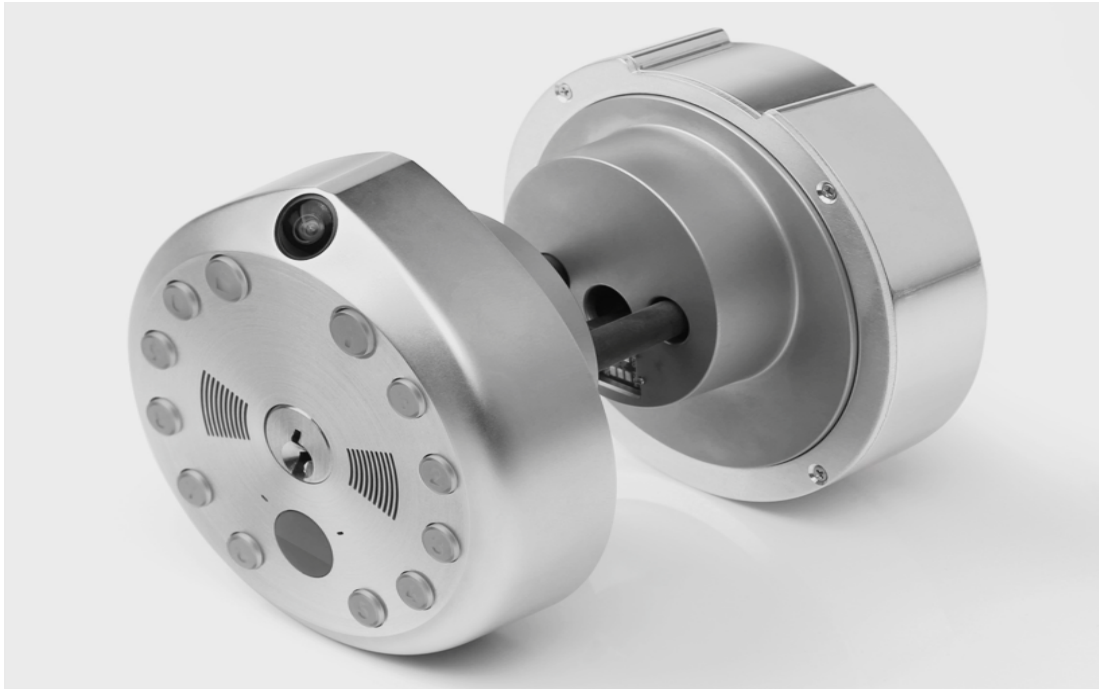


Senior Design I

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Divide and Conquer

Smart Integrated Home Security System



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Group 4

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Project Narrative

According to the US Department of Justice, there are more than 2.5 million home intrusions reported annually. 75% of burglaries occur on residential property. In addition to the total amount of break-ins, 30% of all reported burglaries occur when homeowners leave the front door unlocked/unattended. To put this into perspective, every year more than 750,000 family owned properties are left completely vulnerable to burglars because the owners simply forgot to lock their doors. If families can have the ability to access the lock on their front door by a push of a button anytime and anywhere this will undoubtedly reduce the number of intrusions. In the world of technology, Smart Home Security Devices are quickly becoming a necessity for the average family household, however, because of high prices for these systems, families have long delayed this expense until their first break in. With all the smart security system devices available to consumers, an affordable and fully equipped security device seems to still be missing from the market. As society's demand for all-in-one security device continues to grow, this necessity has inspired us to create a product that will contain all the features a homeowner desires in a security system. Compared to the isolated single function security devices currently on the market, our design will work parallel with sensors, a camera, and plug-and-play peripherals to meet all the security needs for the homeowners. Our design will guarantee low cost, user friendliness, easy installation, and most importantly, safety to families and their belongings.

The main objective of this project is to integrate several essential hardware together to form an all-in-one security system that will operate seamlessly, and in some instances, hands-free. The hardware will include both a Wi-Fi and Bluetooth module, microcontroller/processor, camera link, sensor, and/or USB hub. In addition to the hardware, will produce a mobile application that shall support the security system's interface. The mobile application will allow users to lock and unlock doors, view camera pictures, and be able to visualize a comprehensive list of entering or exiting activity. The mobile application that shall pair with the secure lock will, for now, run only on the mobile Android operating system in the infancy of this project. Over the course of the semester the application will be developed, completed, and presented to the faculty on the designated presentation day. There will be two options for the user to communicate wirelessly with the security system. The Wi-Fi module will allow users to correspond with the security system at much farther distances, as long as there is a stable network connection. However, even if there is a case of no internet connectivity, users of this system will still be able to wirelessly interact with security device via bluetooth

transmission. A camera will be responsible for capturing or presenting live images as guests arrive at the front door or proceed to press the front doorbell button. The microprocessor will receive digital data from the camera and store images in memory for later use. The microprocessor will also communicate with a USB hub that allows users to include more attachments to the security system that comply with USB connections.

For our system, we propose to construct a device that is cost effective for a potential buyer and also we desire to have a system that has low power consumption. We want the security system to appear as a product that could potentially be on the market someday. With adequate research and development and hard work we believe this outcome is more than within reach.

Project Specifications

<p>1. PCB Board Design</p>	<ul style="list-style-type: none"> - 2 board designs: 1 board for power management and 1 board for microcontroller/ microprocessor functions. - Both designed to be mounted vertically on flat surface. - Dimensions: 4"x 5" and varies with microcontroller. - Receives power from external battery or power supply. - Will distribute power to all components. - Shall mount all components.
<p>2. Wireless / Application Functions</p>	<ul style="list-style-type: none"> - Send signals to power motor functions within lock. - Wifi module will be able to broadcast long distances. - Bluetooth module will be able to broadcast signals without internet connectivity, but loss of range. - Web browser interface after wifi setup and account creation - Mobile Application UI

3. Sensor	<ul style="list-style-type: none"> - Detects open and close of door. - Will send data to microprocessor to store in memory. - Data will be recorded so security system user can view history.
4. Camera	<ul style="list-style-type: none"> - Shall capture image once doorbell button has been pressed. - Digital data shall be sent to MCU/CPU for use and storage.
5. Environment	<ul style="list-style-type: none"> - Setting has allowed us to ignore potential damages from water and other outside forces
6. Battery	<ul style="list-style-type: none"> - Should last hours without charge - Will have power conserving mode

House of Quality Table

			Marketing				Target
			High Quality	Low Cost	Power Efficiency	Simple Installation	
			+	+	+	+	
E N G I N E E R I N G	Wifi	+	↑	↑	↑	↑	> 30 feet
	Bluetooth	+	↑	↑	↑	↑	>=4V
	Security	+	↑ ↑	↑	↑		>= 3 security measures
	Battery (life)	+	↓	↓	↑ ↑	↓ ↓	> 3 hours

	Cost	-	↑	↑ ↑	↓		< \$300
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Table 1 - House of Quality

Block Diagram

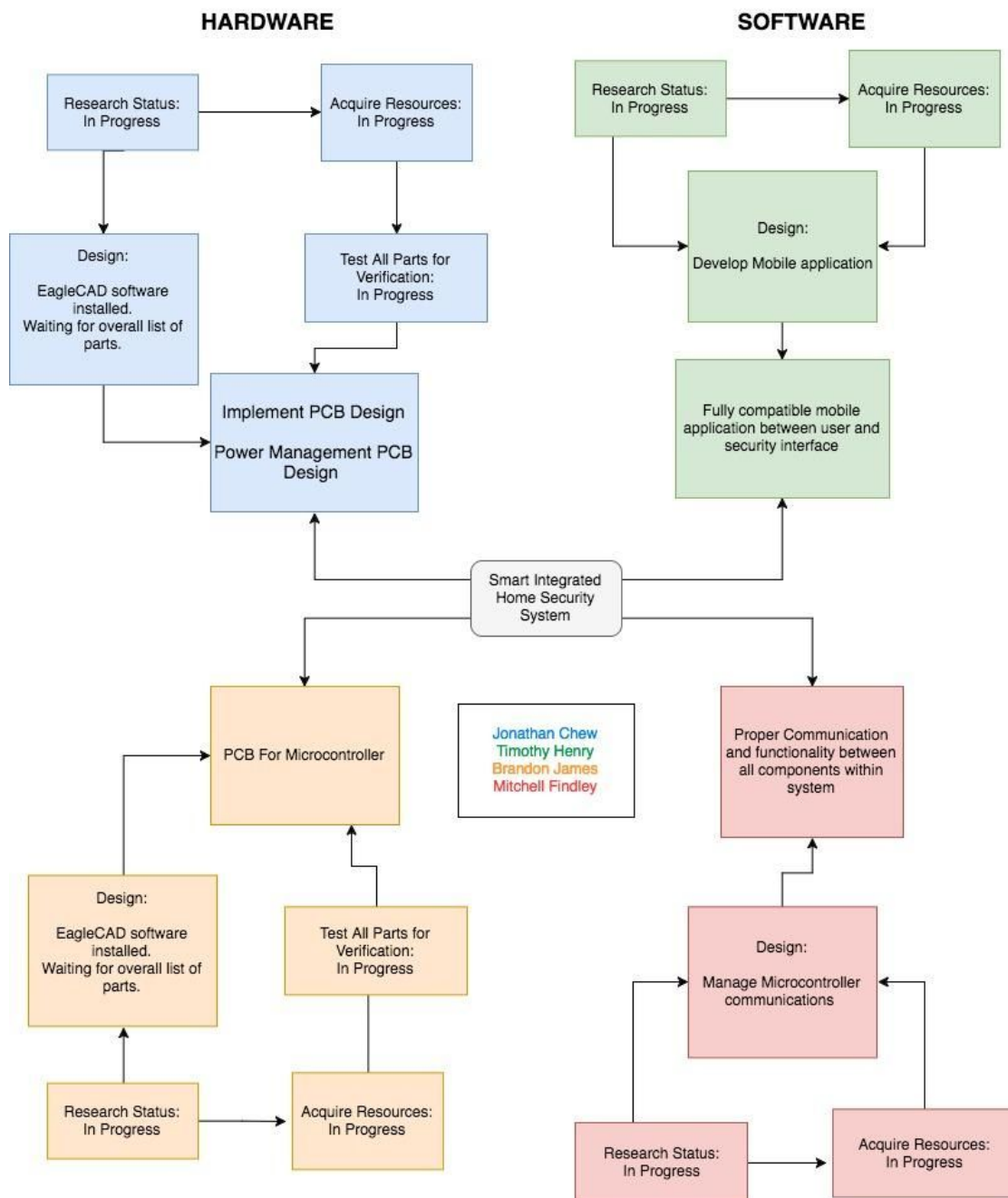


Figure 1 - Group Member Task Assignments

Estimated Budget and Financing

Item	Quantity	Price per Unit	Total Price
WiFi Module	2	\$3	\$6
ESP32 Bluetooth/WiFi Combo Chip	2	\$3	\$6
PCB board	2	\$10	\$20
Electronic lock	1	\$50	\$50
Batteries	1	\$10	\$10
Fingerprint Scanner	1	\$35	\$35
Camera Module	1	\$12	\$12
Embedded Microcontroller	2	\$20	\$40
AC to DC converter	1	\$15	\$15
Electrical components	N/A	N/A	\$15
Estimated Total Cost			\$209

Table 2 - Total Estimated Cost

The table above records the estimated prices and total costs of the entire Senior Design project. These summations are simply rough estimates based off of hypotheses and current market prices for the components listed for the project. For this project we will obtain two printed circuit boards (PCBs), one will be used primarily for the power management and the other board will be used as backup if any errors arise with the first board or for power management within the system. We will have one or two WiFi

modules in our possession. One will serve as the primary chip while the other one may be used for backup. The WiFi chip will be utilized to connect wirelessly to a nearby Wireless Local Access Network to communicate outward to mobile connected devices. Two Bluetooth chips could also be attained which we will budget for incase of any difficulties or unforeseen errors. Since we are building a lock that will go onto a door, we must purchase a door knob and a small motor that will move the actual lock back or forward. The smart lock that shall be created will be desired to come with a camera and a fingerprint scanner so the group will provide the costs for these integral components. We also will need to procure soldering equipment to join components to one another.

All in all, we will look to gaining the funds over the course of the semester to build this project from the ground up or possibly locate a sponsor that can donate to this cause.

Initial Project Milestones

Task	Start Date	End Date	Status	Responsible
Project Brainstorming	1/17/17	1/27/17	Ongoing	Group
Initial Document - Divide & Conquer	1/27/17	2/3/17	Ongoing	Group
Table of Contents	2/6/17	2/17/17	Not yet started	Group
15 pages completed each	2/17/17	3/24/17	Not yet started	Group
30 pages each completed, paper due	3/24/17	4/27/17	Not yet started	Group
Research, design, and build PCB	2/3/17	4/1/17	Ongoing	Group
Acquire all components	3/24/17	4/27/17	Not yet started	Group
Build first prototype	5/1/17	5/31/17	Not yet started	Group
Initial code research and development	5/1/17	5/31/17	Not yet started	Group

Finish final product and documentation	6/1/17	7/7/17	Not yet started	Group
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Table 3 - Initial Project Milestones

Summary/Goal

There are two main goals with this project: one that is a personal goal and another that is client-motivated. The personal goal for the group of this project project is the attainment of skills that will be relative to the work experience that we will get from the real world. Sitting in classes and doing homework is an important foundation, but getting hands-on working experience within a team, accomplishing a goal, is integral to the development a budding engineer’s career. We have heard testimonials of engineers who couldn’t get projects done or failed because of a lack of team cohesion. Our goal is to combat that with a steady stream of communication and debriefing. We also look to build upon our technical skills that may soon appear enticing to our future employers

On the other hand, our client-motivated, main goal of this project is to make an affordable and accessible smart locking system that fixes many of the problems that plague smart locks today. Too many families are missing out on such an important piece of technology just because of the price. And for those families that do have smart locks and have paid the premium, there should be more features to justify the cost. So in the end, our plan is to provide a locking system that is smarter, more feature- packed, and more affordable than any other on the market.