HOMES (Home Observing and Monitoring Entry System)

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***Abstract* — HOMES is an automated entry system that provides homeowners with easy access into their home as well as easy monitoring. There are two main components of HOMES: the entry system that features several ways to enter the home all without a key and a monitoring service that will enable the homeowner to view when any external entry points have been accessed. HOMES features a web application that allows the users to interact with the system. To enter their home, the user can use any of the entry methods provided by HOMES, they are facial recognition, blue tooth, fingerprint, or the web application.**

***Index Terms* — Face recognition, fingerprint recognition, power integrated circuits, microcontrollers, Bluetooth, internet of things, and object oriented programming.**

I. Introduction

The purpose of HOMES is to advance the technology of home monitoring and entry systems. In 2014 only 15% of Americans had an alarm system in their home [1]. This indicates that most of the United States has no technology protecting or monitoring their house. However, the alarm security industry has been increasing their revenue with a 3.0% increase in 2014 to 2015 [2]. This provides a window for developing home security and monitoring; since the alarm security industry is increasing.

There are two main parts of HOMES: an entry system and a monitoring system. The entry system consists of several methods of entering the home through the front door and a pet door that unlocks when the homeowners pet comes within range. The modes of entering the home are facial recognition, Bluetooth, fingerprint, and the web application. The monitoring system will detect when any external entry point has been opened and will be available on the web application log.

The group was motivated to make this system because there is a serious lack in technology when it comes to entering our homes. The fact that the world has been using the same outdated technology of a lock and key since ancient Egypt six thousand years ago is alarming. Recent advances have been made in this area but there aren't many people using these new products.

HOMES will provide a compact system that attaches to the front door. This system will have a camera, a light, and a fingerprint scanner for entry methods. It will also have a LCD touchscreen for easy user interactions. It will provide a pet door of average dimensions that will lock and unlock when the pet comes within range and it will provide a collar for the pet. It will also provide a small magnetic detector to alert the system if an external entry point has been opened.

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II. Single board computer

The most important part of HOMES is the single board computer. There are numerous options when it comes to power single board computers. Some of the options we considered were the Raspberry Pi 2, the Beaglebone Black, and the Arduino Uno. All of these options were good choices because they have a significant amount of processing power and GPIO pins. We choose the Raspberry Pi 2 to be the brains of our system. It had numerous USB ports which will be utilized to connect a camera, a mouse, and a keyboard for easy developing. It also has enough RAM, GPIO pins, and processor speed to accomplish all the requirements for our system. In fact, it had the most GPIO pins (with 40) and USB ports (with 4). It was also one of the more cost friendly options. The Pi will be responsible for facial recognition, the camera, Bluetooth, controlling the power printed circuit board, and the LCD touchscreen user interface. The user interface is a very important part of the Raspberry Pi because it will enable the user trying to enter the home to interact with the system, and it will display the status of entry.

In addition to the Raspberry Pi, an Arduino microcontroller will be used, the atmega328p. We choose the AtMega because group members were familiar with how it works. Also a group member already had the microcontroller so we didn't have to order it. This will be responsible for the motion sensor, the LEDs, and the fingerprint scanner. The Arduino microcontroller needed to be added to the single board computer because it needed a little more processing power and it will be easier to program the separate systems instead of doing everything on the Raspberry Pi.

In order for the microcontroller to communicate with the Raspberry Pi we will be using the Pi's GPIO pins to connect with the atmega238p. This communication will enable the microcontroller to talk with the Pi. Since the AtMega will be controlling the motion sensor, the LEDs, and the fingerprint scanner, it will need to tell the Pi when an

authorized user is trying to gain access to the system so the Pi can unlock the door.

III. Entry System

The entry system consists of two parts: the front door, and the pet door. HOMES provides a safe way of entering the home without the need to carry around a key. Our entry system provides homeowners several options for entering their home as well as a pet door that will only allow their pet inside.

A. Front Door

We considered several different methods of creating a locking mechanism: an electric strike, an electronic deadbolt, and a regular deadbolt with a servo that turns the lock. We decided to use an electric strike for our project purposes mainly due to budget constraints. Both the electric strike and the electric lock would be good and simple to use for our project since all either would need is a pin being set from low to high to operate the mechanism that sends the voltage through the strike or activates the motor in the lock. Thus the choice was one of the battery power, security and elegance of the electric lock versus the low cost and ease of set up of the electric strike. Ultimately we ended up using the electric strike since the purposes of our project is to make the entry control system and not necessarily a method of entry (i.e. lock or strike) and the extra cost would not be justified. The electric strike has a fail secure feature that will keep the strike locked until 12V is applied at which point it unlocks and the door can be opened. As mentioned earlier there are four ways of entering the home: facial recognition, Bluetooth, fingerprint scan, and the web application. The user will be able to interact with the system via a LCD touchscreen. If the user is an authorized person then the Raspberry Pi will communicate with the power PCB to apply 12V to the strike and unlock the door.

For the demonstration of HOMES, a door was acquired and an electric strike was fitted in the frame. It also holds the 3D printed casing for the Raspberry Pi and the Arduino microcontroller as well as the LCD screen, the camera, the LEDs, and the fingerprint scanner. The 3D printed casing is to protect all the components as well as giving the system a clean and organized appearance.

B. Pet Door

HOMES doesn't just have an entry system for humans. Since pets are such a big part of many people's lives, the group wanted to incorporate a pet door that would unlock when a pet came within range and then lock when a pet becomes out of range. Most pet doors use some kind of aluminum sliding door to stop the flap from being pushed in or out. This means that the pet has to wait for the homeowner to come and lift the sliding door before they can use it. However, there are a few pet smartDoors that allow pets to unlock or lock the pet door so they can get out when they want to. This is similar to our idea for HOMES. Current electronic pet doors on the market use a variety of different communication technologies from Bluetooth to ultrasound. We also wanted to make sure it wouldn't unlock for any pet but only the homeowners pet(s). The best way to tell if an authorized pet is in range is to put a transmitter on its collar. HOMES uses a Bluetooth transmitter development board called the LightBlue Bean. It has a small CR2032 coin cell battery that power the 4.0 low energy Bluetooth transmitter. It is easily programmable and is small enough to use as a wearable to put on an animal collar. The LightBlue Bean is shown in Fig. 1.

In order to accomplish this, a pet door of average dimensions was built out of 2x4s. The average dimension for a pet door is about 10 ½ by 16 ½ inches. The lock will be an arm that will not allow the plastic flap to be pushed open. When the pet comes within range, a servo will mover the arm out of the way so the flap can be opened. Then as the animal moves out of range the servo puts the arm back preventing the flap from opening again.

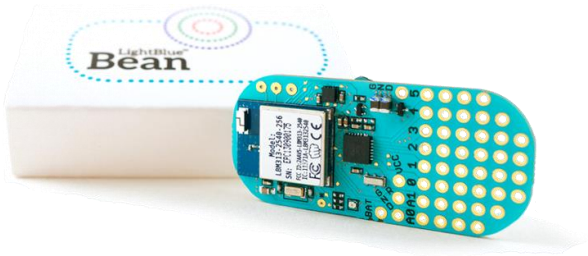

Fig. 1. LightBlue Bean board

IV. Monitoring System

The second of the two main parts of HOMES is the monitoring system. The group wants to provide homeowners with a method of viewing when an external entry point has been opened. We define external entry point as any back or sliding glass doors as well as any windows. HOMES will display this log on the web application. This enables homeowners to view when or if an external entry point has been opened.

We looked at several different methods to detect if a window or back door has been opened. A magnetic sensor can be used to determine if the entry point has been opened by placing a magnet on the bottom part of a window for instance, and then another one on the part that will open. When the window is shut, the magnets will come together.

However when the window is opened, the link will be broken.

A displacement sensor can be used as well by measuring the displacement at time intervals and comparing it with that of a base value (which would be when the window is closed). If the displacement measurement is greater or less then the base value then the entry point has been moved.

Lastly, an acceleration sensor can be used to detect an entry point opening or shutting. The sensor would need to be attached to the section of the entry point that will move if it is opened or shut. It will constantly measure the acceleration and check if it is greater than zero. If the acceleration is greater than zero then the entry point is moving and thus opening or closing. If the acceleration is zero then it is stationary and has nothing to report.

Out of all these options HOMES utilizes magnetic contact switches. These come in two main types: normally open and normally closed. Our system uses a normally open switch which will be an open circuit until a magnetic field comes into contact with it and closes the circuit.

When the circuit is closed (which means the external entry point is opened) a small PCB will send a signal to the Raspberry Pi through Wi-Fi. It will then be displayed on the web application on the log of entry points. The Wi-Fi module that is being used is called the electric imp. The imp is an SD card that is inserted into the April development board.

We decided to use this instead of adding a Wi-Fi module to our small PCB because it is easy to set up and one of our concerns was that if the Wi-Fi changes (either the provider or the password) then the homeowner may have a hard time reprogramming these modules for their external entry points. With the electric imp however set up is very easy because of their “blink-up” technology. All the user has to do is download the electric imp application on their smartphone and connect to the Wi-Fi they wish the external entry point module to connect to. Then they hold the phone up to the electric imp SD card and wait as the application flashes a series of lights that then sets up Wi-Fi on the module.

V. MODULES

There are several hardware based modules for accessing the entry system: fingerprint scanner, Bluetooth, and facial recognition. Other hardware based modules are the LCD touchscreen, the motion sensor, the camera, and the lights. The door can also be opened through the web application which will be discussed in that section. HOMES has several methods of unlocking the front door because the group wants to give homeowners options. If facial recognition or a fingerprint is used then the user doesn’t need to carry anything with them, not a key or a phone, they only need themselves to gain entry into their home.

A. Fingerprint Scanner

There are two types of fingerprint sensors, optical and capacitive. HOMES employs an optical scanner because they are significantly cheaper than a capacitive scanner even though they are not always as accurate [3]. The scanner will be connected to the raspberry pi via pins. An optical fingerprint scanner uses lights, usually LEDs, to light up the ridges and valleys in a fingerprint. It then compares the light and dark areas that correspond to valleys and ridges on the fingerprint with one in a database. The pin output for the fingerprint scanner is shown in Fig. 2 along with the fingerprint scanner which is approximately the size of a quarter.

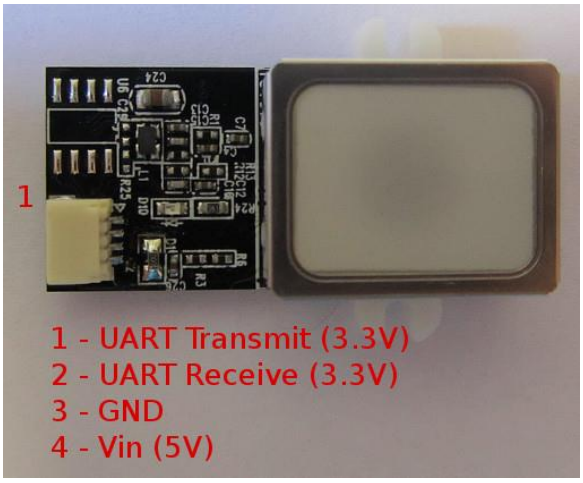

Fig. 2. Fingerprint scanner pins

The fingerprint scanner that was purchased has a 32 bit CPU that does all the hard work for capturing and identifying fingerprints as well as comparing them using a SmackFinger 3.0 Algorithm [4].

The fingerprint scanner will be connected to the atega238p microcontroller. When the scanner has a registered user pace their finger on it, it will send a message to the microcontroller that there was a successful attempt. The atmega238p will then tell the Raspberry Pi to unlock the door. If an unregistered user tries to gain entry through the scanner then it will tell the microcontroller that there was a failed attempt at accessing the front door and the Raspberry Pi will not receive a command to unlock the door.

B. Bluetooth

Bluetooth is wireless standard used to exchange data over relatively short range via UHF radio wave at frequencies between 2400 to 2483.5 MHz. This was a technology initially developed by Ericsson in 1994 but has evolved via its open platform and support of major companies such as Intel, IBM, and Nokia into the defacto standard for short range non Wi-Fi data transfer with the 4.0+ versions reaching a data rate of up to 24 Mbit/s. Bluetooth devices work with a Master/Slave model inside their own networks usually called piconets. With the Master/Slave method one master can connect to up seven slaves while the slaves can only be connected to one master. While connected the master can send and request data from any slave, but slaves can only send and receive from the master and not any of the other slaves.

As was mentioned earlier Bluetooth will be used to create a pet collar wearable that will allow only the homeowners pet(s) access through the pet door. We will also be utilizing Bluetooth for humans. The group had been considering other types of wireless communication such as RFID and NFC but we choose Bluetooth because an adapter for the Pi was already needed for the pet door, we decided to also apply it to humans. Registered users can turn on the Bluetooth on their smartphone and when they come within range of the door it will automatically unlock for them. The Bluetooth adapter for the Raspberry Pi is a USB dongle.

The web application will allow the homeowner to register and unregister users. This is convenient because it means they do not have to be home when a guest visits, all the homeowner has to do is register that persons Bluetooth name and they can enter the home. It also saves the trouble of exchanging and returning keys for guests who stay for an extended period of time or workers that need access to the home.

C. Facial Recognition

Facial recognition is one of the best features of HOMES. It is implemented in python on OpenCV. OpenCV has several classes that can be used for facial recognition, HOMES utilizes the FaceRecognizer class which uses Eigenfaces to compare a picture with pictures in a database. An Eigenface is somewhat a negative of a face, as shown in Fig. 3. This OpenCV recognition will be run on the Raspberry Pi.

The web application will allow users to register for facial recognition, as long as it has a webcam. At least five pictures are needed of a user to properly register them for facial recognition. The more pictures, the more accurate the algorithm is. The pictures don't need to be at different angles but different facial expressions help the algorithm

Fig. 3 – Sample Eigenfaces

measure main points of the face. The quality of the webcam doesn't matter too much since all recent webcams use a decent camera.

Once a face database is created we will keep and update it as needed. The web application will implement a Cascade Classifier which OpenCV's CascadeClassifier() function can handle once we have a XML with the results of training with a database of faces and non-faces. With the Cascade Classifier setup we read each frame of the video as a grayscale image and apply the OpenCV's detectMultiScale() function to detect all the faces present in the image. With the detected face we will now convert it to and compare it to the images in our database using OpenCV FaceRecognizer class and using Eigenfaces [5].

D. LCD Touchscreen

The LCD touchscreen is an important component of HOMES. It enables the user to interact with the system and see progress on the facial recognition process. The LCD touchscreen will have an easy to navigate user interface that will enable users to interact with the system. The home screen will show the guest several options. They are to open the door using facial recognition, ring the doorbell, and video call. The system will be run on the Raspberry Pi using python.

A diagram of the system is shown in Fig. 4. Once the system is on it will be on screen 1 until any input is received. If a user touches the about option the screen will then display screen 2 with all the information about the software and a button to return to screen 1. If a user wants to notify the owner about his presence at door he can ring the doorbell which the displays screen 3 and sends the owner a notification on his phone and the returns the application back to screen 1. If the user touches to video call screen 4 is displayed and the owner receives a

notification on the mobile application, if he chooses rejects the call screen 6 is displayed and the user is returned to screen 1, if the call fails the same thing happens with screen 7 displayed, but if the owner chooses to accept the call screen 5 is displayed until the connection has been made and screen 8 is brought up with the video stream, once the call ends the user is returned to screen 1. If the user wants to gain entry via facial recognition screen 9 pops up with the video from the webcam and if the user matches a registered user the door is unlocked for him and screen 10 is displayed otherwise screen 11 is displayed. The last option a user can select is Settings which then leads to screen 12 where the user must provide the access pin in order to view and change the settings, if that is successful screen 13 appears and the user can change the settings he wishes.

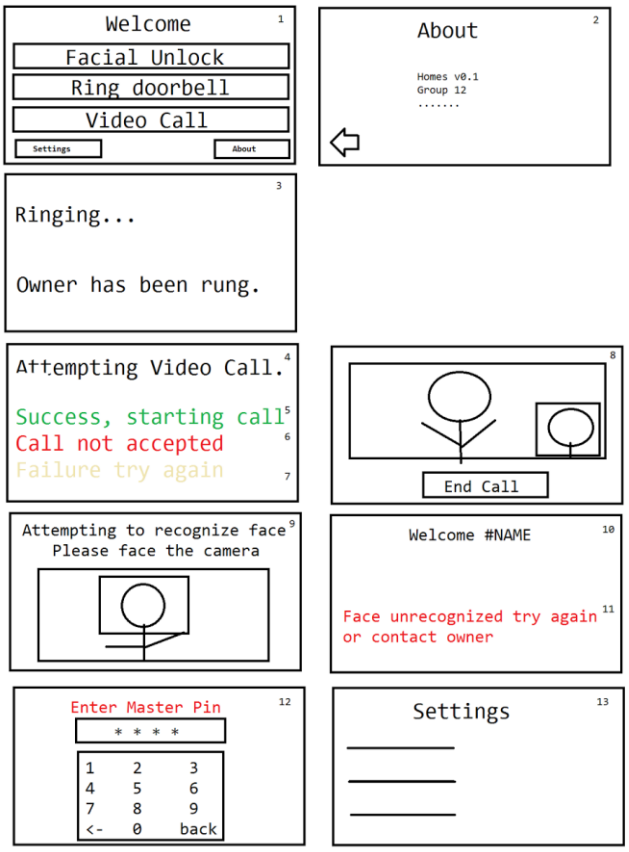

Fig. 4. LCD touchscreen user interface

E. Motion Sensor

The motion sensor will detect when a person is within a few feet of the door. It will then take a picture of the guest for the homeowner to view on the web application. This way they can see who is at the door before they go to answer it. It is important that the motion dector doesn't detect movement too far or else it will pick up movement of people who are not approaching the front door of the home. For many basic projects or products that need to detect when a person has entered, left, or approached the area PIR sensors are great. PIR Sensors are small, inexpensive, low-power, have a wide lens range, easy to interface with, and are pretty rugged don't wear out. Another benefit to PIR Sensors is that it comes in only one part so installation is only at one point and can be set up in an area where it cannot be reached. Furthermore, PIR sensors can be programed to only detect movement at a certain distance. Since we do not want the sensor to go off when there is movement far away, we want to restrict it only two or three feet.

Motion sensors tend to not be picky when it comes to what will set it off. Birds, animals, and even large insects can set of a motion sensor. Since we only want HOMES to sense motion when a human approaches the door we will want to program the PIR so that it only detects movement of large proportions. In this way we will eliminate the possibility of the homeowner receiving notifications to the web application whenever an animal crosses in front of the door. The PIR sensor will be physically connected to the Arduino microcontroller atmega238p. The motion sensor will automatically trigger an array of LEDs so that the camera can have a well-lit photo.

F. LEDs

HOMES needs lighting for the camera, especially if it is dark out or the homeowner lives in an apartment that has a poorly lit hallway. The camera will need light to make sure the photo of the guest is well-lit. To do this we considered wiring a porch light to the system but instead we decided to use LEDs because a group member already had an array ready to be wired to the system. LEDs are very powerful lights in high quantity and they last longer and take less energy than any other kind of lighting system. The LEDs will light up whenever the camera needs to be operated. Also the LEDs can be activated through the web application.

G. Camera

The camera has several uses for HOMES. First it is used to take a picture of the guest when they approach the front door to send the picture to the web application for the homeowner to see. Second, it is used when a user selects to video call with the homeowner. Third and lastly, it operates when the guest selects to open the door through facial recognition. As was mentioned earlier each time the camera is to be used, the LEDs turn on to ensure the best well-lit picture. This is especially important with facial recognition because it needs a good photo to compare with those already in the database.

There were several options when it came to choosing the camera for HOMES. The group considered the Raspberry Pi camera module, both the regular and the IR camera. An IR camera was decided against because of the picky light conditions needed for it. Also facial recognition is easier to implement with a regular camera. We decided to use a webcam one of the group members owned, the Logitech C310.

VI. Power

There are three parts of HOMES that need their own separate power supply. They are the Raspberry Pi and all the modules connected to it, the external entry point detecting system and its small PCB, and the Arduino microcontroller atmega238p and the modules connected to it.

The Raspberry Pi and its modules need a 5V 2A. The Raspberry Pi is a tricky system to power, since it is a computer it has to have a dependable power source and it has to not drop below a certain amount. Because of this and the amount of computing we intend to do on the Pi we quickly realized that it would be unwise to power it through batteries because they would not last long.

We would want to also power the electric strike along with the Raspberry Pi since the Pi is what is going to communicate with a relay and provide the 12V to unlock the strike when an authorized user is trying to enter. Because of this we would need a 12V battery, an A23, which runs at roughly 55mAH. Then we would have to step it down using a regulator to give the Raspberry Pi the 5V 2A it needs. Using equation (1) with these values we discover that the battery would only last about 19 hours which is very poor battery life.

$$B = C/I*0.7 \quad (1)$$

Where B is battery life, C is the capacity in mAH, and I is the load current [6].

We then considered adding a battery back up to the Raspberry Pi so if the power goes off it will not leave the system unusable. However, upon testing this we discovered that the brief time between when the main power is cut and the battery starts to power the Pi is devastating to the Pi. Since it is a computer, once the power is disconnected it shuts down incorrectly so to speak and then must take special time and care to reboot. Because of this we decided it was best to power the Pi on its own with a stable power supply from a wall adapter.

The AtMega microcontroller will need 5V 2A just like the Raspberry Pi. Only for this microcontroller a steady voltage and current is not as important. We created a PCB

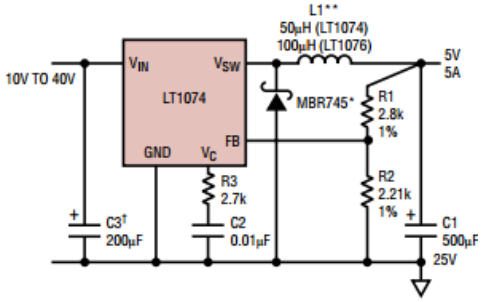

Fig. 5. Switching regulator circuit from datasheet

that takes 12V from a wall adapter and steps it down to 5V 2A using a switching regulator.

A switching regulator was needed because linear regulators cannot handle a current that large and start to heat up. The switching regulator we are using is the LT1076. Using the application of the Basic Positive Buck Converter, shown in Fig. 5, on the datasheet we were able to create a circuit that can accurately step down 12V [7].

When the electric strike needs to be unlocked the Raspberry Pi will unlock it through use of a relay control circuit. This relay provides 12V when it is turned on and then will deliver that voltage to the strike. Since the strike is a fail secure strike it will stay locked until this voltage is applied at which point it will unlock.

The external entry point system also needs power. Since this is a separate module it will need a separate supply than the power PCB created for the strike and the AtMega. The Wi-Fi module needs a voltage anywhere from 3.3 to 17V. We choose to use a 9V battery to power this small PCB because the group already had the adapters and batteries. Also this provided plenty of voltage so there was no risk of the battery losing efficiency and the voltage becoming too low. Also using the same battery equation as was used earlier (1) we discover that there is over 150 hours of battery lift for a 9V battery with this load which is acceptable.

VII. Web Application

The web application is another important component of HOMES. The website is meant to give the homeowner a more in depth control over their system. We have divided the application into two sections: the backend and the front end. But first what functionality it will offer needs to be discussed.

A. Functionality

The web application has numerous functions. First, it will provide the homeowner with an option to turn on the light,

or unlock the front door. The group wanted HOMES to include this feature for two main reasons: to make entry easier for the user and to make entry safer for the user. For example, if it is dark then the homeowner can turn on the light before they even get out of their car.

Second, the web application will allow users to register for facial recognition. This will be a convenient way to update, add, and delete users from the facial recognition database on the Raspberry Pi.

Third, the homeowner will be able to update authorized users on the Bluetooth list. They will be able to add or delete users using their Bluetooth name. This way there is no asking for keys back that have been lent out, all that has to be done is to delete the user from the authorized list.

Lastly, the web application will display a log for the user to see which entry points have been opened, if they are still opened, and at what time they were logged. For example, the homeowner can check on the web application if they left a window is open.

B. The Backend

The backend is the bones of the website. Without a strong server and database the web application will not work. The backend of the HOMES website will be PHP with MySQL as the database. In order for the website to be accessible to an admin it is a requirement for the user to log into the system in a secure fashion. With the use of log-in credentials the user or homeowner is authorized to control aspects of HOMES not applicable to other users under the account. The user must register an email username, and password that complies with the password requirement set forth. Once the user has set the password, it is encrypted and stored on our database where it will decrypted and compared to the user's input to verify the password and granting access. If the user enters a password that does not match we will deny the user access to the system and prompt the user to enter the password again. When a user enters an incorrect password three consecutive times, the system will lock the user out for a certain time period, causing a delay between the time the user is denied access and the time the user is allowed to re-enter a password which will protect the system against a brute force approach from unauthorized users. The specified delay will be set to a reasonable value, 30 seconds for example, but will then increment for every third failed attempt e.g. 30sec 60sec 90sec. This algorithm will increment in 30 seconds for up to three lock outs, after the third lock out the delay will jump from 90 seconds to 30 minutes and will increment by 30 minutes thereafter. If the user has forgotten their password to the system there will be a method to safely reset the password.

Using PHP and MySQL together allows the group to create dynamic page content, encrypt data, collect form data, modify data in the database and modify files on the server. This will allow us to have a well backboned website that is secure and simple.

C. The Frontend

The frontend of a website is the most important part of a website. Even if the website functions beautifully, if it doesn't look good then people won't use it. For example, think of a time where you googled something and the first website that came up was poorly formatted and had a bunch of ads and just looked terrible, you probably didn't use that website but tried to find another one with the same information or product that was needed but that looked better. While the backend is important for a website it is not as important as how it looks. For the frontend of the website we will be using bootstrap 3.0. This framework functions with HTTP, CSS, and JS to form a responsive, mobile first website. A responsive site is one that can be displayed well on any device. In order to accomplish this, bootstrap is one of the first and only mobile first developing frameworks. A mobile first website starts with a smartphone sized screen, and if the website can be displayed properly on this then it can be displayed properly on any other size screen. It starts small and then getting bigger is no problem. Bootstrap has a lot of great built in features that make designing a good looking website easy. It also has easy to use frameworks that can be customized, this makes it so an educated user can tell if a website uses bootstrap because all bootstrap websites have the same backbone. Bootstrap also is very well documented and has a wonderful forum if a developer gets stuck.

The HOMES website will also utilize jQuery. It is the most popular JS library and is used to eliminate cross-platform incompatibilities. jQuery helps the website be more fluent and can do a lot with not a lot of code which is nice for storage space as well as time and effort. It makes the main components of a website easier with an API that works in all browsers. It is also very well documented with a good forum with millions of developers available to answer a question. We will be using HTML5 and CSS3 to help with page reformatting, site-wide consistency, offline storage, and performance integration.

Originally we wanted to do both a web and a mobile application, but as time passed we realized we only had the time to do one application. We choose the web application because it can be accessed anywhere, not just by those who have a smartphone. Also it can be accessed on any smartphone, while a mobile application must be developed for the specific marker (android or iOS).

VII. Conclusion

We choose a home observing and monitoring entry system as our project because all the group members are passionate about our homes and we strive to make interacting with it to be easy, and safe. HOMES has been a rewarding project because all the group members have learned many things in building this system from the ground up.

HOMES is a diverse project that has two main systems: an entry system and a monitoring system. The entry system enables the user to enter the home through several different methods. The entry system has four ways of being opened: the web application, a fingerprint scan, Bluetooth, and facial recognition. The entry system also includes a pet door that will unlock when the homeowner's pet(s) come within range of the door and then will lock when they move out of range. The monitoring system detects when any external entry point has been opened.

In order to organize and run this system HOMES has implemented a single board computer, the Raspberry Pi 2 to be the brain of our project. The Pi will control the power PCB, the camera, facial recognition, and the LCD user interface. The LCD user interface is in Python and is used to make the interaction with the system easy and intuitive. In addition to this single board computer HOMES is applying an Arduino microcontroller the atmega238p. This microcontroller will regulate the motion sensor, the LEDs, and the fingerprint scanner.

The external entry points will be using magnetic contacts to detect if one has been opened. It will then send a message to the Raspberry Pi to display the time on the web application log.

The power PCB was made to supply 12V to the strike when an authorized user tries to enter the home through a relay control circuit. Then it steps down this voltage using a switching regulator to 5V 2A for the Arduino microcontroller. The external entry point will be powered by a 9V battery. This module is powered separately from the other components because it will be attached to external entry points, meaning back doors and windows, so they need to have their own power source. According to the power calculations, the battery will last over 150 hours which is an appropriate life time.

The web application is a place where the homeowner can go to interact with the system, register users for Bluetooth or facial recognition, view logs, lock and unlock the front door, and turn on and off the LEDs. The application will be an easy and user friendly way to interact with the system. The application will use PHP and MySQL on the backend in order to have the correct functionality and bootstrap, HTML and CSS for the front end to format the page and ensure that the web application will be cross browser compatible.

HOMES has become a complete home entry and monitoring system. As a group we have had some problems to overcome such as overloading the Raspberry Pi and making a power PBC that will be able to supply the correct amount of power to all the components and create a algorithm for facial recognition that will be accurate.

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Group Members

Colleen Caffey is getting her degree in electrical engineering from the University of Central Florida. She is currently working at Nelson Engineering Co. She is going to pursue a career as a substation designer for Custom Engineering Solutions after she graduates.

Bruno Calabria is getting his degree in computer engineering from the University of Central Florida. He is pursuing a career as a software engineer for Amazon after he graduates.

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