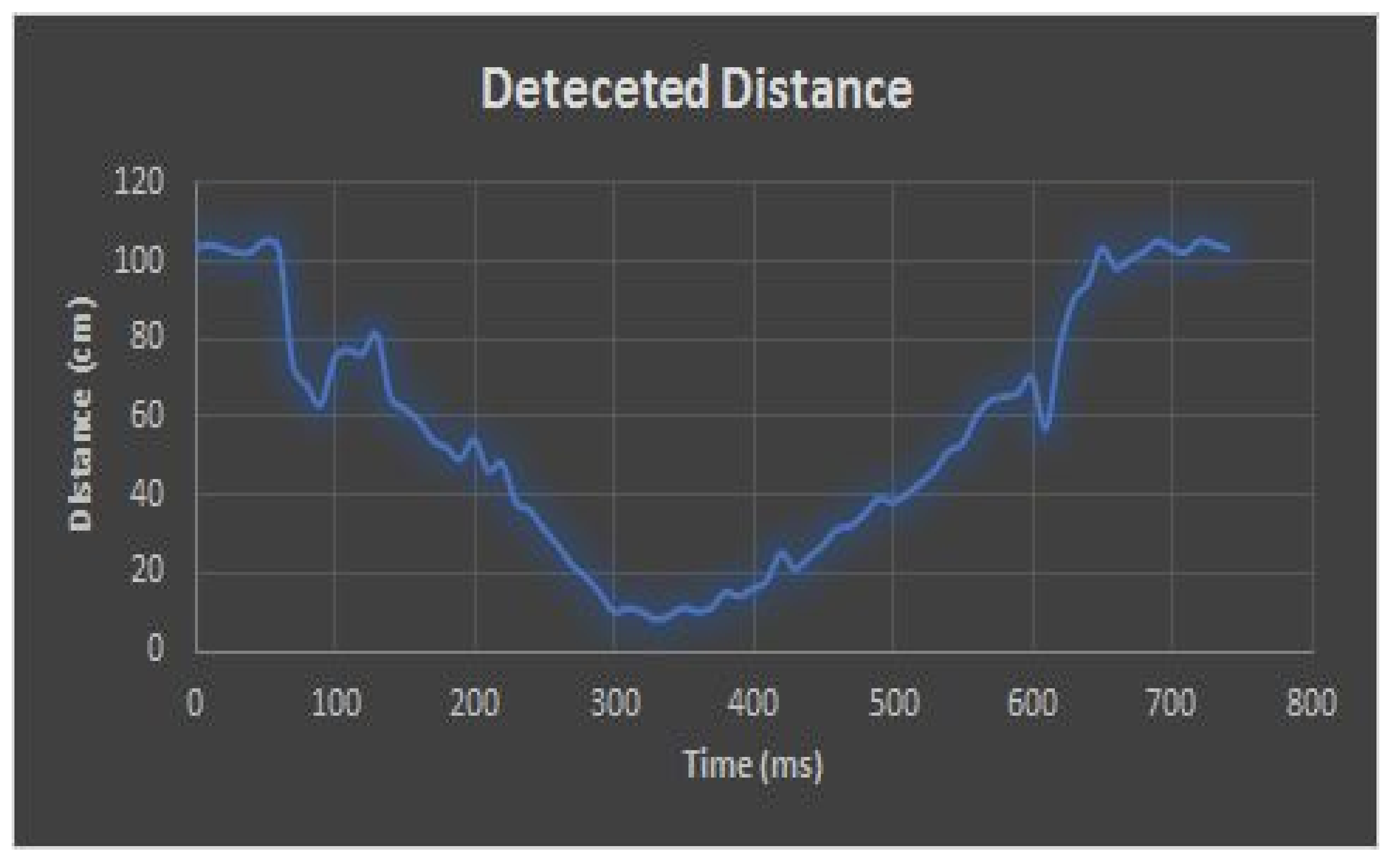


Fig 4. Distance detected in centimeters vs time in microsecond

By serially reading the distances, the car will be aware of intervals from surrounding objects. Whenever the distances are not enough for normal usage, i.e. lower than preset thresholds, stopping or turning modules will be automatically implemented.

Contact Info

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Zhilai Shen:zhilais@uci.edu Ningfeng Zhang:ningfenz@uci.edu
web:http://srproj.eecs.uci.edu/projects/project-41-auto-pilot

Pixy Camera

Pixy Camera is a small, fast, easy-to-use, low-cost, readily-available vision system[4]. The pixy camera can send 4 data values, x, y, width and height back to the board. X and y represents locations of the selected region on the image frame; width and height represents the size of the detected region.

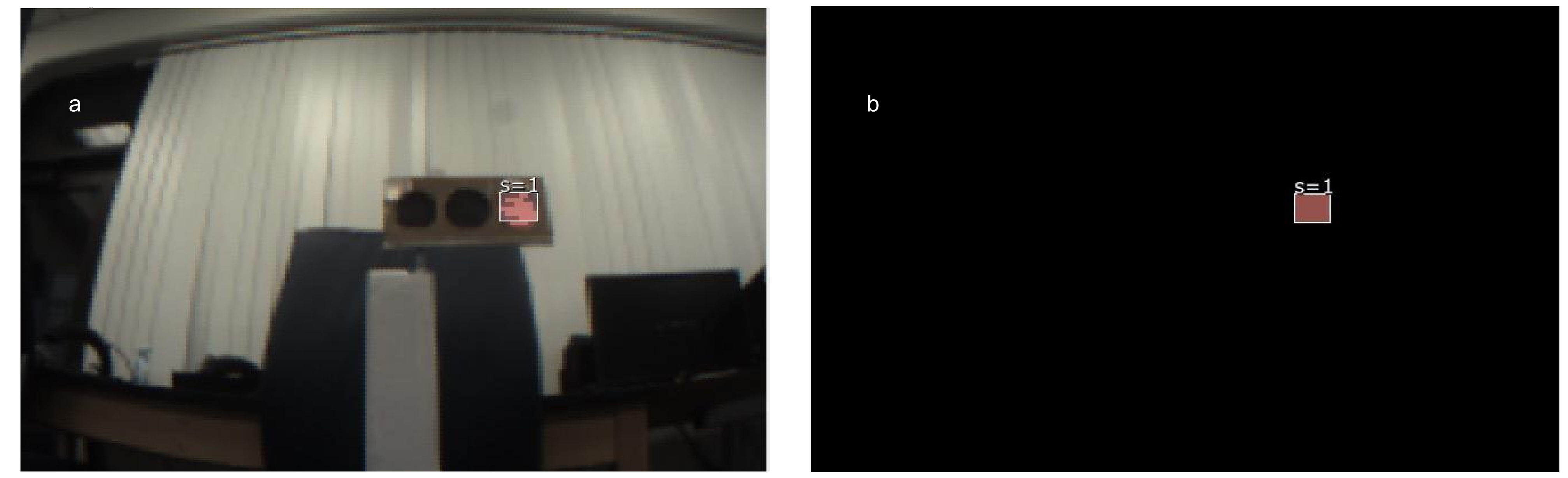


Fig 5. Analyzing color signals on computer pixymon is required. a) The pixymon can select a color of interest. Once the camera finds the color of interest, it can feedback to the Arduino board. b) The region that Arduino board detects. If the size of detecting region exceeds the threshold dimension, the stop module will be implemented.

Timeline

content \ week	1	2	3	4	5	6	7	8	9
Marketing	■	■		■		■			
R&D	■	■	■	■	■				
Car Cons	■	■			■	■			
Motor testing		■	■		■	■			
Ultrasonic testing			■	■	■	■			
Camera testing						■	■	■	
Optimization						■	■	■	■

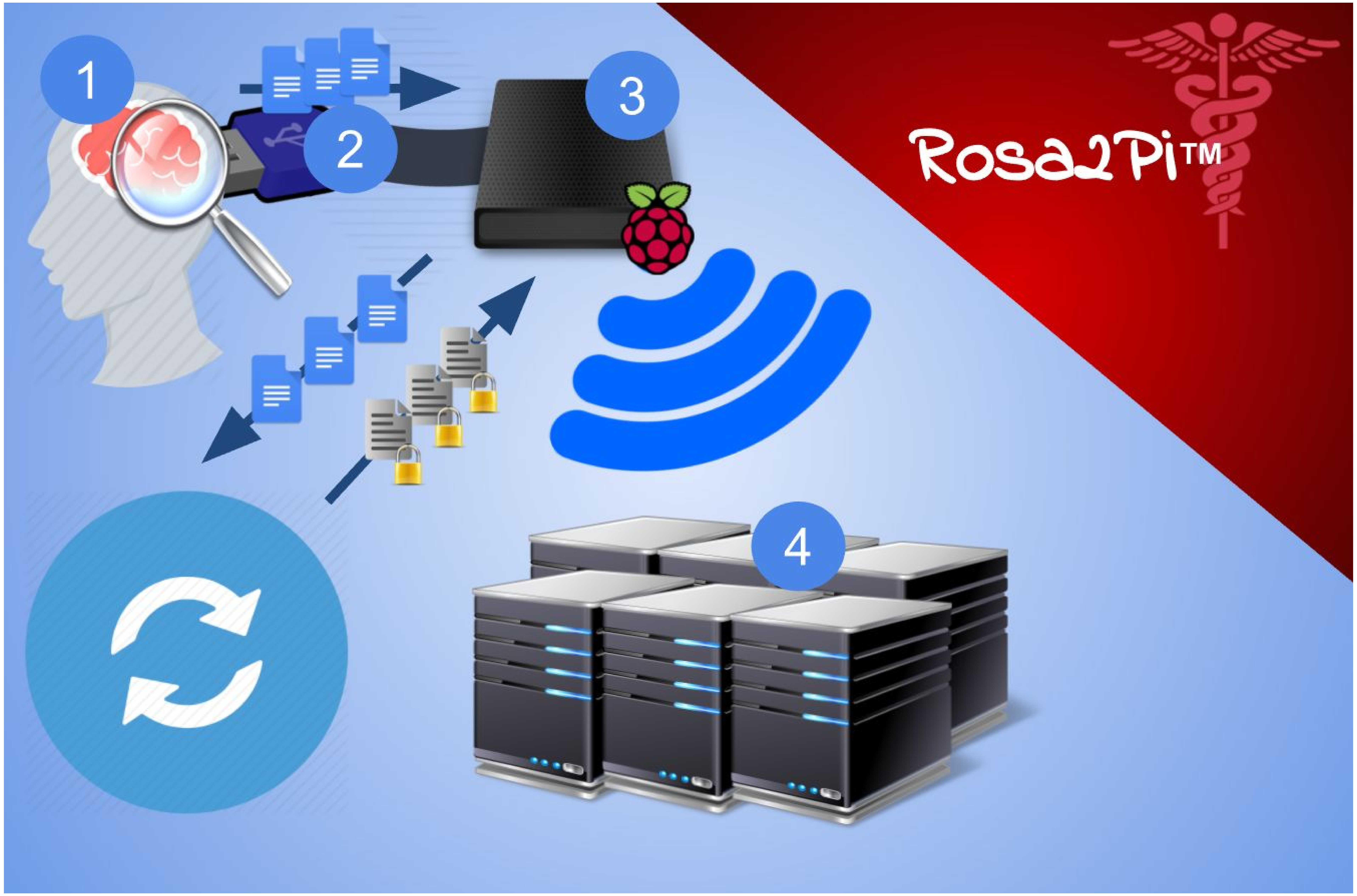
Acknowledgements & Reference

We gratefully acknowledge the support of the Henry Samueli School of Engineering at UCI. We also appreciate help from Professor Glenn Healey and TAs, Haeseung Lee, Subramanian Sundaram,Seyedemahya Safavi, and Neha Udaiwal.

[1]"10 million self-driving cars will be on the road by 2020." *Business Insider*. Ed. BI Intelligence. Business Insider, 15 June 2016. Web. 26 Feb. 2017.
[2]Stanley , Morgan . "Smart Driving Cars ." Morgan Stanley Blue Paper. N.p., 06 Nov. 2013. Web. 26 Feb. 2017.
[3] Gantt, Charles. "Using an ultrasonic distance sensor to illuminate NeoPixels." The makers Workbench. 4 June 2015. Web. 26 Feb. 2017.
[4] Lang, J.-P. (2006). Introduction and background - CMUcam5 Pixy - CMUcam: Open source programmable embedded color vision sensors. Retrieved February 26, 2017.

Clinical Database Transfer for Brain Images

Aaron Zhong, Brian Shen, Leianne Roylo, Yu (Albert) Jiang
Dr. Nicolás Phielipp
Department of Electrical Engineering and Computer Science



The aim of this project is create a secure, convenient, and automated process to incorporate CT and MRI scans for Deep Brain Stimulation(DBS) from an isolated hardware system to an accessible database through methods that are compliant to the Health Insurance Portability and Accountability Act (HIPAA) standards.

Software/Hardware Leianne Roylo CSE	**Software** Aaron Zhong CSE
Team Captain Yu (Albert) Jiang CSE	**Hardware** Brian Shen EE

Learn More!
bit.do/rosa2pi_srproj

THE HENRY SAMUELI SCHOOL OF ENGINEERING
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Smart Air Vent

Group 43 - http://srproj.eecs.uci.edu/projects/smart-ac-ventilation-system
Aaron Daniel - aaronad@uci.edu -- Austin Raun - araun@uci.edu
Hunter Meurrens - hmeurren@uci.edu - Tex Taylor - trtaylor@uci.edu
Professor Fadi Kurdahi
Department of Electrical Engineering and Computer Science

GOAL

To create a Wi-Fi connected air vent which will automatically open/close in order to optimize airflow and reduce cooling costs. It may also be controlled manually via a smartphone app, where you can also view data on all your connected vents.

Introduction

Currently the technology to control airflow in one's home exists, however it must be installed within the air conditioning system's ducts. As such, it requires a professional to install and is rather expensive. Other products that achieve similar functionality as ours are expensive, with some options being over $100. We aim to design an all-inclusive air vent which can be easily installed with a few screws in place of a traditional air vent at a cheap overall cost. The market for this product is anyone with an existing air conditioning or heating system in their home. We hope for this product to be a worthy investment that pays for itself in how much it reduces your electricity bill.

Team Members

Professor F. Kurdahi – Mentor
Aaron Daniel – CSE – App Back-end
Austin Raun – CE – App Front-end
Hunter Meurrens – CE – Vent/Mechanical
Tex Taylor – CE – HW/SW Interface

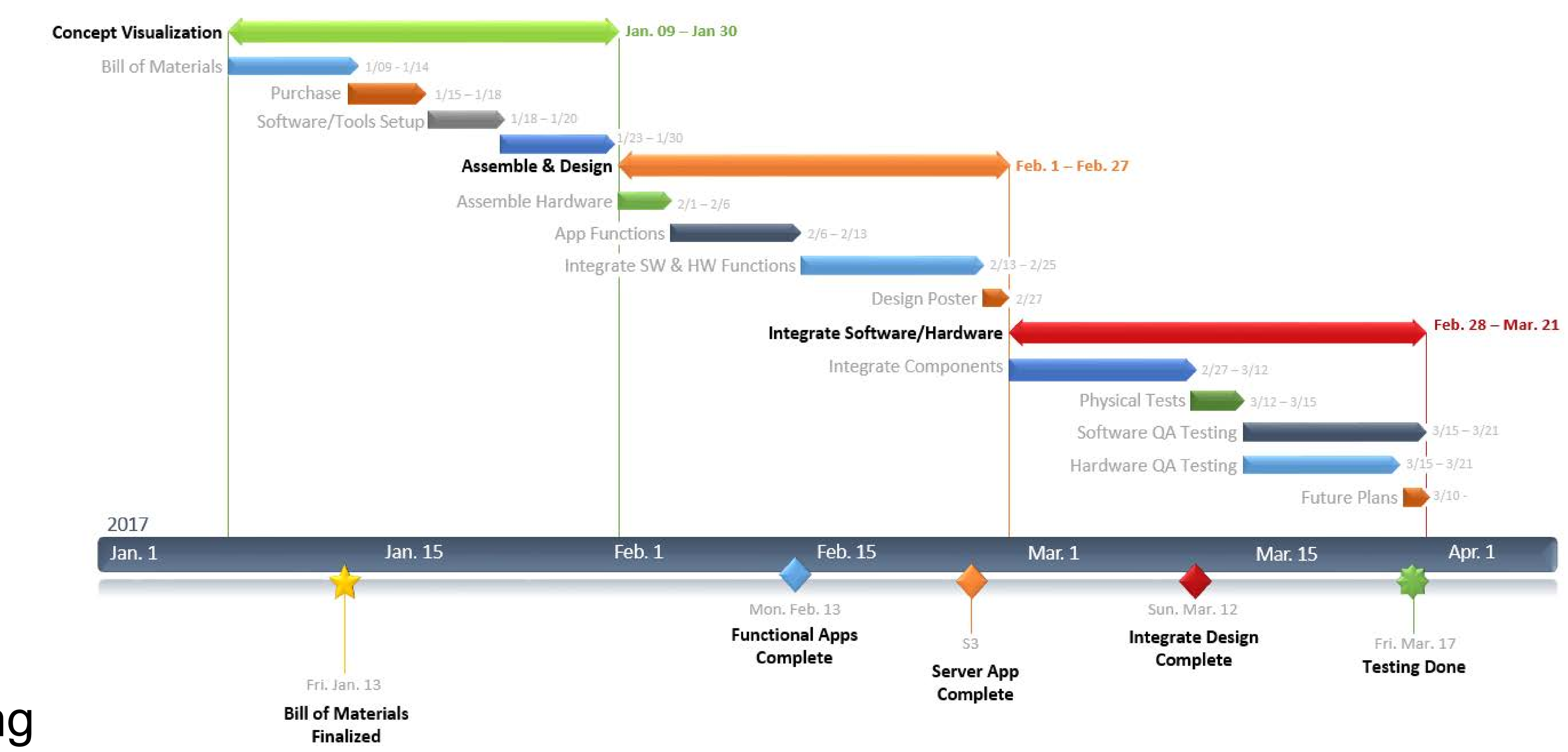
Approach and Design

Ease of use – The design is such that everything is as intuitive as possible. The user downloads the app and interacts with the vents via Wi-Fi.

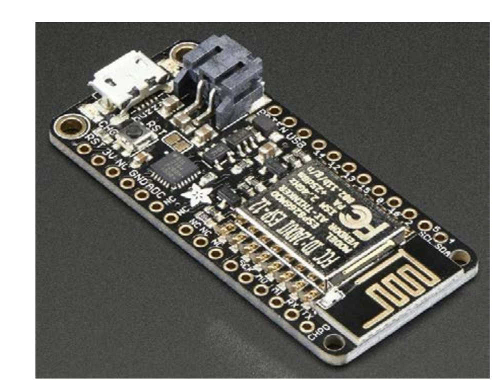
Discrete appearance – Air vents are not a centerpiece of one's home, rather they are discrete and go mostly unnoticed. Our vent is designed with this in mind, keeping a sleek profile it will blend in with the user's home and look like a standard vent.

Low Power Consumption – Our vents will utilize a low-power Wi-Fi development board with a built-in USB and rechargeable battery.

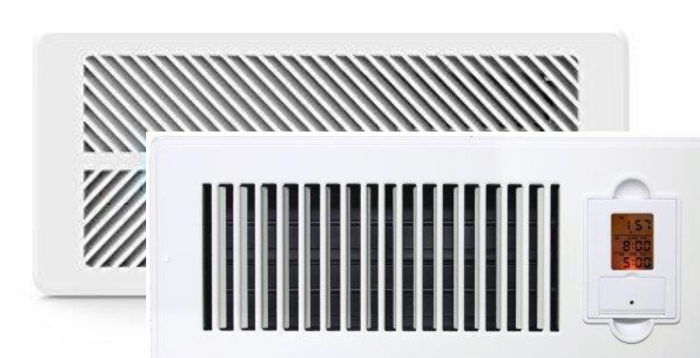
Timeline



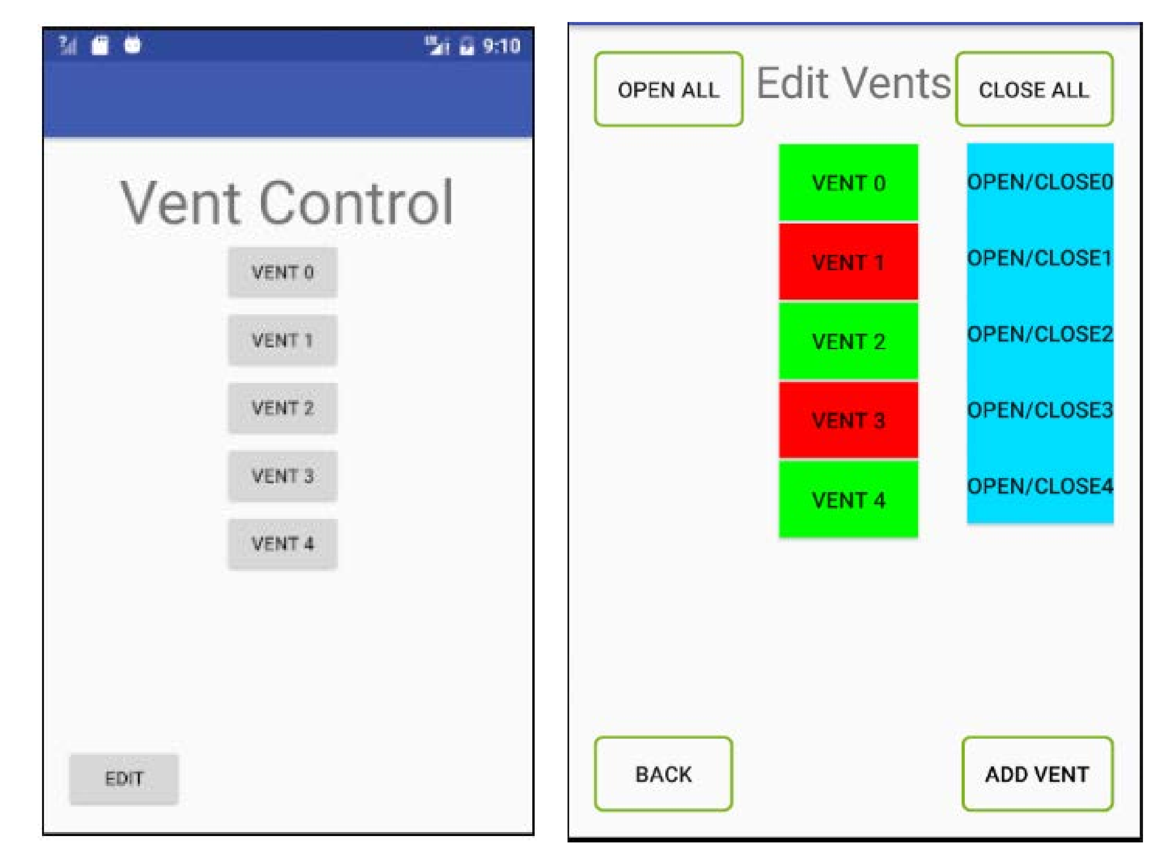
Progress & Current Status



WiFi Board



Similar Products



Application Design

The Henry Samueli School of Engineering
University of California • Irvine

UCI Self-Driving Car Project

Team Racecars.zip (#44): Daniel Jooryabi, Travis Wolf, Zainab Khan, Hamza Khan
Professor Mohammad Al Faruque
Department of Electrical Engineering and Computer Science

NEW THINKING. NEW POSSIBILITIES.

Mission Statement

- **Create a student research platform for experimenting with autonomous cars.**
- **Program car control software on embedded real-time system with linux OS.**
- **Programming drive train and velocity control**
- **Selecting and optimizing sensors for autonomous driving as well as fusion of different sensors data**
- **Object detection for safety**

Figure 1 - Racecars.zip team members

Figure 2 - Our mentor Professor Al Faruque

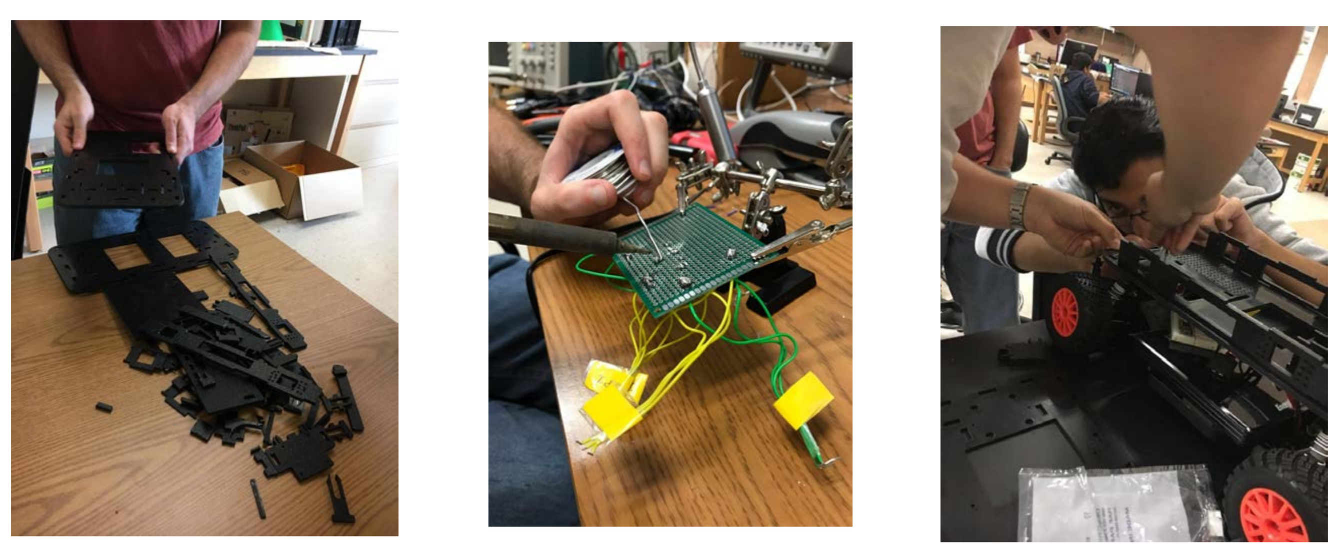


Figure 3 - The build process (left - chassis components, center - microcontroller circuit, right - putting it all together)

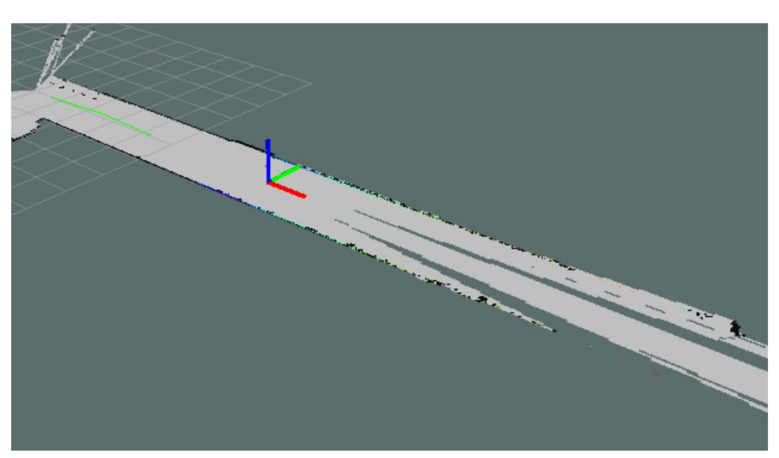


Figure 4 - Mapping using HectorSLAM

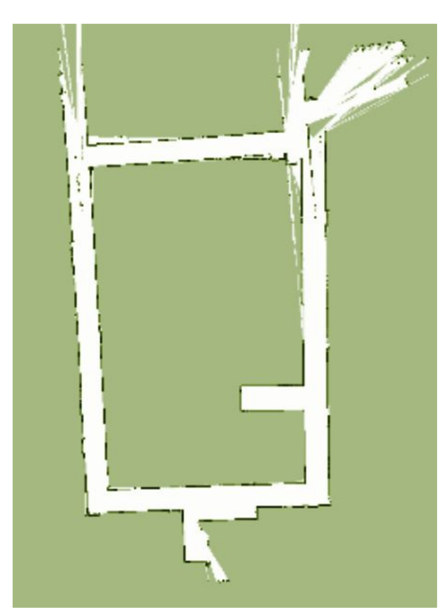


Figure 5 - The final race-track map

More information about the project can be found at:
http://srproj.eecs.uci.edu/projects/autonomous-rc-cars
We can be reached by emailing our team leader, Daniel, at djooryab@uci.edu.

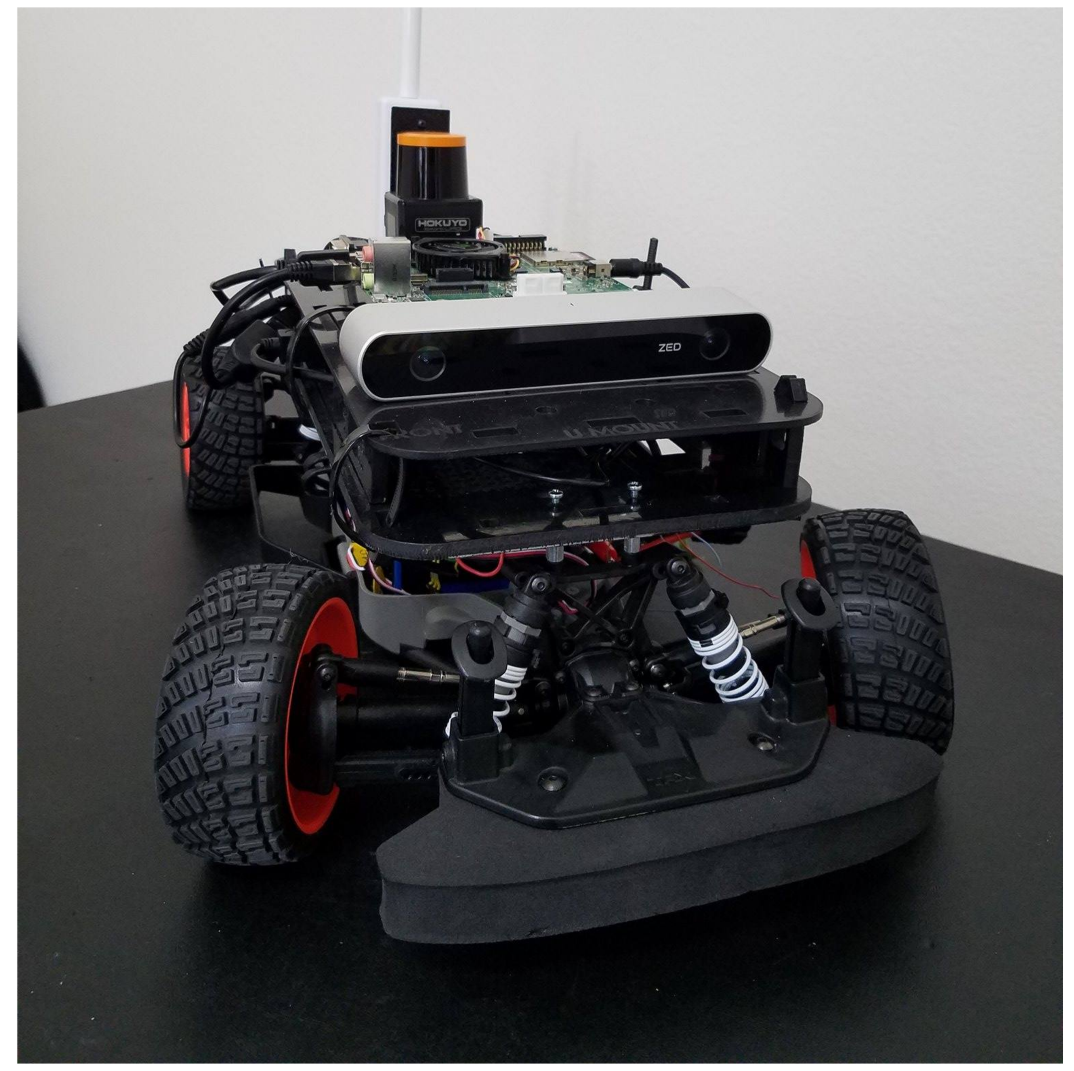


Figure 6 - Our final car, "JuJu"

Components

Hardware

- **Hokuyo UST-10LX LIDAR**
- **ZED Camera**
- **Razor Inertial Measurement Unit (IMU)**
- **Nvidia Jetson TK1**

Software: Robot Operating System (ROS) on top of Ubuntu linux

Figure 7 - Two racers are head-to-head in the Formula 1 competition

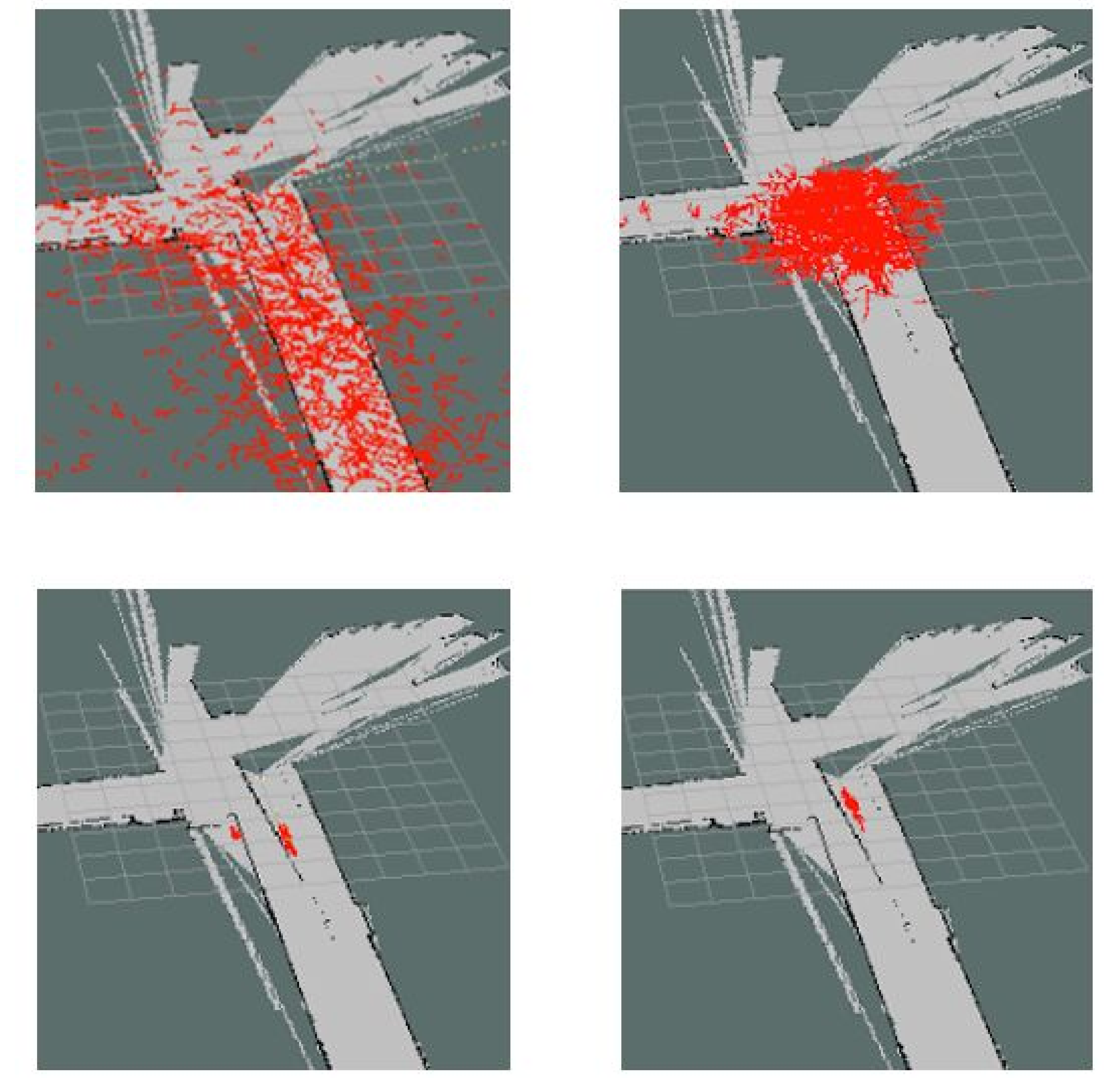


Figure 8 - Using Monte Carlo methods to localize on a map

How It Works

- **Localization**
  - **Simultaneous Localization and Mapping algorithm (Hector SLAM): determines position relative to map**
  - **Adaptive Monte Carlo Localization (AMCL): increase the accuracy of the position estimates using probability**
- **Collision Detection**
  - **High speed = higher risk of crashing**
  - **Varied stopping distance to minimize risk of injury to the car and its environment**
  - **Currently developed for speeds of up to 22 mph**
- **Driving Quickly**
  - **The top-speed of the car is 40 mph, but we currently cap our autonomous car at 11 mph**
  - **We slow down to 5 mph for turns**

Future Work

- **Increasing accuracy of localization**
- **Optimizing to run at faster speeds**
- **Taking more efficient turns**
- **Obstacle detection**
- **Incorporating computer vision to race with cars around**
- **Compete in F1 Tenth competition**

The Henry Samueli School of Engineering
University of California · Irvine

Connected Energy Control of Plug Load Devices

William Lin Wei (Electrical Engineering, B.S.), Shuma Edwin Le (Computer Science & Engineering, B.S.), Victor Choi (Electrical Engineering, B.S.), Eric Cho (Computer Science & Engineering, B.S.)
Faculty Mentors: Prof. G.P. Li (CalPlug/Calit2) & Dr. Michael Klopfer (CalPlug/Calit2)
Department of Electrical Engineering and Computer Science

CalPlug
California Plug Load Research Center
University of California · Irvine

Calit2
University of California · Irvine

Objective

This goal of the project is to develop an intelligent system for reliable and responsive power management using connected sensors and devices. This project serves as a demonstration of this novel approach to device control. Although this project will focus on a residential setting to demonstrate this capability, it can be generalized to a much larger scale. The system will contain a network of devices to share information of each other, including device state, sensor input and power consumption. Using this shared data, each device will have extended “spatial-awareness” and be better able to detect and predict user engagement. This project demonstrates a system that combines network and sensor data, which may be implemented with many types of consumer electronic devices. The devices will intelligently change power states based on information gathered from internal sensors and external sources (nearby sensors). Intelligence can be implemented in a centralized fashion (i.e. in the “cloud”) or at the device itself (i.e. “edge” intelligence), or a hybrid of these approaches.

Demonstration Design Considerations

There are two primary factors to consider in regards to the design of the project. These factors are connectivity and intelligence.

Connectivity refers to the way the devices connect to each other. This can be either over a gateway based network (**infrastructure**), such as router based TCP/IP over WiFi or peer to peer in nature (**ad-hoc**) such as via a general “packet radio” communication scheme. For the demo we, we are using Wi-Fi for the network layer and broker-based, centralized MQTT for communication.

Intelligence refers to decisions made from static rules or from learning patterns. This can be implemented on the devices (**distributed**) or remotely in a common location (**centralized**). Distributed intelligence is the goal for this project.

This project will take a majority *infrastructure-distributed* approach using Wi-Fi to connect the devices together through MQTT. Decisions for control will not be made at the MQTT level, but at the devices themselves with additional information about the other devices in the system. This “context” information provides framework for decision making.

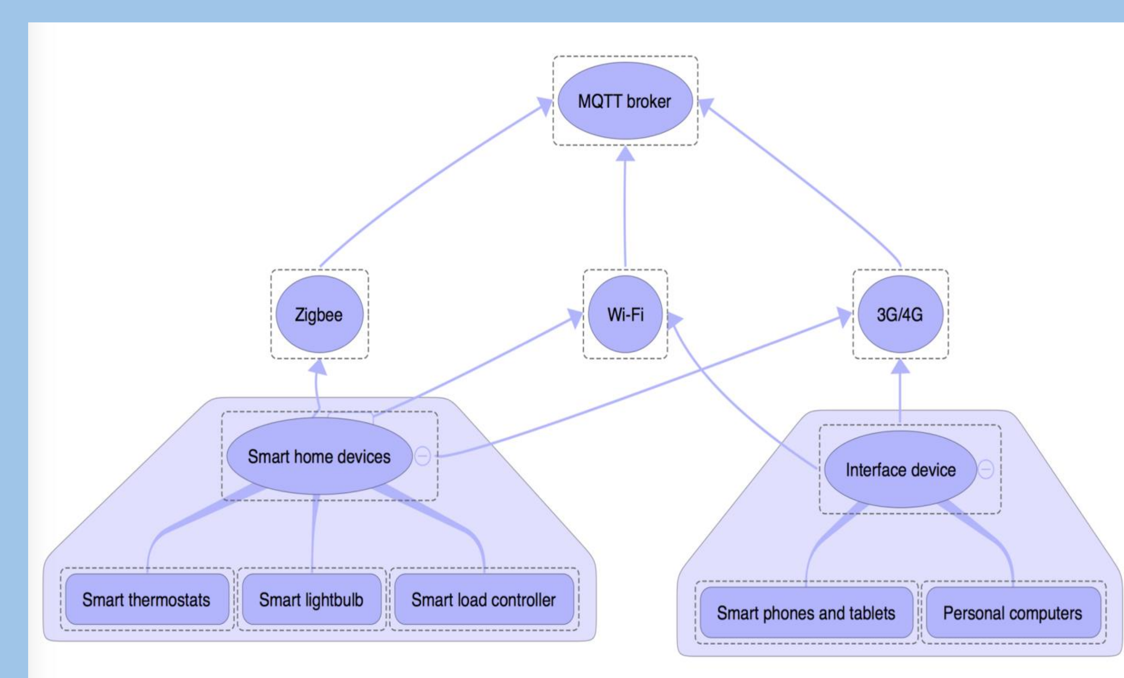
<Version 1 Prototype Device>

<EspressIF ESP8266 based NodeMCU v2>

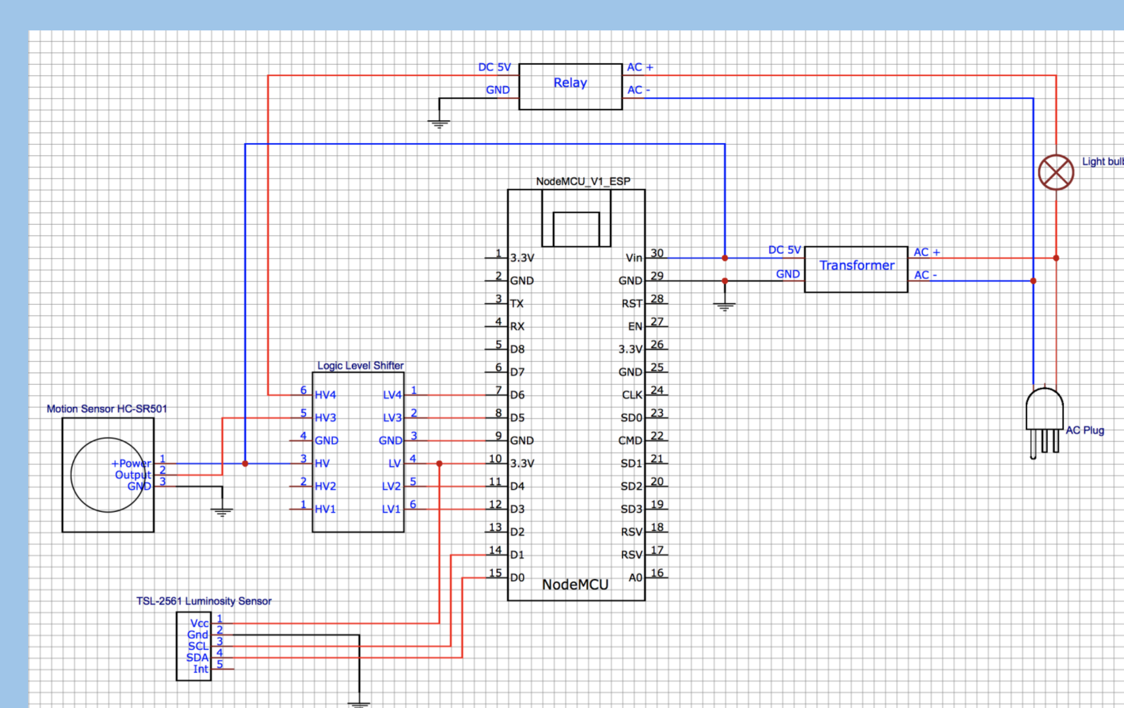
Design Concept

For our demonstration, the following sub-system components are considered:

- **A network of interconnected devices**, A set of devices will be connected to a MQTT broker through different types of network connection including Wi-Fi, Ethernet, and ZigBee. Devices will be able to exchange information about themselves(state and operation) and share sensor-related data.
- **Intelligent Energy Control**, each device can make decision entirely by itself without user input. It can collect sensor input and other information from itself and the subscribed MQTT topics to make accurate prediction and thus actuate the hardware. System intelligence can also be implemented on the broker itself, allowing artificial intelligence and machine learning to be deployed to the system.
- **Control Application**, a control panel to manage system-wide operation and thresholds to provide users control of energy management policies.



<Combined-layer diagram of system component integration >



< Circuit schematic of the prototype >

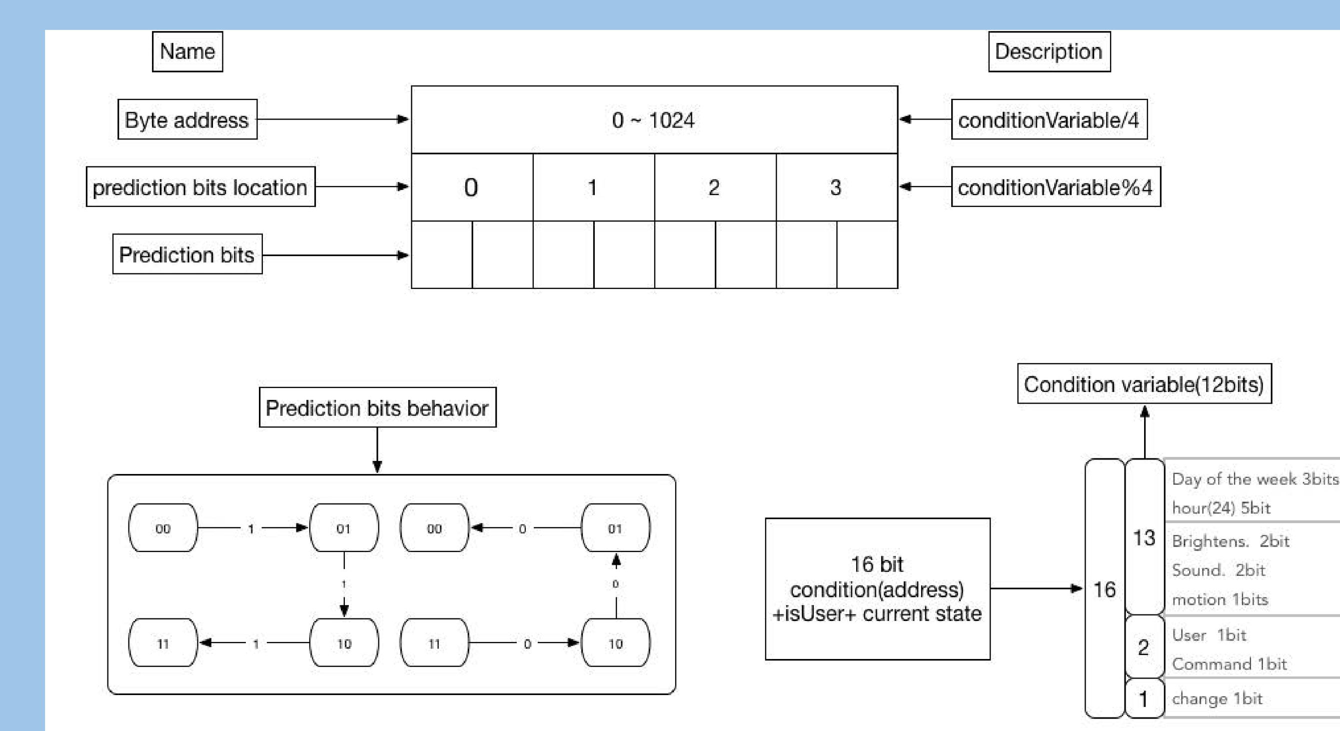
Design Details

Controller: The Espressif ESP8266 is the main micro-controller used in the demonstration project. It is a low cost, energy efficient micro-controller unit with an integrated Wi-Fi interface. The analog pin on the chip has 1024 levels of resolution and is easily multiplexed, it enables precise analog readings from sensors as required. It also has digital pins that support I2C, SPI, and UART communication protocols, makes it compatible with most of the sensors and actuators. In addition, the board can be programmed with Arduino IDE, which supports C, C++ and LUA. Its characteristics make it the ideal IoT board for energy saving purposes.

Sensor: The NodeMCU can be connected to a number of sensors including sensors for current/power, motion sensors, ambient light, time (RTC), sound, RF, etc. which provide environmental awareness for each device.

Network: Message Queue Telemetry Transport (MQTT) is a lightweight TCP/IP protocol that uses a broker to relay messages between devices. Messages are typically outbound, thereby bypassing many firewall concerns in practical implementation. Amazon IoT services and Facebook Messenger use variations of MQTT for their respective services.

Predictor: The NodeMCU contains a non-volatile memory called EEPROM. Every time the user manually changes the power state of the device, that action will be stored on EEPROM. The system will consider the power state of the device based on the predefined logic, and also that personal data record.



< Circuit schematic of the prototype >

UCI Samueli School of Engineering | Department of Electrical Engineering and Computer Science

Smart Recyling

Luis Ribaya, Byron Aguilar, Frankii Tang
Professor Nalini Venkatasubramanian
Department of Electrical Engineering and Computer Science

Goal Statement:

We aim to create a trash management system that is capable of monitoring smart trash around UCI.

With different types of sensors (toxicity, camera), the Smart Recyling System is capable of providing the most efficient and cost saving trash management..

Introduction

There's a lot of problems in diversion in trash. At UCI the diversion rate is 83%, but at resident halls are 22%. Since recyling products cannot be contaminated, we will capture an image to check if it is. The trashcan will reject the contaminated materials and it will communicate with the database to get the trash cleaned

DESIGN INNOVATIONS

Our design combines the Internet of Things, sensors, and sustainability to create a product that is powered by the Raspberry Pi 3 model that can serve a multitude of functions.

Approach / Team Members

Byron Aguilar: MCU Hardware / Firmware

Frankii Tang: MCU Software / System Server

Luis Ribaya: Image Processing & Project Managing

SCHEDULE

12/23: Design of Trashcan ready
1/13: First prototype of Trashcan
2/2: Image processing done with materials
2/20: Second operation on image processing & Second review day
3/5: Implementing, testing, and debugging components altogether
3/13: Final product finished

Progess & Current Status

Currently, we are testing each component to be implemented for our smart trashcan. We have yet to connect all components together.

Figure 1: Exterior of the trashcan that will have Raspberry Pi's / components attached

Figure 2: Interior of the trashcan that will have sensors implemented in.

WEBSITE URL & CONTACT INFORMATION

Website: http:/ /srproj.eecs.uci.edu/proj ects?page=2

Contact Information: fttang@uci.edu, buaguila@uci.edu, lribaya@uci.edu

THE HENRY SAMUELI SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA · IRVINE

Jelly the Chess Robot

Team members: James Ortiz-Luis (CpE), Allan Rodriguez (CpE), Mario Ruiz (CpE)
Team name: J.A.M. and Jelly
Advisor: Professor Rainer Dömer
Department of Electrical Engineering and Computer Science

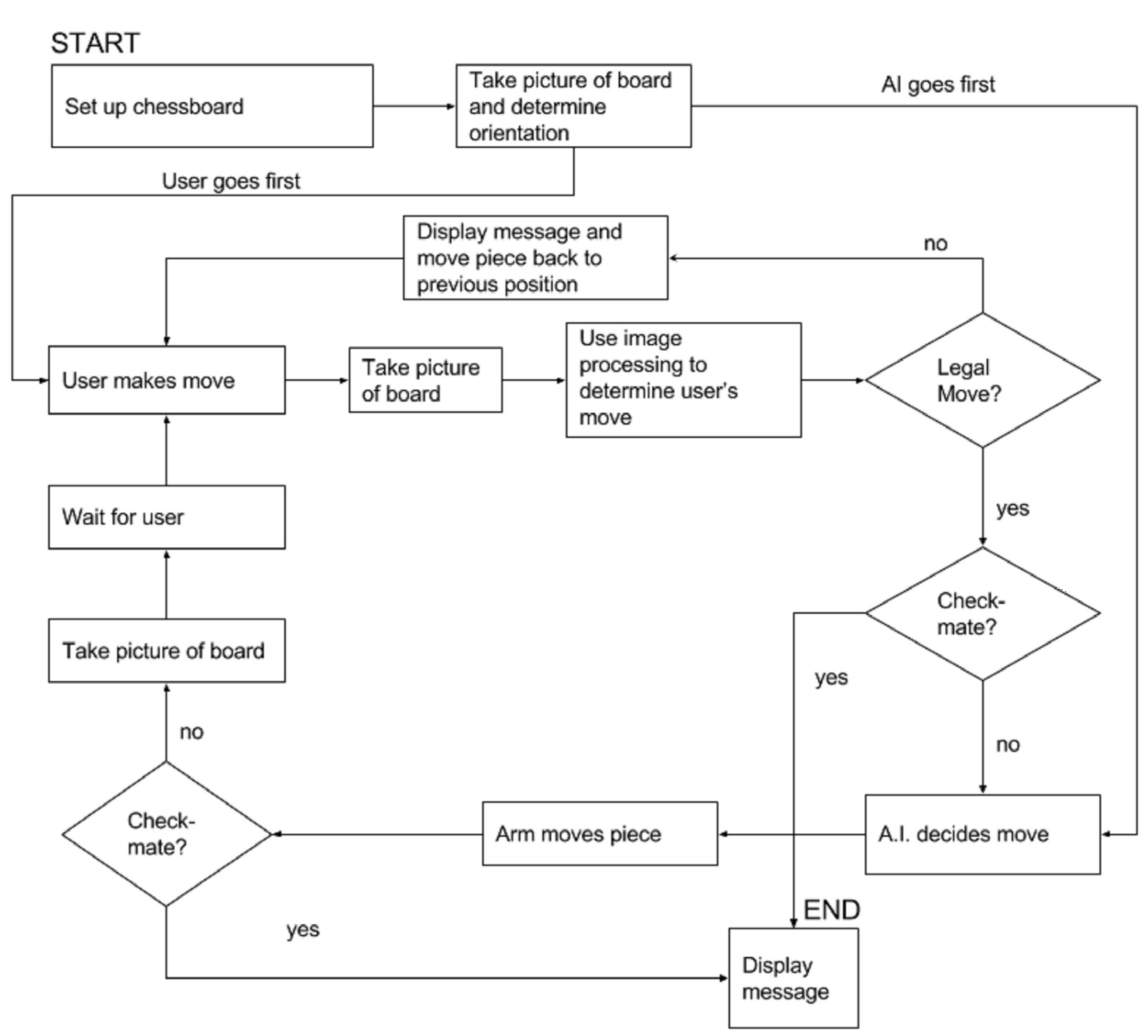
GOAL STATEMENT

Our goal is to demonstrate the application of computer vision and robotics through chess.

RESPONSIBILITIES

James - Jelly's eyes
Allan - Jelly's brain
Mario - Jelly's arm
Jelly - Play chess

FLOWCHART



WEBSITE

http://srproj.eecs.uci.edu/projects/project-group-48-chess-robot

APPROACH

The main controller of our project is the Raspberry Pi, which runs our chess engine and A.I. To determine the position of pieces on the chessboard, we use a Pi camera and image processing. To physically move the chess pieces, we use a robotic arm programmed to receive direction from the Raspberry Pi.

SETUP

JELLY'S BRAIN

We built our own chess engine to power Jelly's decision-making by defining chess rules, then using existing chess knowledge to assign point values to potential moves. Our engine then builds a tree of moves and prunes it as it goes, so as to minimize computation and deliver the optimum move for Jelly.

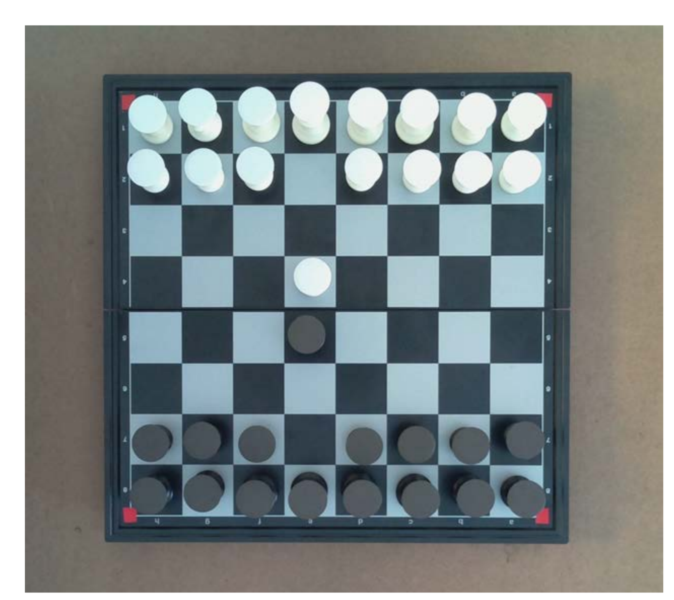
JELLY'S ARM

Jelly is equipped with an arduino controlled robotic arm which we programmed to establish a serial connection to our main controller. This way the main controller can send the A.I.'s move to the robotic arm through the serial port, and the arm can precisely move the chess piece to the designated position on the board.

JELLY'S EYES

Jelly sees the pieces on the board by the following steps:

1. Take top-down image of chessboard
2. Segment the image into the 64 squares of the chessboard
3. Count the number of white pixels on a square after edge detection to find a piece.
4. Use the average pixel intensity of the grayscale image of an occupied square to determine the color of the piece.



→

1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	0	2	0	0	0	0
0	0	0	0	0	0	0	0
2	2	2	0	2	2	2	2
2	2	2	2	2	2	2	2

THE HENRY SAMUELI SCHOOL OF ENGINEERING
UNIVERSITY of CALIFORNIA · IRVINE

Autonomous Car Project: Self Perpendicular Parking

Brenden Vogt - Nathan Chan - Neeraj Shah - Matthew Footitt

Mentor: Professor Charless C. Fowlkes

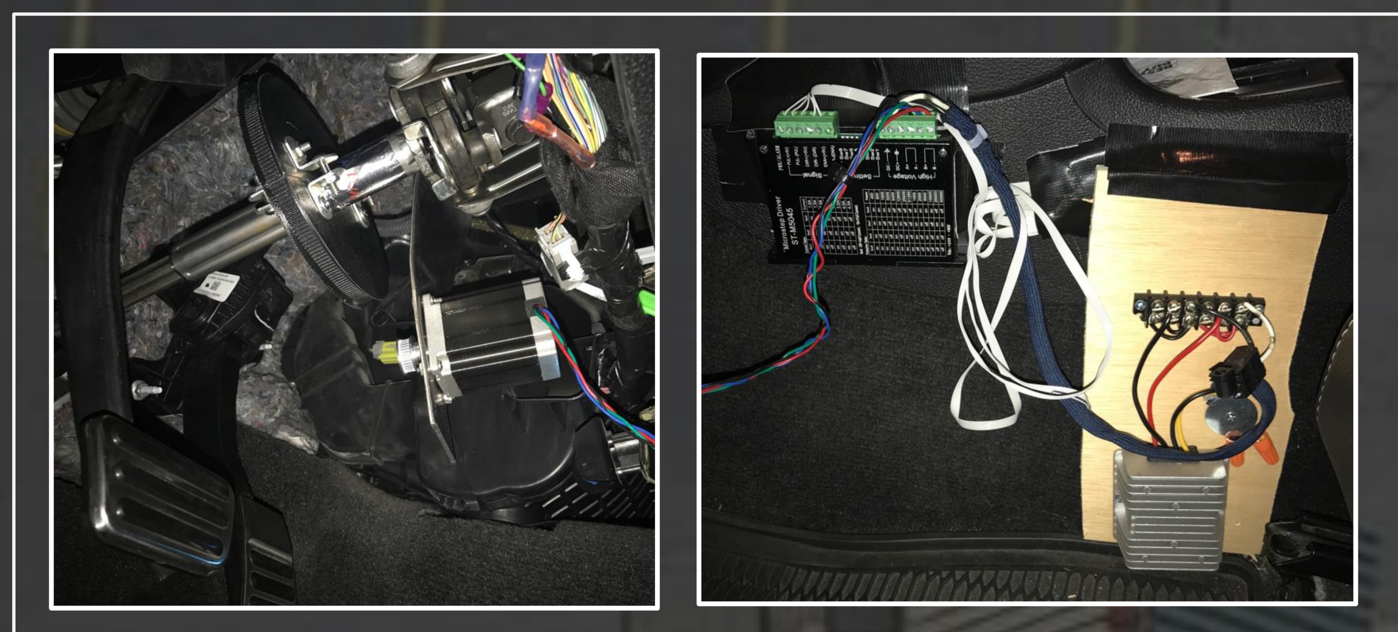
Group 49

http://tiny.cc/AutonomousCarProject

AutonomousCarProject@gmail.com

Goal

Develop a hardware and software system to enable self parking capabilities on an ordinary car



Steering Control

Brake Control

Team Members

Brenden Vogt - CSE - bvogt@uci.edu - Project Leader, Hardware & Controls
Nathan Chan - CSE - channk@uci.edu - Control Software, Hardware Firmware
Neeraj Shah - CSE - neerajs@uci.edu - Image Processing, Control Software
Matthew Footitt - CSE - mfootitt@uci.edu - Image Processing, Control Software

Winter Quarter 2017 Progress

Hardware Progress

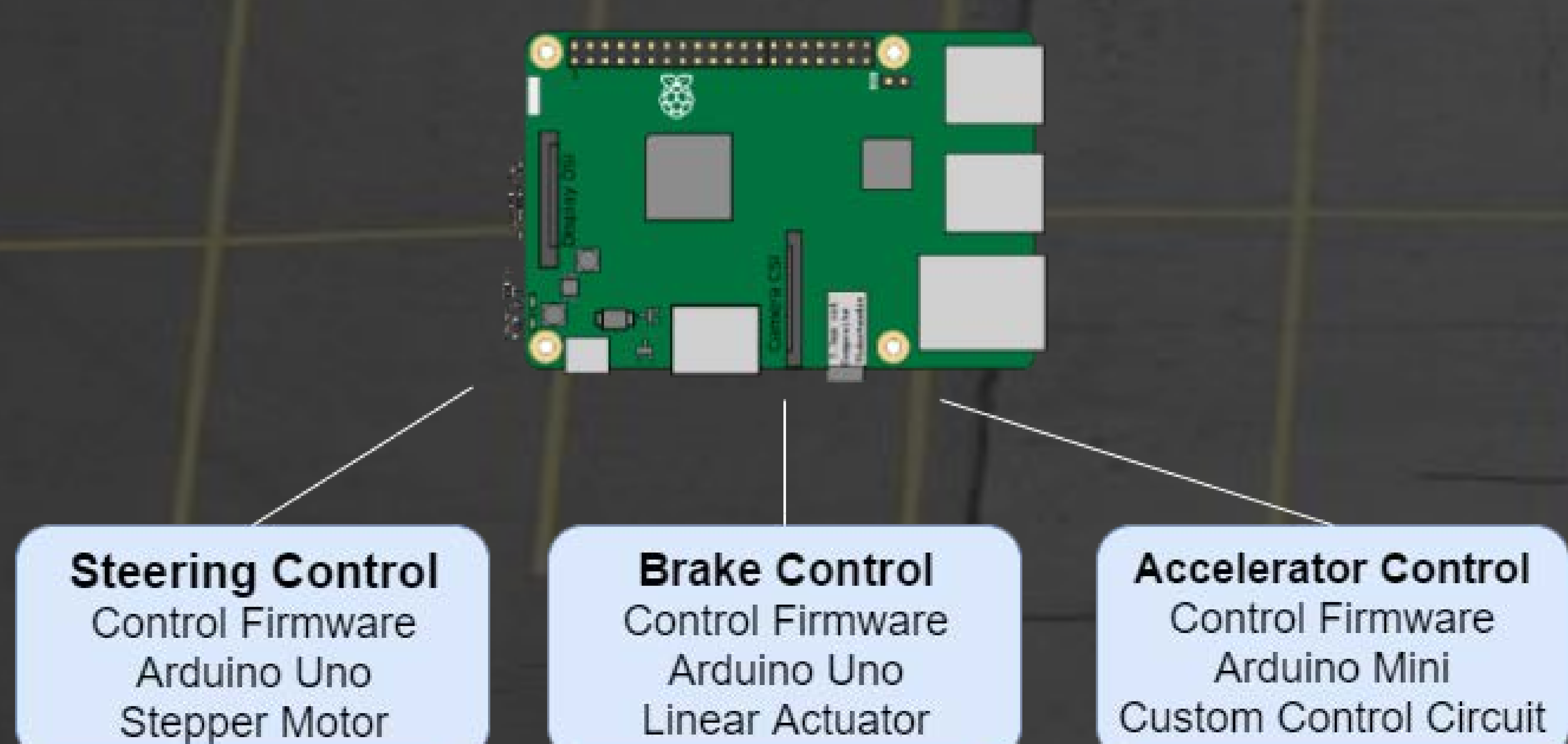
- Design & installation of steering, brake, and accelerator control finished

Software Progress

- Firmware for steering, brake, and accelerator control finished
- Currently developing instruction generator based on a preset path for left handed perpendicular parking
- Plan to complete computer vision parking lot line detection by Spring Quarter 2017

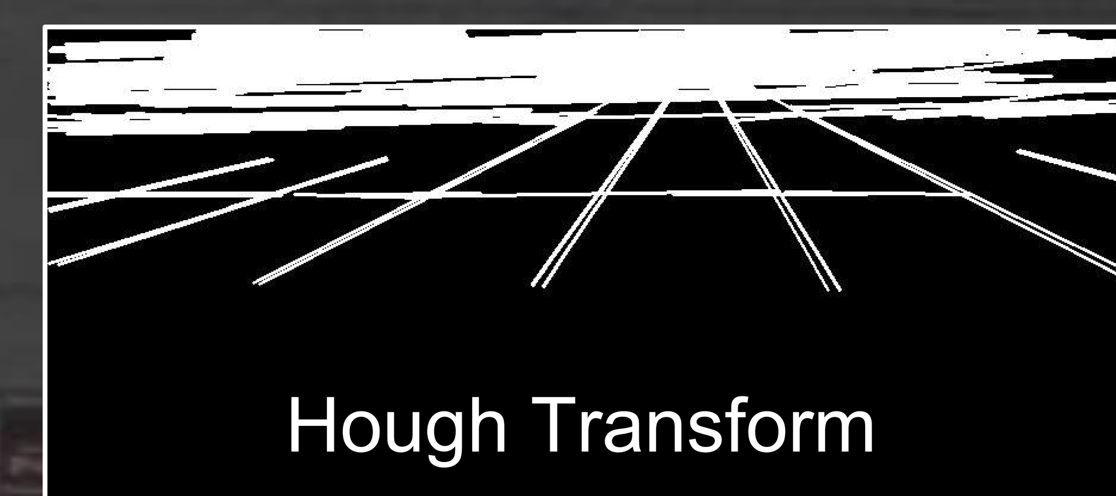
Hardware Architecture

- Each hardware node (steering, brake, gas) individually controlled by an Arduino microcontroller
- Raspberry Pi 3 serves as centralized ROS controller node

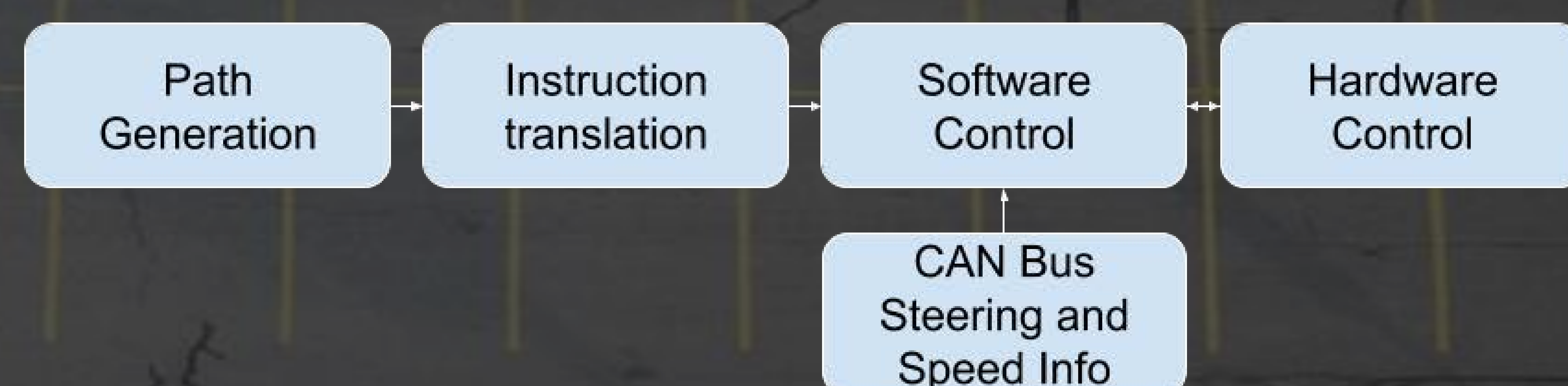


Software Architecture

- Communication between input (instruction) and output (hardware control) nodes done in Robot OS



Hough Transform



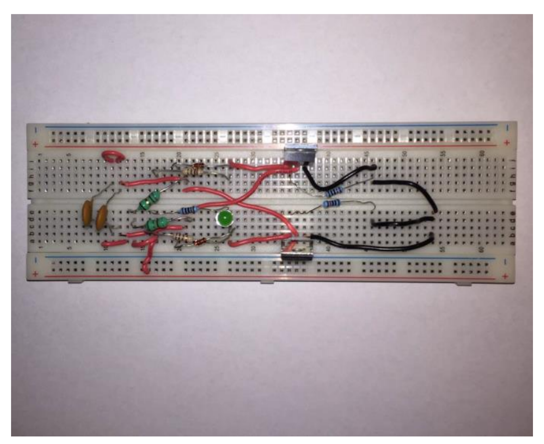
Wireless Inductive Charging

Nicholas Farabee, Kevin Rojo, Cody Williams
Professor Michael Green
Department of Electrical Engineering and Computer Science

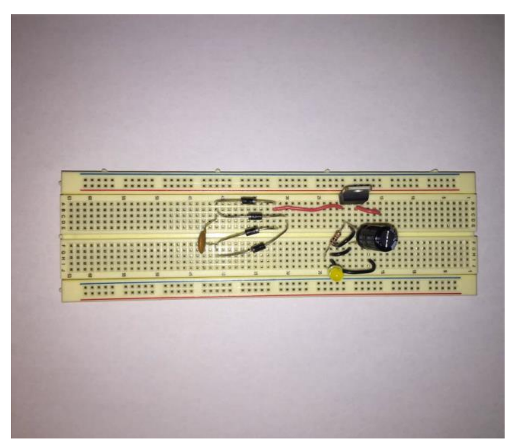
Goal Statement
With the rise of smartphones, the market for wireless chargers has recently seen a resurgence and experienced market growth. The ease of use and simplicity of wireless charging has led to newer smartphones using it as their preferred method of charging. In an effort to make wireless charging more affordable and available to more smartphones, there have been cases/accessories that have tried to extend wireless capabilities to all smartphones. However these accessories/cases are bulky, heavy and inconvenient. The goal for this project is to create a power efficient wireless charging system that includes a transmission station/pad and a portable receiving circuit that can be installed in a variety of smartphones to enable them to use wireless charging. A secondary goal for this project is to create a software application that enables the user to turn on/off a wireless charging station and notifies the user of the battery status.

Prototypes
Through the course of the project there were two main prototype circuits that were tested for the implementation of the wireless charger.

Prototype 1
Our first prototype attempt was a modified Royer oscillator

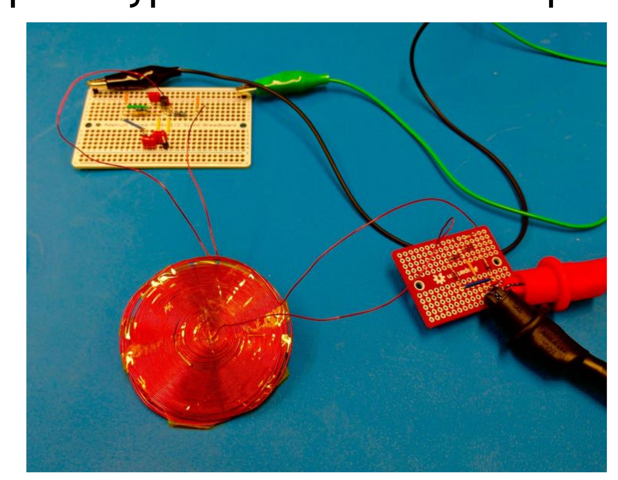


Tx Circuit



Rx Circuit

Prototype 2
Our second prototype was common Coolpitts oscillator

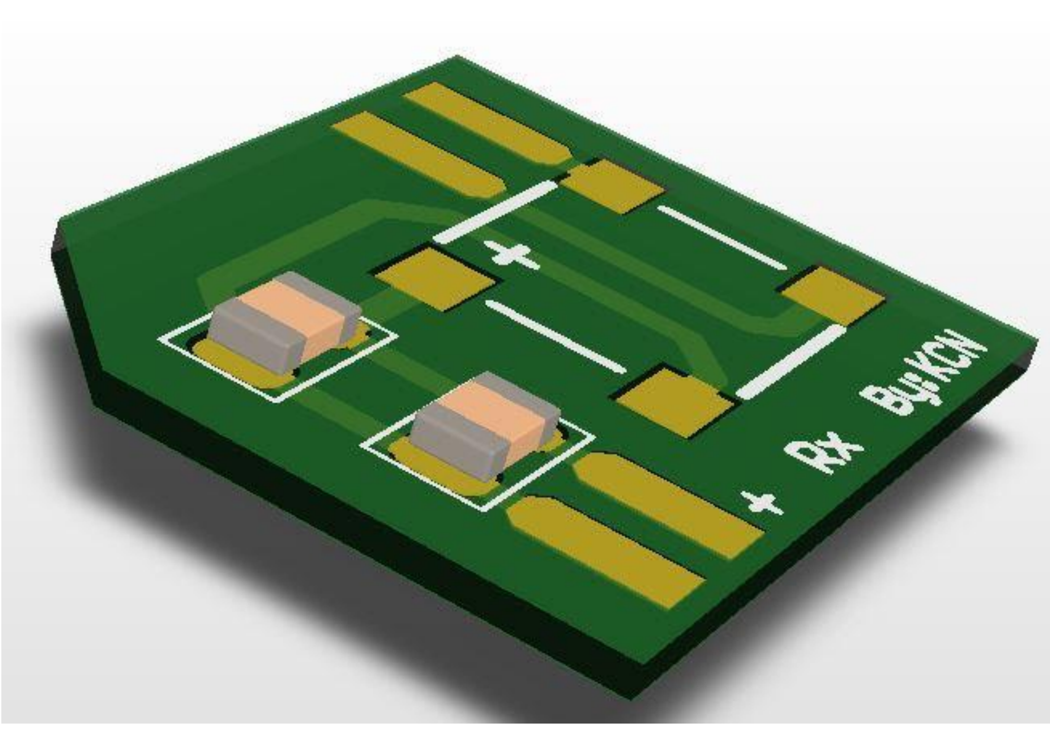


Tx Circuit (White PCB) and Rx Circuit (Red PCB) with hand made coils

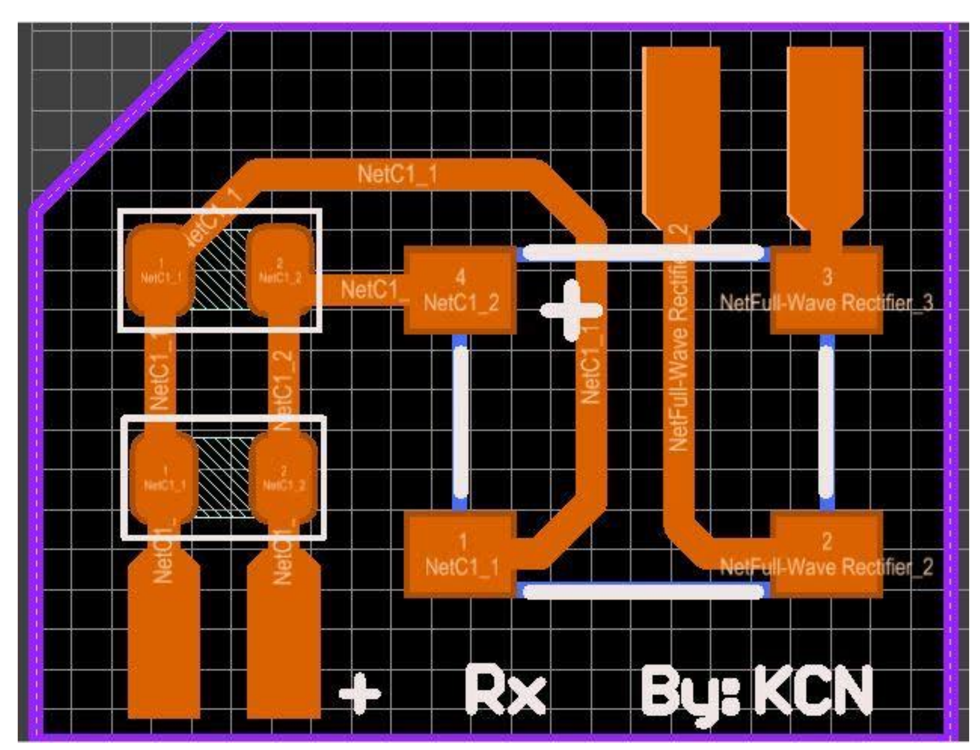
Prototype 1 Testing: After a a lot of testing, the team concluded that this prototype was not reliable, power inefficient, and took up to much space. The high input voltage required to make this circuit oscillate, was ultimately the reason we decided to move on from this prototype

Prototype 2 Testing: The testing for circuit showed that the output of the oscillator was reliable, required less components, and the input voltage required was significantly lower than that of prototype 1. This circuit also lent it self become more modular.

Current Status
Currently the team has successfully built and tested the wireless charger prototype, the prototype is capable of charging a mobile e a mobile phone with constant power. We have also designed a modular PCB version of receiving circuit and have sent out to be manufactured. We are on track to finish the project by the end of the quarter, in the remaining weeks the team will concentrate on both designing a chassis that will house the transmitting circuit, and making the circuit more power efficient.



Modular Rx Circuit
Sent out for production



THE HENRY SAMUELI SCHOOL OF ENGINEERING
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Parking guidance and mutual assistance based on the data network platform

Hongjian Lu, Bo Ning, Xingdong Wang, Lei Xu
Professor Fadi Kurdahi
Department of Electrical Engineering and Computer Science

Background and Objectives

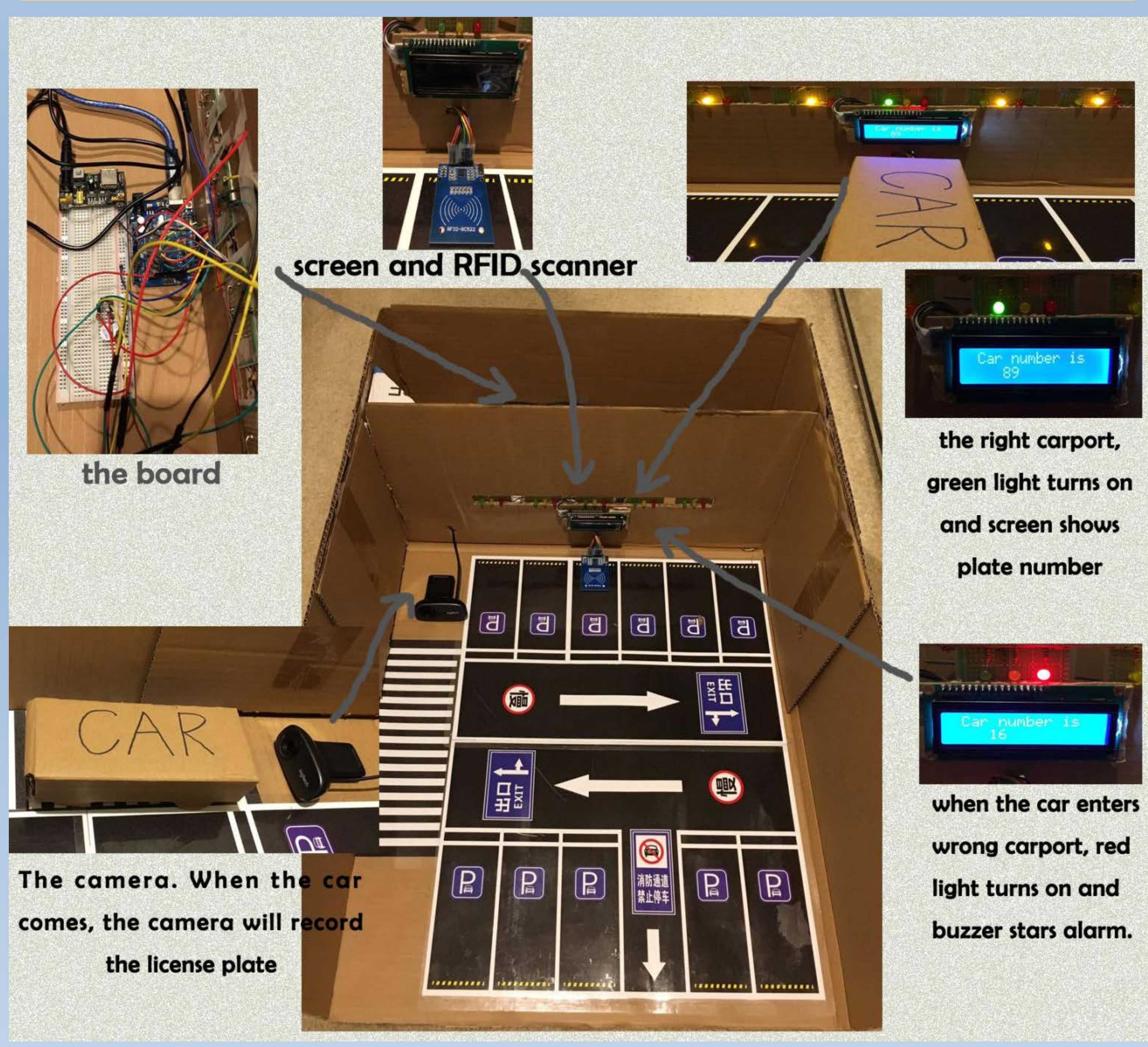
Background:

Parking has become a universal problem for urban inhabitants. Particularly in crowded areas, people have always been bothered by finding an available carport no matter in parking lots or parking structures. As UCI students, our group has been annoyed by these problems in UCI parking structures. Due to such personal experience, we start to think how we can optimize the parking process. So we determine this project is worth working on and we aim to make parking to be smarter.

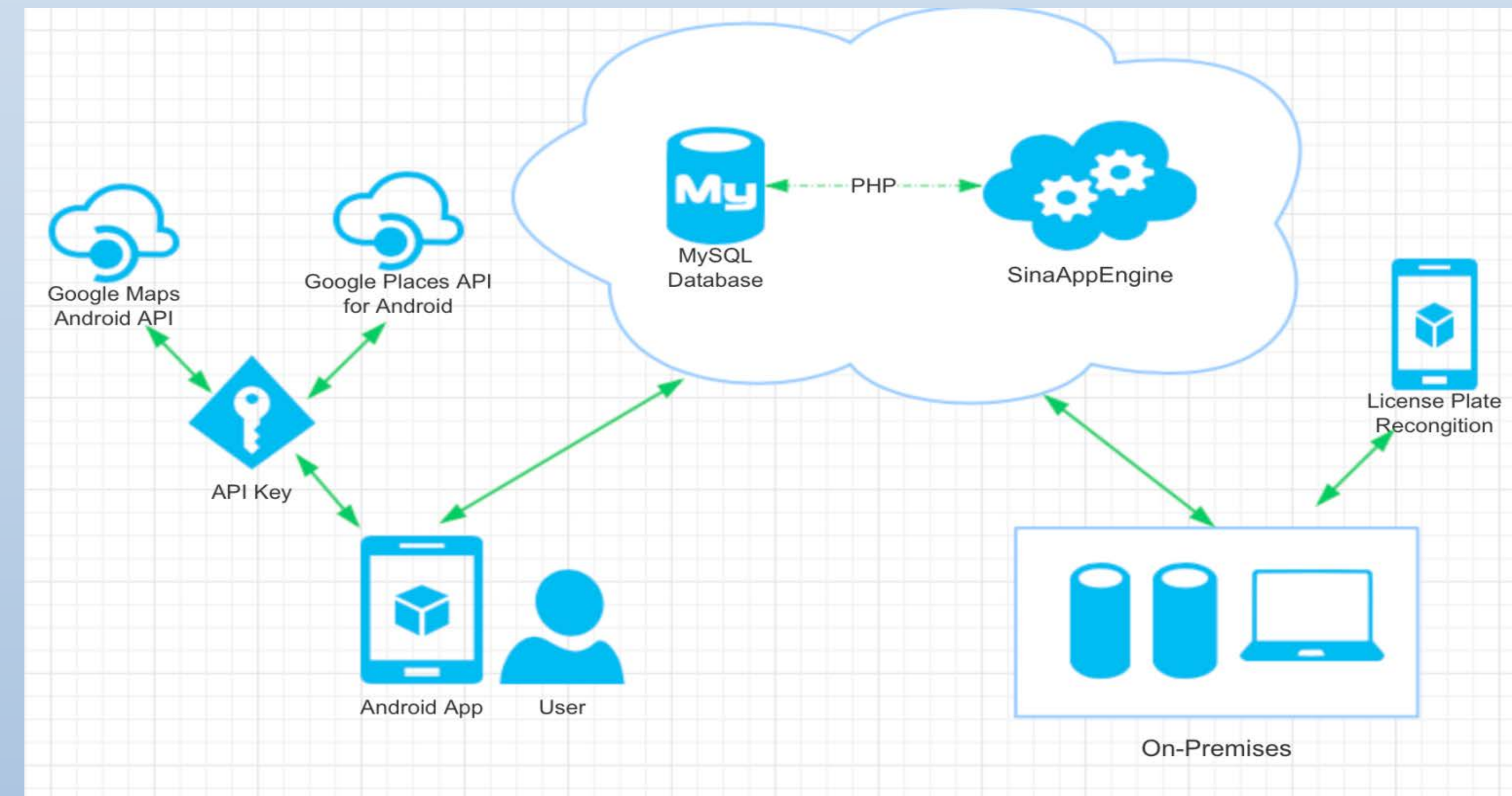
Objectives:

Our aim is to design a smart parking system by which subscribers can easily find an available carport, make a reservation for a certain carport, it is exactly matched with a car.

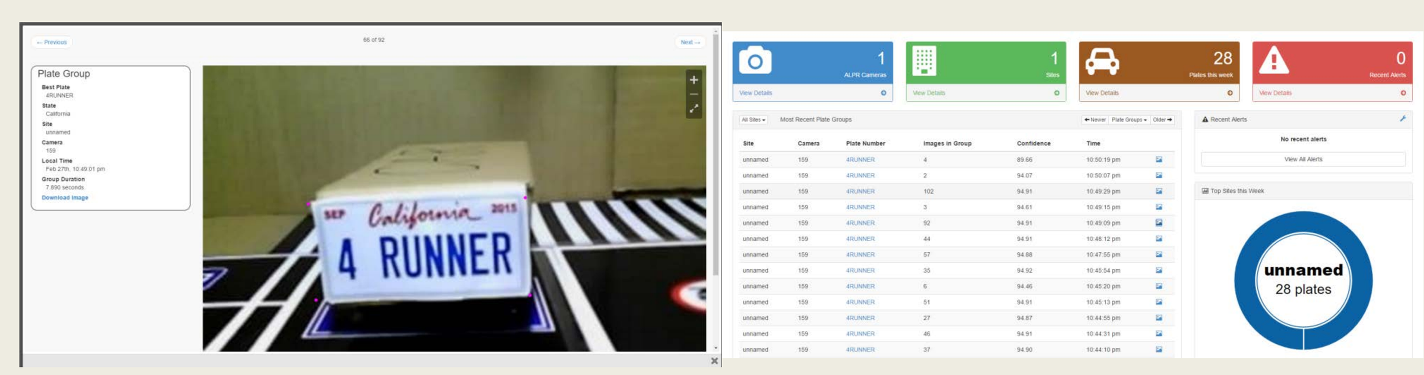
Car and Carport Matching



Topology Chart



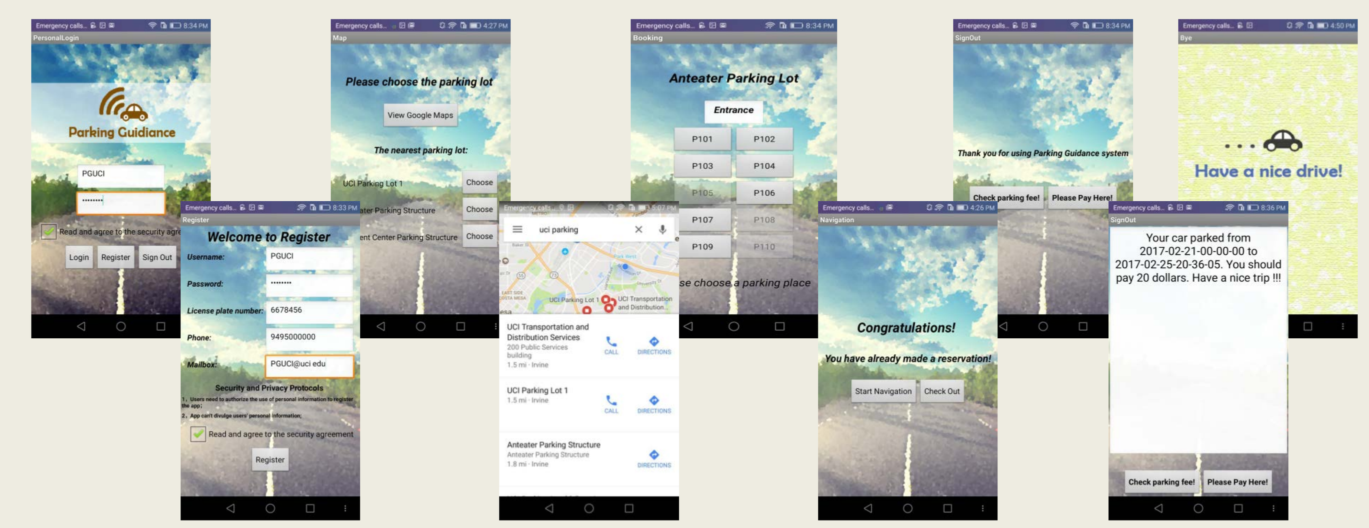
License Plate Recognition



This part is for the users who do not make a reservation in the app. If the user comes to the parking lot without reservation, we use an IP camera to capture the license plate information at the door of the parking lot and the license plate number with the time of the car entering the parking lot will be stored in the database online. The method we use to do the license plate recognition is an open source website called openalpr which can give out the license plate number when the IP camera upload video stream to the website. It is very convenient and powerful and the result it gives out is very accurate. Then by using API port the information of license plate number can be imported into the database directly.

Mobile Application

"Parking Guidance" App



In order to respond to the trend of informatization and datamation, our team use "App inventor 2" to design a new application which can help users to make a reservation of parking space, providing accurate parking space's navigation and payment system.

The Parking Guidance App connects with the online database and help users to find the most convenience method to book a best parking area.

Team Member

Mentor: Prof. Fadi Kurdahi (kurdahi@uci.edu)

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Major: Electrical Engineering

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Boaty McBoatface

Jaden Wright, Jackie Jie Ying Li, David Tran, Nirduna Abodia
Professor Alexander Ihler
Department of Electrical Engineering and Computer Science

Goal

Build a water vehicle that is able to track a moving object while avoiding obstacles fully autonomously.

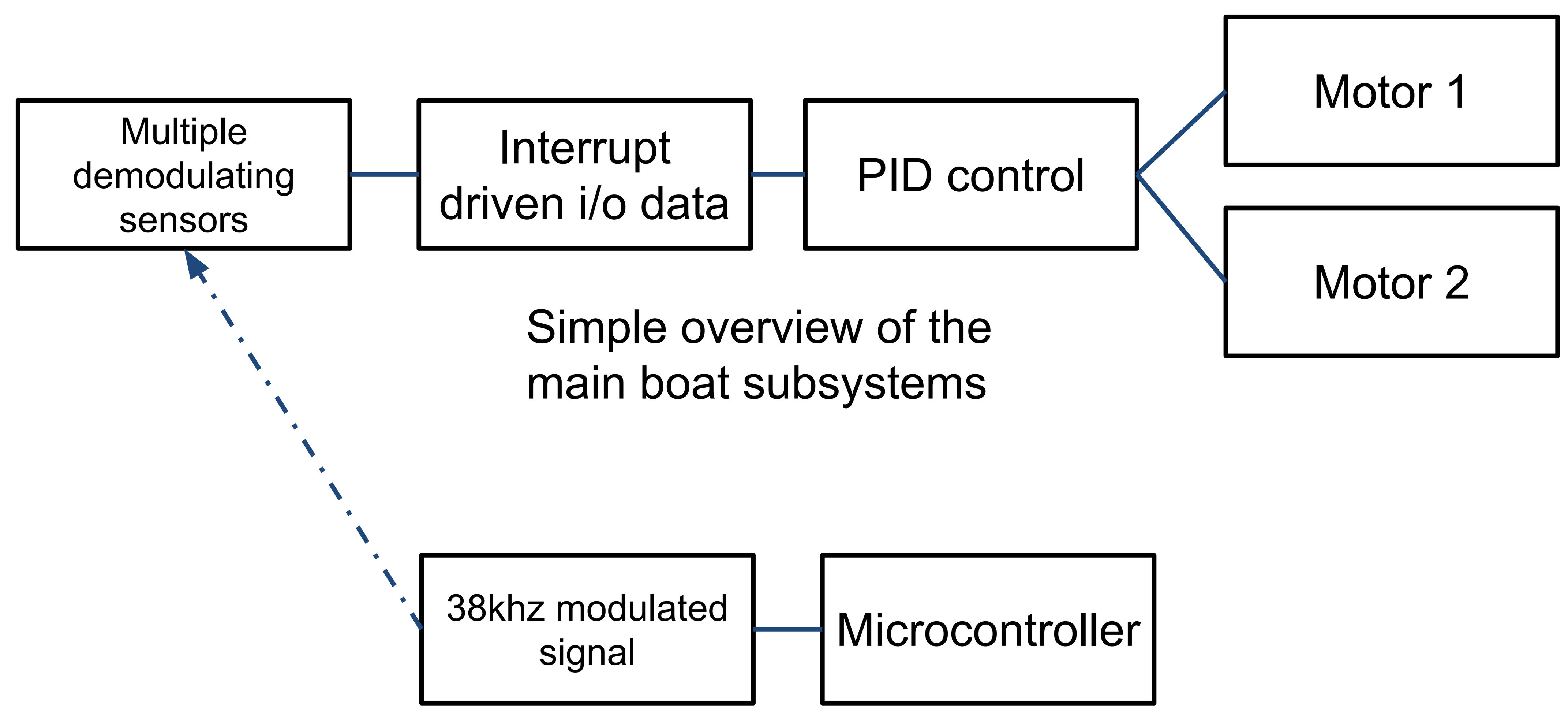
Background

There are many important applications of an autonomous boat, including cheap and reliable tugboating or shipping. We will be implementing this system by building an infrared signal transmitter on a lead boat, and a tracker on another boat with an array of sensors which will allow it to make course corrections to avoid obstacles and follow the transmitter.

Responsibilities

Jaden Andrew Wright (CSE)	Direction algorithms
Jackie Jie Ying Li (CSE)	Actuator control
Nirduna Abodia (EE)	Hardware
David Tran (CSE)	Signal transmission and detection
Professor Alex Ihler	Consulting

Diagrams and Pictures



Simple overview of the main boat subsystems

Simple overview of the lead boat subsystems

Technology

Signal modulation: An important aspect of our project is ensuring signal integrity even in noisy environments such as outdoors, where infrared radiation from the sun will interfere with our own infrared signals. To combat this, we use a signal modulation scheme commonly found in home TV remotes, allowing us to filter the desired signal from noise.

PID control loop: By using a proportional–integral–derivative (PID) controller for our artificial intelligence, we are able to correct for errors in our path, and stabilize the direction of the boat by making large corrective moves when we are far from the correct path, but also not make over-corrections when we are headed in the right direction.

Approach

Artificial Intelligence: Fully autonomous tracking and obstacle avoidance

Market

The water transportation industry has not kept up with the technological progress of the automotive and aerospace industries. We want to help advance the field of aquatic vehicles to decrease costs and increase efficiency and reliability.

Team

Jaden Wright CSE — Jackie Li CSE — Nirduna Abodia EE — David Tran CSE

Contact Information

Website: http://tiny.cc/boatymcboatface

Team Leader Jaden Wright Email:
jadenw@uci.edu

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University of California · Irvine

NO TOOL LEFT BEHIND

Team Members: Aditya Kudva, Shrishti Bhatnagar. Anand Shah and Dacoda Strack

Professor G. Li, Dr. Michael Klopfer

Department of Electrical Engineering and Computer Science

BACKGROUND

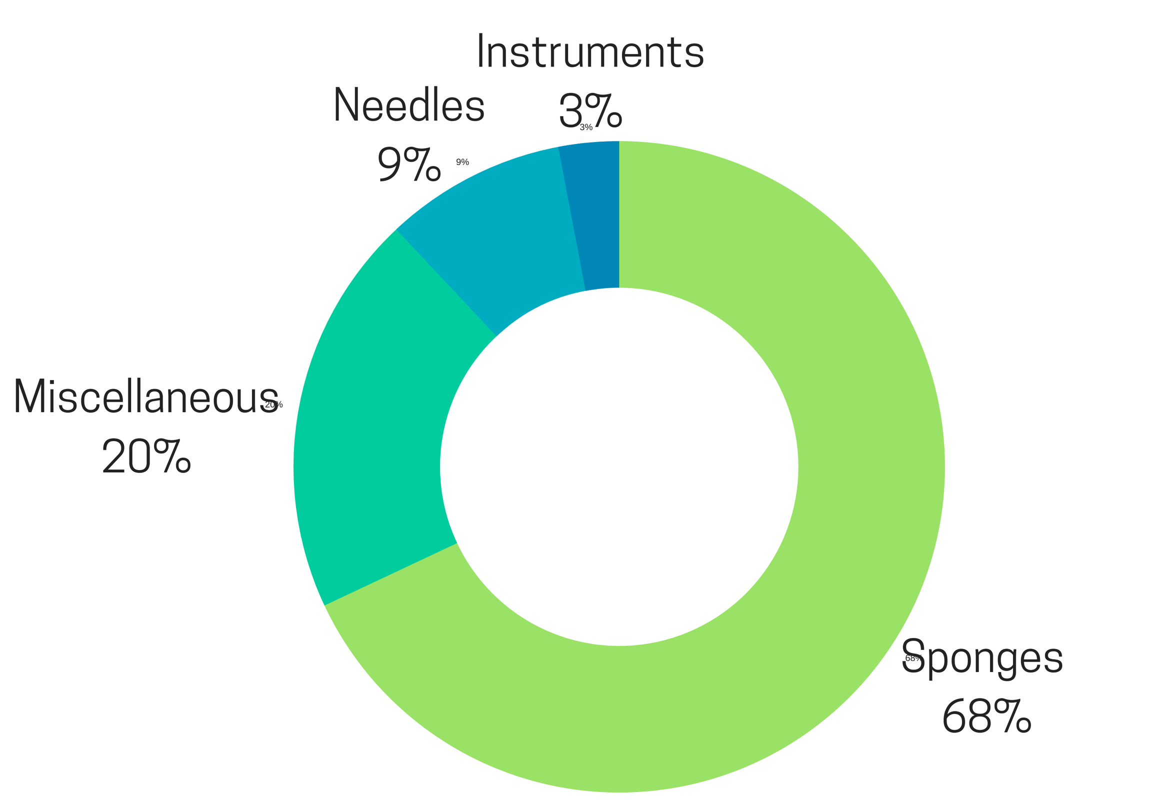
Our aim is to design a device that tackles the issue of surgical tools being left behind in a patient's bodyafter an operation. Such objects are referred to as Retained Foreign Objects (RFO).

Unintentionally retained surgically placed foreign bodies have been associated with increased morbidity and mortality, as well as increased costs and medicolegal consequences.

Hence the need to develop a technology that can detect RFO's arises, since there is no room for error. Small pieces of magnets are attached to a surgical sponge (RFO). The magnets will help detect the sponges if they are left behind. by wrapping two mats around the patient securing them using a safety strap.

The tiles on the mats have magnetometers that detect the presence of the sponge in the patient's body. Two readings are taken using the mats. The first one is taken before the operation and the second one, after.

This allows us to measure the change in the earth's magnetic field by comparing the two readings. The data is sent to a smartphone device where the heat maps are generated and compared to pinpoint the location of the sponges.



Types of Retained Surgical Objects

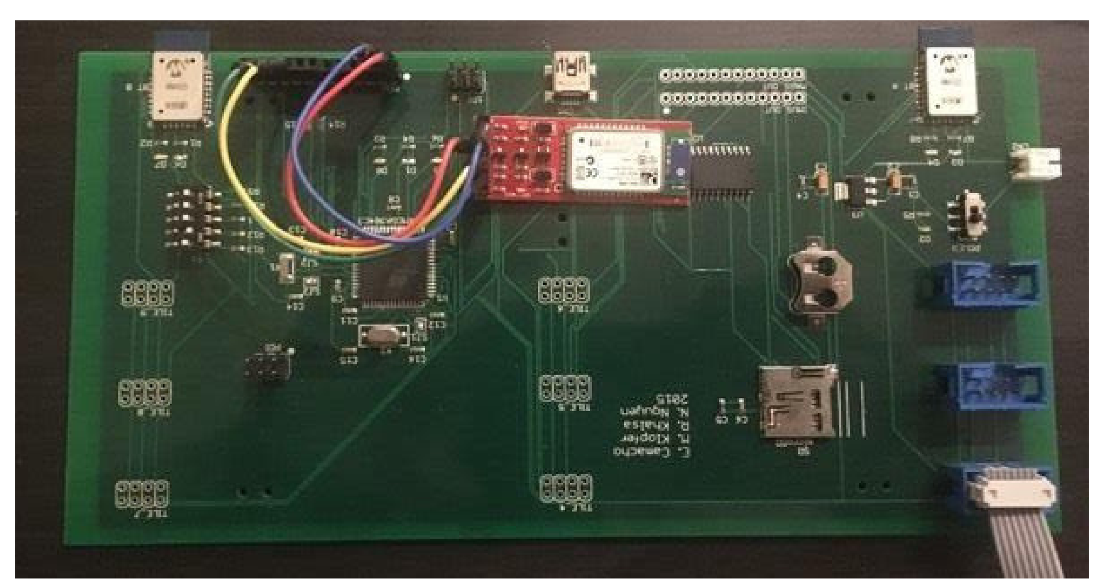
HARDWARE

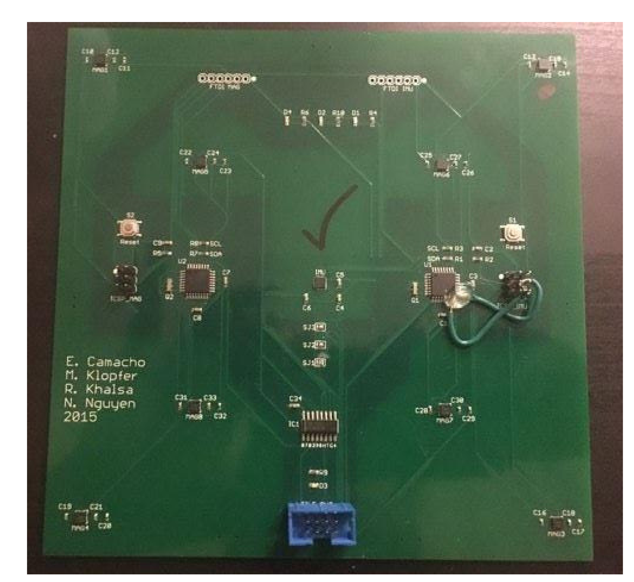
The hardware design consists of 10 Printed Circuit Boards (PCB). A MAT (Magnet Array Tile-Set) will be fabricated which will have four "tiles" on each side and two "hubs."

Each tile has 8 magnetometers which is used to detect a deviation from the earth's natural magnetic field. It also has an accelerometer which will be used for tilt correction.

The tiles then communicate with the hub through Serial Peripheral Interface (SPI) protocol, to transmit its detection of disturbances.

The hub has a Bluetooth module attached to transfer the data to an Android device in order to plot graphical visuals, called "heat-maps," (as shown in the figure below) that help pinpoint the location of the tool retained.t



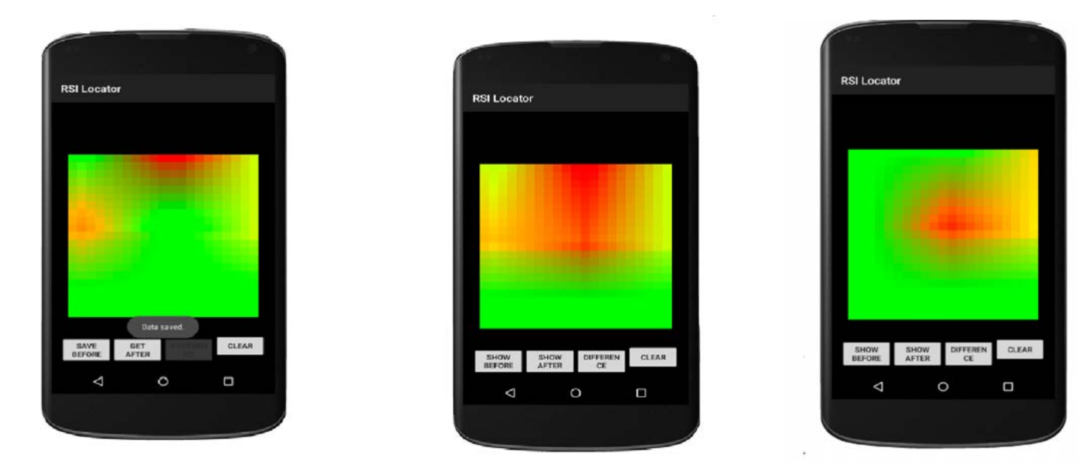


FABRICATION

There are two mats which contain 4 tiles and a hub each. The tiles are placed in a 2X2 square and the hub is placed to the side. For the mat to be placed on the bottom of the patient we used a gel cushion wheelchair seat and for the mat on top of the patient we used a yoga mat. Two pairs of belts were used to ensure that the mat could be secured around the patient's body. We used Velcro safety straps to secure each tile and the hub. The Velcro were used to ensure that tiles could be easily accessed in case of any damage.
Each tile is connected to their respective hubs.

SOFTWARE

For this project we have developed on an easy solution to send the data collected by the MAT to an Android smart-device.
In the software side, a dialect of a communication protocol known as MAVLink, which is commonly used on small UAV's, has been implemented. The android application plots the heat-maps in real time so that pinpointing the retained surgical tool is easier even when the MAT is not static. The application also includes a function for tilt correction which uses the data from the tiles' accelerometers. The heat-maps are plotted after tilt-correction in order to make sure the determination of the location of the retained object is as accurate as possible. The application also permits taking screenshots of the heat-map plots for the purpose of future analysis and research.



Graph 1. Mat Graph (Before) Graph 2. Mat Graph (After) Graph 3. Mat Difference Graph

FUTURE IMPACT

The impact this project can have on the future is tremendous. The Washington Post, estimated in 2014 that surgical tools are left behind in on in every 5500 to 7000 surgical procedures performed in 2010, according to the National Center for Health Statistics. Thus, the project can prevent thousands of casualties. This not only helps the patient remain healthy but also saves cost for future treatments and procedures caused by the RTO.

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Code Obfuscator

Team members: Zeyang Liu (CpE && EE), Alex Almanza (CpE) , Shuai Zheng (CpE)
Professor Homayoun Yousefi'zadeh
Department of Electrical Engineering and Computer Science

Goal

The goal of our project is to prevent the reverse engineering of Java code, via an obfuscation of the Java code while it is hosted on a server.

Introduction

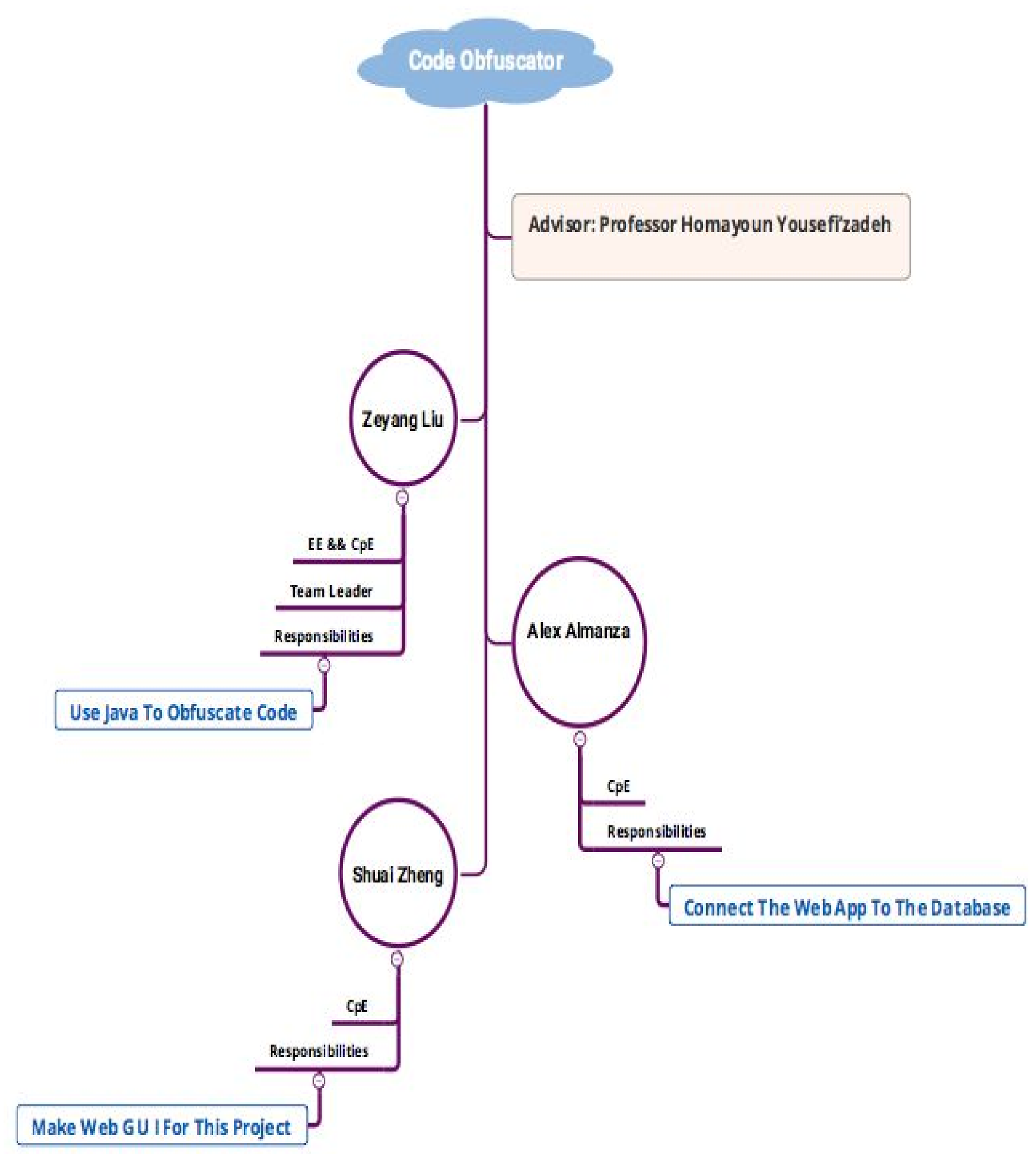
Specifically, we are trying perform an execution of Java code within JBoss container using open source. Additionally, our project is will need both frontend and backend web development, which requires some background about HTML/CSS/JS/JAVA, because we might need .jsp file to build a nice user-interface application. A frontend web page is required to establish as a login interface. From the login entry point, the user will be directed to an admin page, which will contain a button for uploading input files (the simplest format will be JavaScript). Once uploaded, the user will be able to press another button that will initiate an algorithm to process the file; the algorithm must be written using a Java. The resulting processed output will be stored into a database table, which will be based on MySQL. A third button can then be pressed to reveal the result that was stored in the database.

After development, this can be widely used in wireless area. If the same logic can be implemented by using other languages or even ran in a totally different system background, it can be a general anti-hacking / safeguarding application which can be widely used everywhere that communication and data processing is involved.

Approach

So far, the hacker is powerful. They stole the code by decompiling the binary. Thus, software Companies has a big loss. Our Web App is part of the project of reverse engineering. It could be used for Anti-Hacking to protect software code from stealing the code by decompiling.

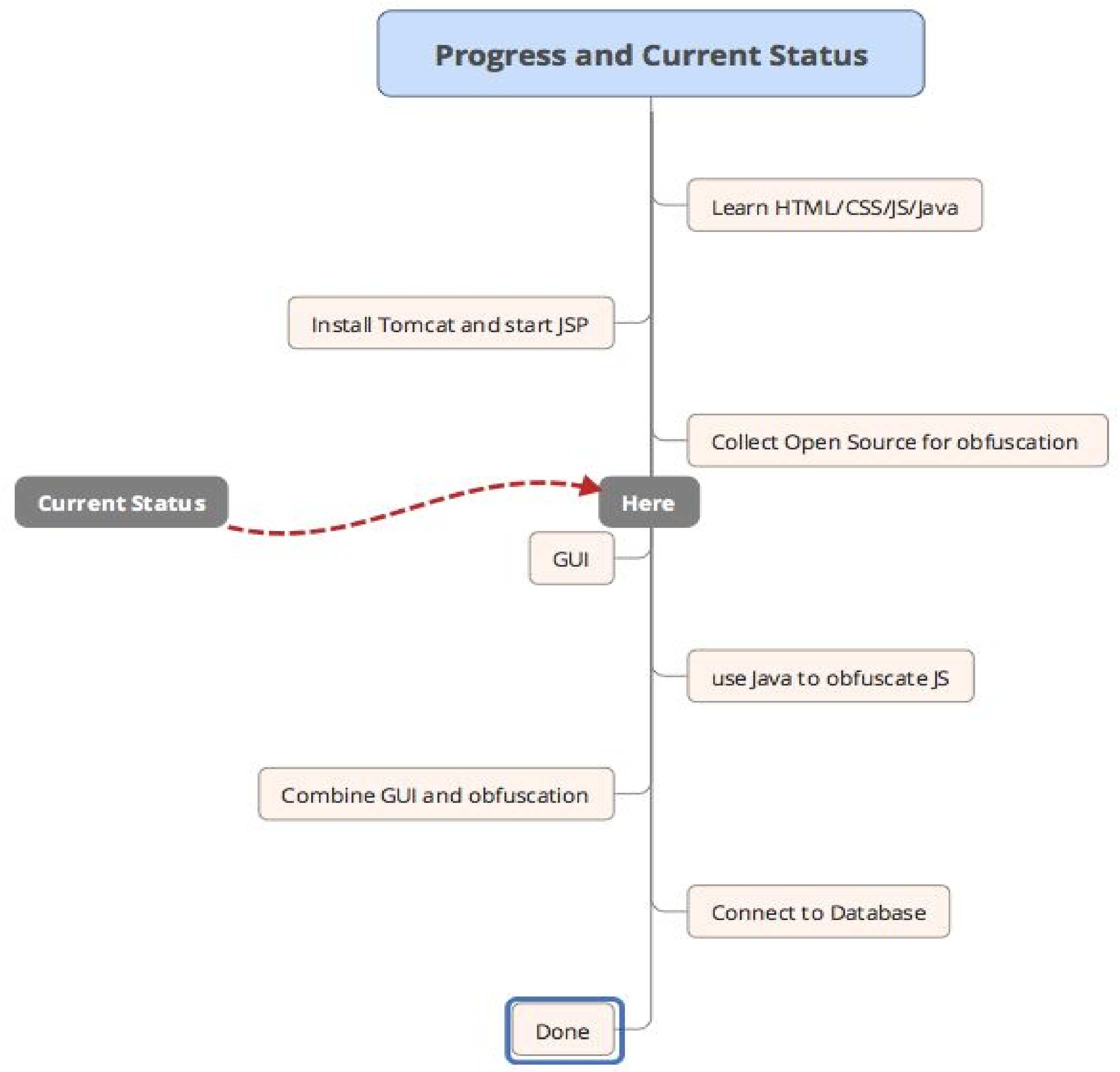
Team Members



Schedule

Major review dates:	Milestones:
Winter Break:	Self Learning HTML,CSS, JS & Java
Winter Quarter: Week1	Collect Open Source Information for obfuscation
Winter Quarter: Week2	Using HTML,CSS,JS to Make GUI
Winter Quarter: Week3	Finish GUI.
Winter Quarter: Week4	Using Java for obfuscation
Winter Quarter: Week5	Finish obfuscation
Winter Quarter: Week6	Combine obfuscation and GUI together
Winter Quarter: Week7	Connect the Web App to the Database
Winter Quarter: Week8	Finished Database part
Winter Quarter: Week9	Deploy Web App
Winter Quarter: Week10	Presentation and Write report

Progress



Contact Us

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- Shuai Zheng <szheng3@uci.edu>
- Alex Almanza <acalmanz@uci.edu>

Our Web: http://srproj.eecs.uci.edu/projects/group-55-java-obfuscation

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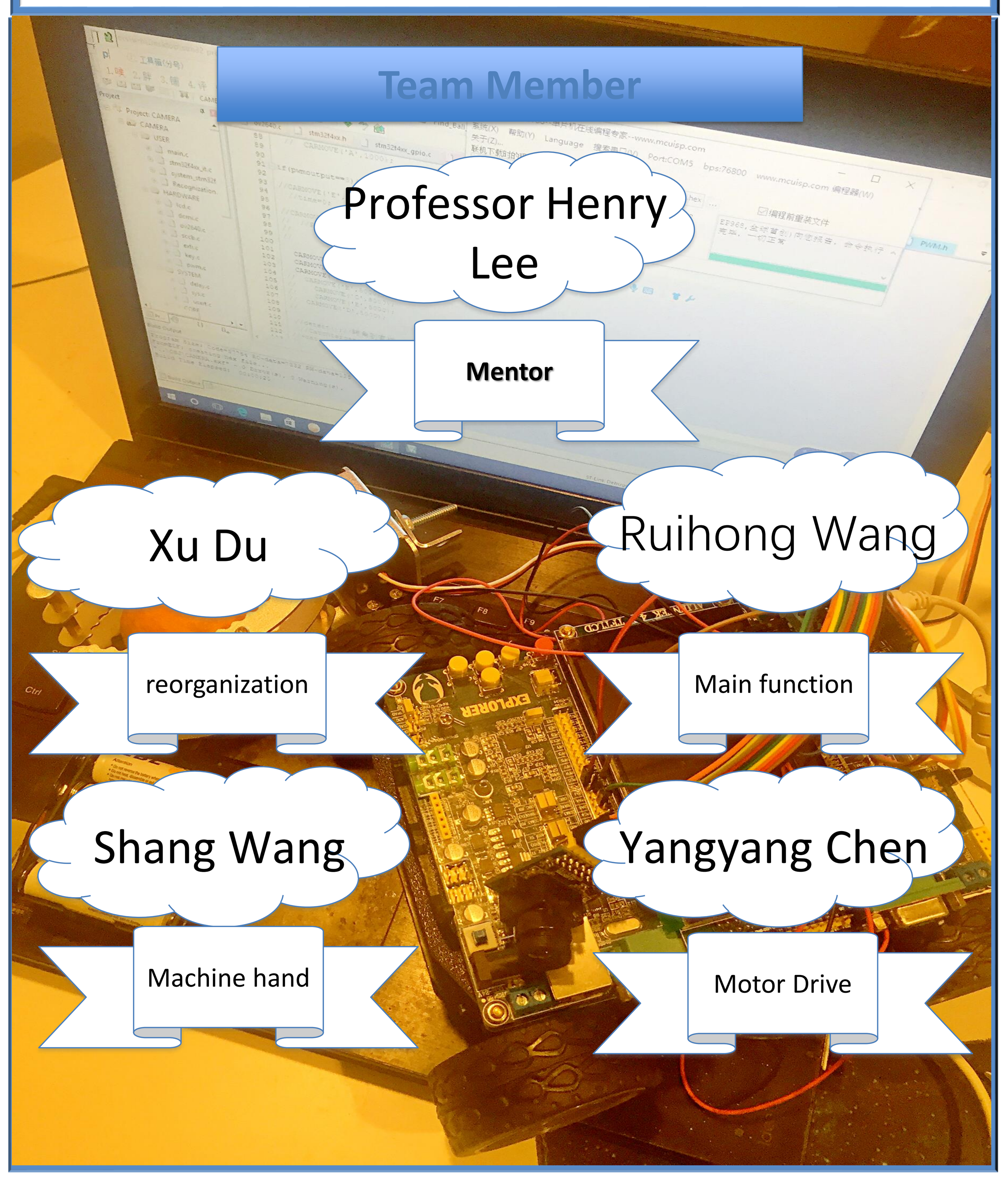
Vehicle for Recognizing Objects Based on Machine Learning

Xu du, Yangyang Chen, Ruihong Wang Shang Wang
Professor Henry.Lee
Department of Electrical Engineering and Computer Science

Goal statement

The project aims to design an intelligent vehicle which exerting Machine Learning technology to acquire key data for analyzing the characteristics of target, and use these characteristics for recognition. Meanwhile, the vehicle is able to interact with the target. For example, a vehicle to recognize tennis balls and collecting them.



Background

Embedded system has an widely application in electronic devices and intelligent of electronic devices is the dominant trend of the future. In our project, we aims to combine the embedded system with the Machine learning. Several main parts of this project show below:

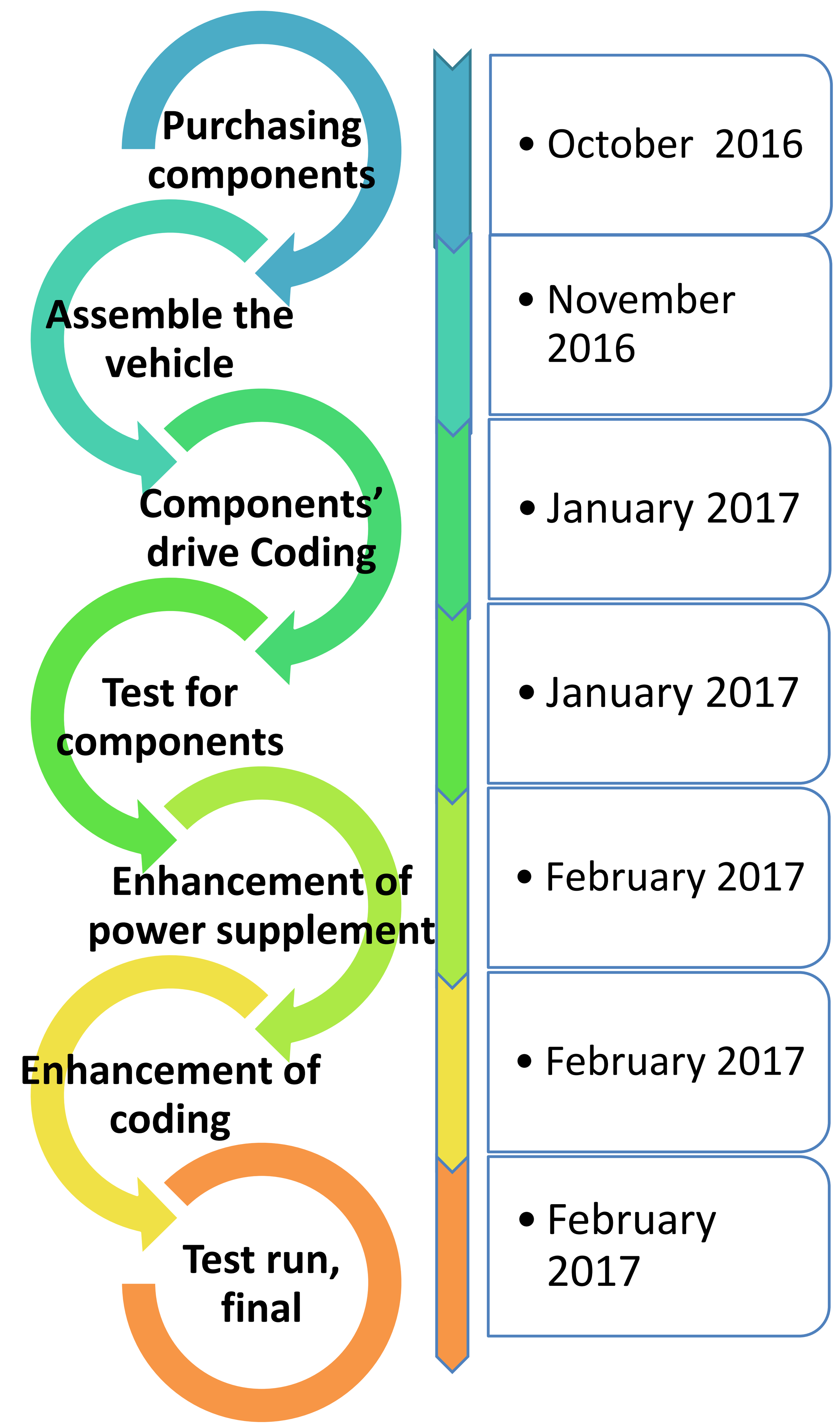
- STM32F407 as the MCU (main control unit of embedded system)
- Recognition program(the fundamental and critical parts of Machine learning)
- Control program for vehicle and machine hand.

Approach

Using recognition technology to figure out and catch a target is the first stage for machine learning. We use C to write programs basing on STM32F407 board to control camera, machine hand and vehicle, also we program the MCU to achieve items recognition.

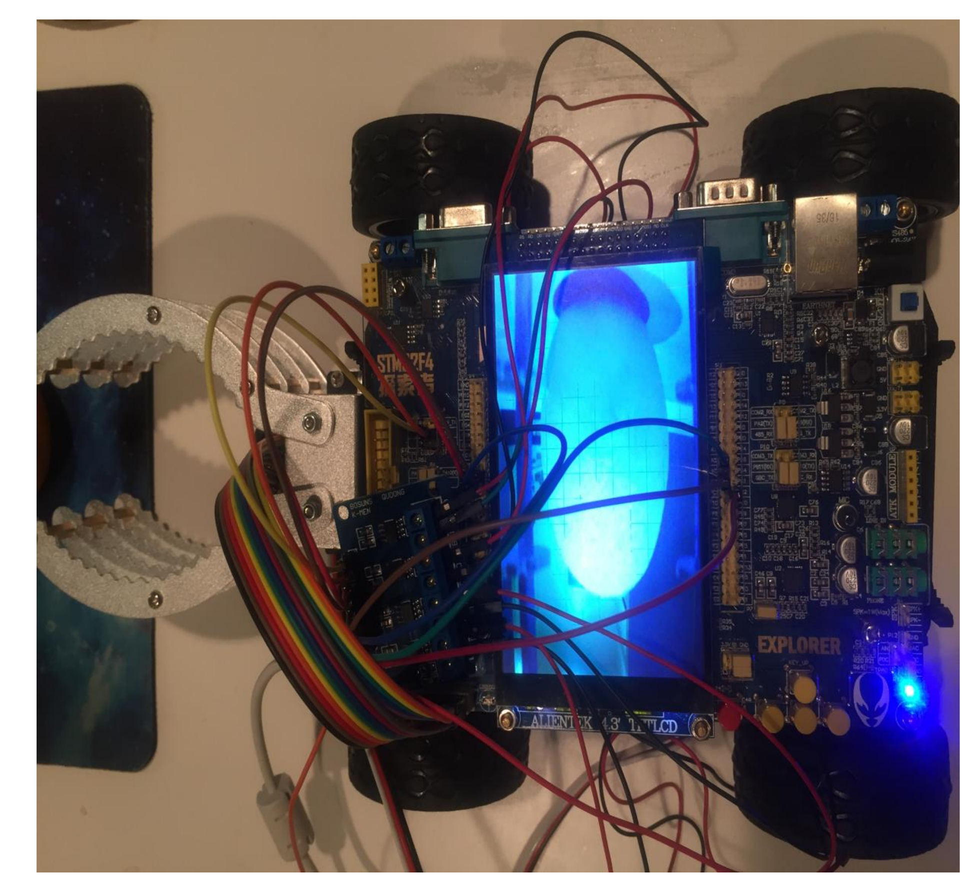
The final purpose is exerting Machine Learning on our device. We use statistical learning to allow MCU to collect the characteristics of items automatically and achieve recognition.

Timeline



Progress

So far we have assembled the vehicle and connection between vehicle and all other individual parts. We have finished the drive program for machine hand and motor which allow us to control the movement of vehicle and machine hand. Our recognition program can now accurately find the target and the mark its shape and center. Our main function combine all these programs together and enable our vehicle to search, detect, and finally catch the ball after we pressed the start button.



$H_2$0-Band

Ye Jin Choi, Saumil Shah, Christopher Rodriguez
Shannon Alfaro
University of California Irvine

Goal: To improve people's health around the world by helping them to drink daily recommended amount of water.

Introduction: Many people don't drink enough water daily because simple they forget, or they are busy with other businesses , and because no one remind them to drink water! H20-Band is a small device that tracks how much a person drinks per day, week, and months. It connects to a phone via Bluetooth, and a person can be notified to drink water if the person doesn't drink enough water throughout the day. With H20-Band , people don't need to worry about if they are drinking enough water or not!

Team Members

Name	Ye Jin Choi	Saumil Shah	Christopher Rodriguez
Major	Computer Engineering	Computer Engineering	Electrical Engineering
Responsibility	Implement the app (setting page, review page)	Implement the app (main page, user interface, design)	Connect the microcontroller to a phone (Bluetooth, accelerometer, electrical paint)

Team Advisor
Shannon Alfaro
Department: Donald Bren School of Information & Computer Sciences
Email Address: alfaro@uci.edu
Phone: (949) 824-9544

Schedule:
- Finalize design(1 week) (11/10-11/17)
- Wait for Parts (1 week) (11/18-11/25)
- Implement codes in the microcontroller (2 week) (12/2 -12-16)
- Implement app & connect with the microcontroller (3 week) (1 /3 -1/24)
- Review (1 week) (1/25-2/1)
- Final revision (2 week) (2/2-2/16)

Approach : We want people to notice that our device is very easy to use. It easily attaches to any different types of bottle because we are using a Stretchable material that will hold the device. Also, we are using an Accelerometer and the point of the touch sensor to determine the flow of the water, so it can correctly detect if a person is actually drinking, And not just moving the bottle.

Current Status:
- 3D Printing the band
- Working on the mobile app
- Working with the microcontroller controller to get data to the phone

Contact us:
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Two-Factor Authentication Lockbox

Salomon Velasquez (Electrical Engineering, B.S.), David Hua (Computer Science & Engineering, B.S.),
Kenny Huynh (Electrical Engineering, B.S.), Russell Okamura (Electrical Engineering, B.S.)
Faculty Mentors: Professor G.P. Li & Linyi Xia (CalPlug/Calit2)
Department of Electrical Engineering and Computer Science

Objective

This project is a physical representation of Mutli-Factor authentication which is widely utilized in online applications and websites containing sensitive information. Similar to how the second layer authentication is sent through another means of communication, SMS, email, etc., this device will utilize said technique in addition to the physical code. The idea is ensure security of confidential documents or private belongings from potential threats through multi-factor authentication. The better state to be in for this project to address the lack of security in traditional locks through addition of smart security. For instance, there is no need for all the lights in a house to be on full power when no one is home. That is just completely energy inefficient. Therefore, the better state would be one where the lights are either on low-power or completely turned off. This decision can only be made from the spatial awareness that all the device together compose.

Design Considerations

For this project, we are implementing a Raspberry Pi MCU that will handle most of the functions of the smart layer of security. We considered this MCU as the most versatile for our application. A limitation of the Raspberry Pi however, is that it is not as compact as we would like it to be for the purposes of a a lockbox. Also, the Raspberry Pi must be plugged into the wall in order for it to be functional.

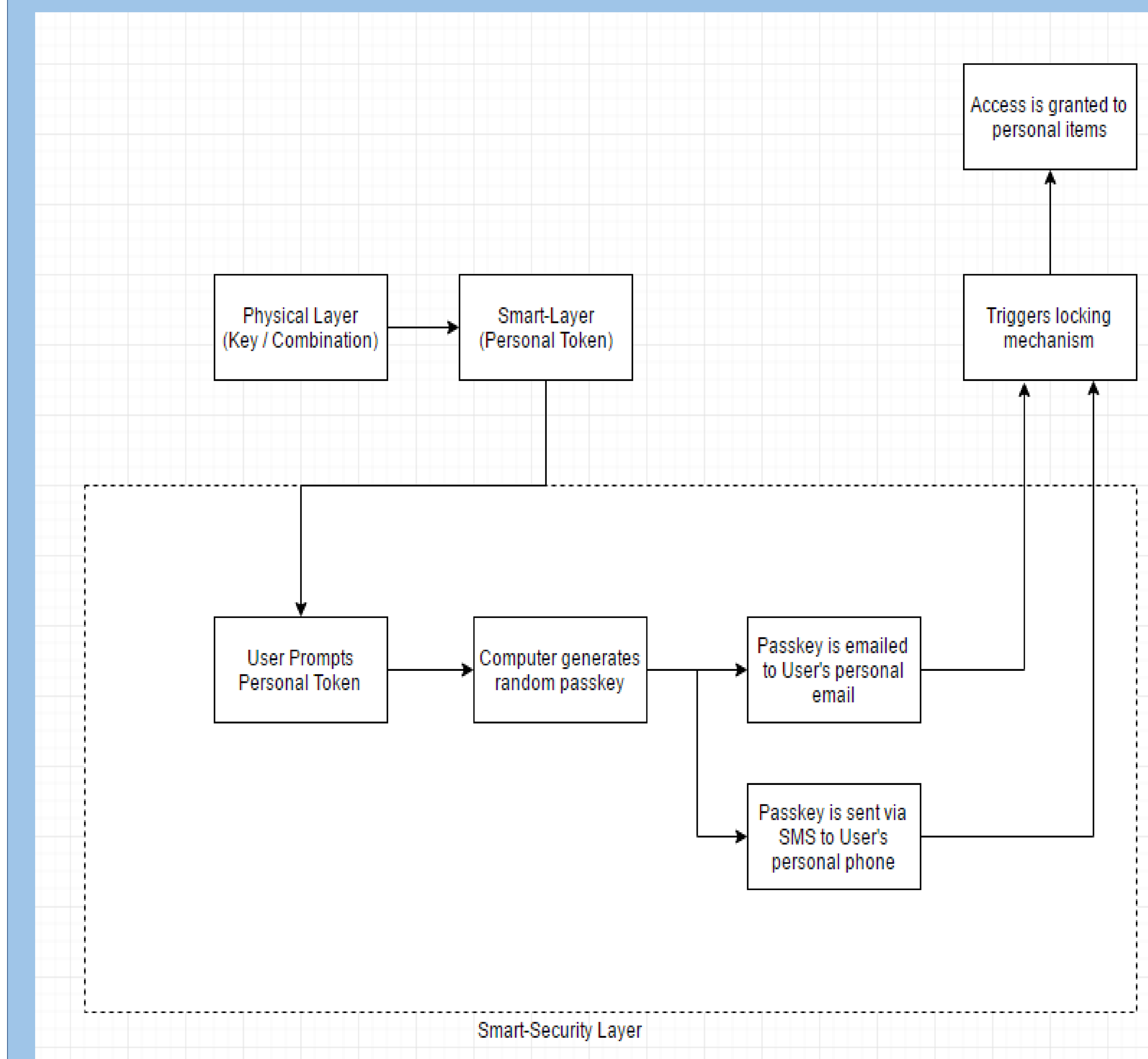
For the purposes of our project, the Raspberry Pi MCU will suffice, however for future applications, it may be beneficial to consider more specific and portable MCU's that do not require a hardwire into the wall to function.

The security layers were factors where we had to consider a few different styles for the physical and smart layer. We are opting to go with a combination style physical layer and a text/email token authentication style for the smart layer.

Design Concept

The main components of this project are:

- **RaspBerryPi3MCU**, a microcontroller unit with a Wi-Fi module. It will be connected to at least one sensor, relay driver, and transformer.
- **MQTT**, a subscription-based messaging protocol, which connects the hardware and application using a message broker.
- **Application**, the physical interface used to manually make modifications to settings,



Design Details

Controller

Each device will have a RaspBerryPi3 MCU, which contains a Broadcom BCM2837 64Bit Quad Core CPU. This is a Wi-Fi chip with TCP/IP stack. The MCU board is programmed using the Arduino IDE, which supports C, C++ and Java. The board contains multiple analog pin and multiple digital pins.

Sensors

The lockbox will also be fit with a number of sensors in order to detect the user's input. This will most likely be in the form of a keypad as a means of typing in the randomly generated number.

Network

Message Queue Telemetry Transport (MQTT) is a lightweight TCP/IP protocol that uses a broker to relay messages between devices. Messages are typically outbound, allowing for bypass of firewall's. MQTT is designed to support wireless networks with various latency levels. Integration of this service can be seen in Facebook Messenger, EVRTHING and IoT platform, and OpenStack to deliver critical communications.

Current Progress

Fall:

During the fall quarter we plan on finalizing our general approach to the project. We are going to finish planning not only the project idea, but also the story behind our idea. We will have finalized the bill of materials and have researched various microcontrollers. By the end of fall, we hope to already begin fabrication.

Winter:

Winter quarter is when we plan to finish up the fabrication stages of the project and plan on having a working prototype by the end of the quarter. In order to accomplish this, we hope to finish most of the prototype by week 8 of the quarter and finish the quarter debugging and refining our product. We also will have a working prototype, which will be presented at the design review

Future Work

Spring:

In spring, we plan on refining, and remodeling our design into a complete, functioning product.

UCI Samueli School of Engineering | Department of Electrical Engineering and Computer Science

Walk Texter

Stefan Cao, Andrew Yu, Linda Vang, Tony Nguyen
Professor Aparna Chandramowlishwaran
Department of Electrical Engineering and Computer Science

GOAL STATEMENT:

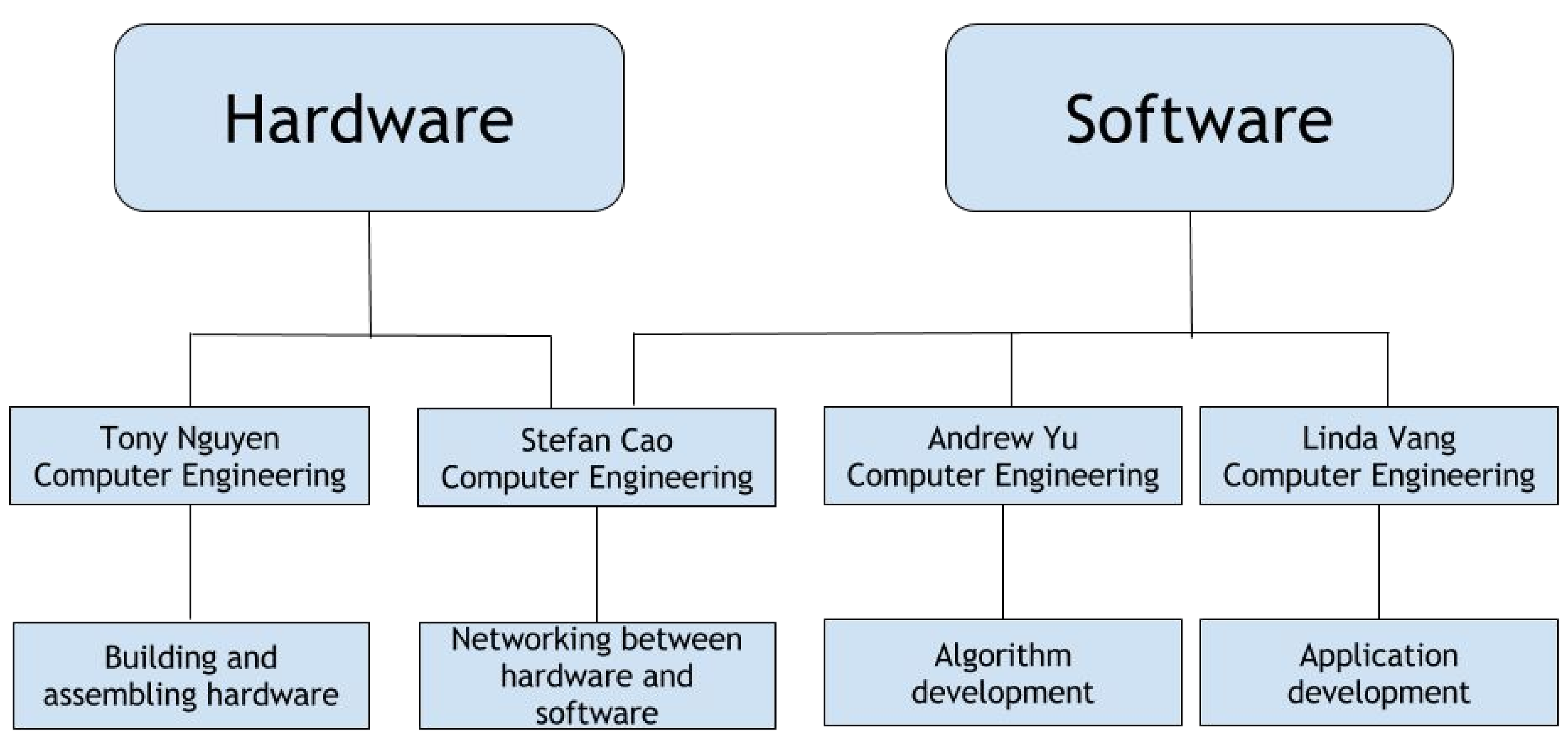
To ensure the safety of mobile device users and reduce pedestrian injuries with a portable device and a complementary mobile application that detects and alerts users of possible collisions.

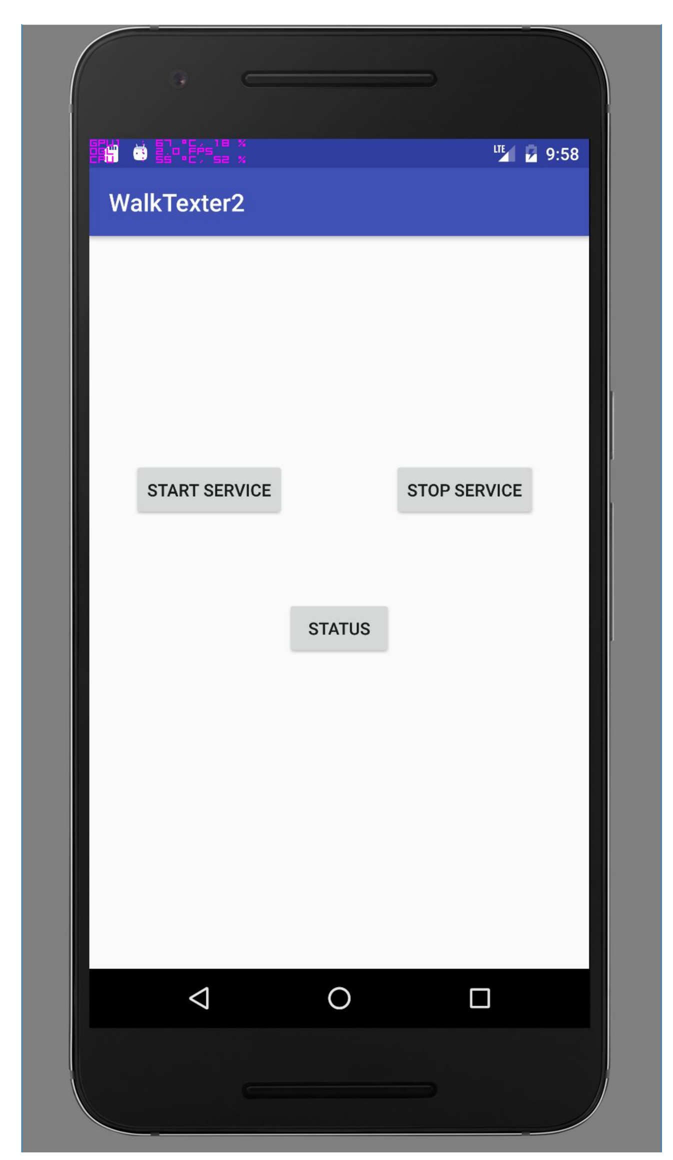
Through the development of the Walk Texter we hope to bring awareness to the dangers of the seemingly harmless and undisruptive act of texting and walking while additionally showcasing that such a commonplace activity does not have to be reduced to a bare minimum to achieve safety and that with the constant advancements of old and new technologies, we can enhance our everyday lives.

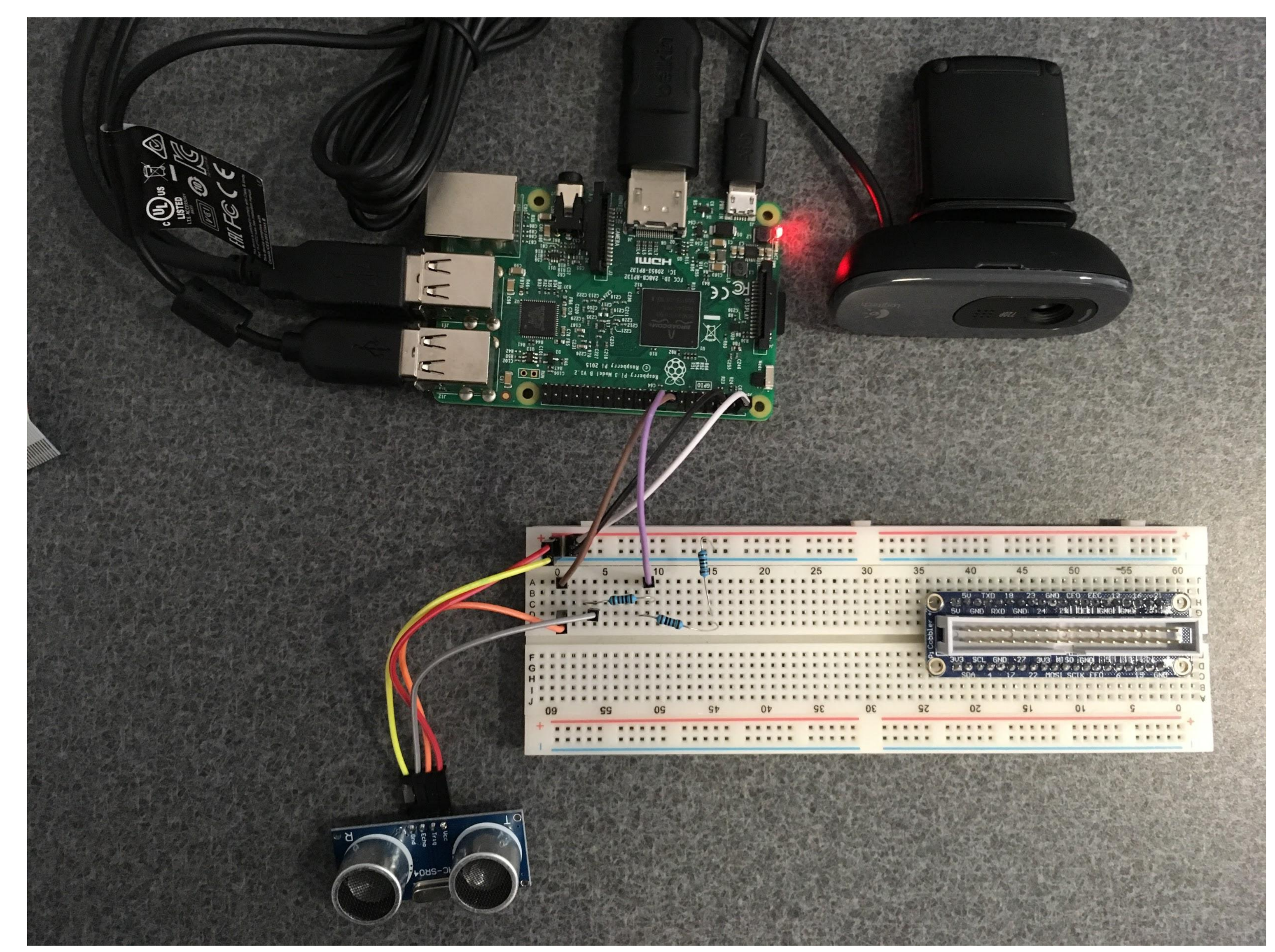
The Issue:	The Target Market:	What is it?	What it does:
There has been a significant increase of pedestrian injuries with researchers believing that injuries occurred with the involvement of electronic devices accounts for 10% of this rise. The situation has raised enough concerns that earlier last year New Jersey lawmakers' proposed a bill that bans the use of mobile devices while walking.	The Walk Texter is a device geared towards anyone with a mobile device, especially those who just can't seem to resist the temptation of texting while walking.	The Walk Texter is a portable device with a built-in camera linked to an application running on a user's mobile phone.	When an obstacle is detected and the probability of collision is below a safe range, the user is alerted of the potential danger with phone vibrations and a pop up window that will warn the user and ensure their safety.

Specifications

Product Name: WalkTexter
MCU: Raspberry Pi 3
Camera Resolution: 5 megapixels 1080p
Ultrasonic Sensor: HC-SR04
Supports Android 6.0 or above







For more information please visit us at:
http://srproj.eecs.uci.edu/projects/project-group-60-walktexter

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