Electronic Lock System

Initial Project and Group Identification Document
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EEL4914

Senior Design I

Group 17

I. Personnel

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II. Project Description

Technology has become a large part of our lives, allowing us to live longer and have a better overall quality of life. Although we have made large advances in our interactions with technology, there is still much room for improvement. To better facilitate the task of creating a "smarter" style of living, we are going to update and improve on older technologies, and reimagine them to get the most from our surroundings. Which brings us to the focus of our senior design project: we plan on creating a smarter, and more innovative door locking system that will allow ease of use and additional functionality to previous lock and key door designs.

There are many inconveniences associated with a normal door lock. If someone forgets his or her key, and no one is home, the person has to wait until someone else arrives and opens the door. Also, there's the situation where a person leaves home and doesn't remember whether or not he or she locked the door. Furthermore, it would be nice to be able to see who rang your doorbell while you were away. The ELS will solve all of these problems. It will enable a user to unlock and lock the door via an Android mobile app. The lightweight, and easy to use app will provide a user interface to control the ELS. A mobile app as an interface is ideal and convenient in today's world, as the ownership of smartphones is increasing, and is almost ubiquitous in America. Another goal of the ELS is to incorporate the use of RF technology. In the case that someone does not have a smartphone, and cannot use the ELS mobile app, RFID tags would be able to be used to unlock the door via the ELS's RF scanner. This is also a quick and easy way to unlock the door. The ELS will also incorporate image processing functionality, and will aim to be very accurate. A webcam will be part of the ELS hardware, and image processing software will be used to recognize faces. The user will be able to use the mobile app to add faces to the ELS face database. When a person who is in the database approaches the door, the mobile app will notify the user who is at the door via a status notification. This functionality is very useful for people who want to know who comes to their front door whenever they are away. In the case of a stranger coming to your front door, the ELS will also take a picture of someone who rings the doorbell if the doorbell is never answered. The mobile app will then display a picture of the person. The owner of the house will never be kept in the dark, as the ELS will act as virtual eyes.

People enjoy being able to customize their devices. For example, ringtones were very popular upon their introduction. The ELS will incorporate customization through a custom doorbell. It will enable the user to select specific music to play when certain people who are in the face database ring the doorbell. Also, many people leave their door light on at night if someone is going to visit. If specified in the settings, the ELS will automatically turn on the door light when it is dark. In addition, the ELS will recognize a specific knock pattern on the door, and will unlock. The ELS represents a system that has a mixture of useful and cool features, making it a practical and interesting project.

III. Specifications & Requirements

Req. ID	Requirement Description
1	The ELS shall unlock within two seconds whenever the user selects the "unlock" command on the mobile app in a strong wifi/mobile data environment.
2	The ELS shall lock within two seconds whenever the user selects the "lock" command the mobile app in a strong wifi/mobile data environment.

| 3	The ELS shall recognize the face of a person who is already in the database within five seconds of the person coming into close proximity.
4	The ELS mobile app shall get information, which includes a picture of a person's face and the time that the doorbell was pressed, within ten seconds after the doorbell is pressed.
5	The ELS mobile app shall allow the user to take a picture of a person's face to add to ELS database, and specify as a "friend".
6	The ELS mobile app shall display information, which includes a picture of a person's face, the time that the doorbell was pressed, and the person's name if the door is never answered within two minutes after a "friend" rings the doorbell.
7	The ELS shall play specified audio when a "friend" presses the doorbell.
8	The ELS mobile app shall enable the user to see what is in front of the door at any time.
9	The ELS will unlock within three seconds upon hearing specific pre-defined knocking patterns.
10	The ELS will turn on the door light when it is dark.
11	The ELS will unlock within one second after an RFID tag is scanned.
12	The ELS shall operate off of a 12V standard power supply.
13	The ELS mobile app will enable the user to query whether or not the door is locked or unlocked. The response will be received in less than five seconds.
14	The ELS face database will be able to hold up to 30 images.
15	A green LED on the ELS will flash for three seconds to indicate that the door has been unlocked.
16	A red LED on the ELS will flash for three seconds to indicate that a failed attempt has been made to gain access.
17	The ELS mobile app shall enable the user to specify settings, such as automatically locking after a specified amount of seconds have passed after the door was unlocked.
18	The ELS shall be highly reliable and in the event the system goes down or loses connection the owner must be notified via the ELS mobile app.
19	The ELS shall communicate between devices via a cloud server to handle data transmission.
20	The ELS will require an internet connection via WiFi to communicate with the ELS

	app.	
21	The ELS embedded microcontrollers shall have sufficient processing power to handle of the input from the various sensors.	
22	The ELS camera subsystem must have enough processing power to quickly facilitate image processing.	

IV. Project Block Diagram

Hardware
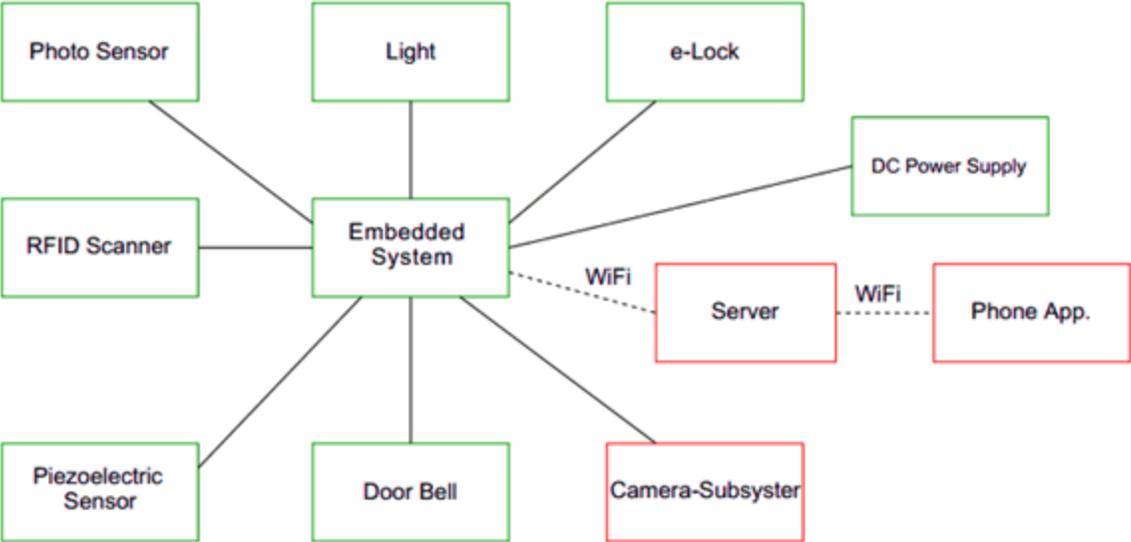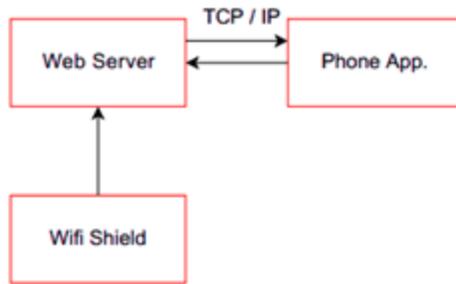
Software

Block Diagram Status

| Block	Assigned	Status
e-Lock	Chris Condella/Jason Wagner	To Be Acquired
DC-Power Supply	Chris Condella/Jason Wagner	To Be Acquired
Light	Chris Condella/Jason Wagner	To Be Acquired
Door Bell	Chris Condella/Jason Wagner	To Be Acquired
Photo Sensor	Chris Condella/Jason Wagner	Research
Embedded System	Chris Condella/Jason Wagner	Research
RFID Scanner	Chris Condella/Jason Wagner	Research
Piezo-electronic Sensor	Chris Condella/Jason Wagner	Research
Camera Subsystem	Joshua Baxter/Sam Demole	Research
Web Server	Joshua Baxter/Sam Demole	Research
Phone Application	Joshua Baxter/Sam Demole	Research
Wifi Shield	Joshua Baxter/Sam Demole	Research

V. Project Budget and Financing

The total cost will be split evenly amongst the group members.

Part	Cost Per Unit	Quantity	Total Cost
BreadBoard	$5.00	4	$20.00
Apache Web Server Software	$0.00	1	$0.00
Android SDK	$0.00	1	$0.00
OpenCV SDK	$0.00	1	$0.00
System on Chip (SoC)	$45.00	2	$90.00
USB Wifi Module	$12.00	2	$24.00
Microcontroller	$30.00	2	$60.00
Microcontroller Wifi Shield	$85.00	1	$85.00
Webcam	$30.00	1	$30.00
Electric Door Strike	$40.00	1	$40.00
RFID Reader/Writer Module	$30.00	1	$30.00
125khz RFID Token Tag	$0.70	3	$2.10
12V DC Regulated Power Supply	$30.00	1	$30.00
Circuit Components: LEDs, Transistors, Capacitors, Wires, etc.	$80.00	1	$80.00
Piezoelectric Vibration	$7.00	1	$7.00

Sensor			
Passive Infrared Sensor	$10.00	1	$10.00
Digital Push Button	$1.30	1	$1.30
Photoelectric Sensor	$1.80	1	$1.80
		Total	**$511.20**

VI. Project Milestone
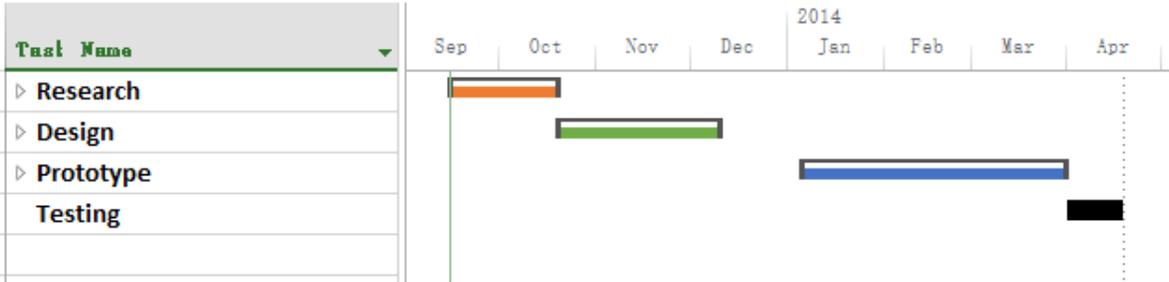
Task Name	Duration	Start	Finish
⊿ **Research**	**27 days**	**Sun 9/15/13**	**Sat 10/19/13**
⊿ **Hardware**	**27 days**	**Sun 9/15/13**	**Sat 10/19/13**
Arduino			Sat 10/19/13
Raspberry Pi			Sat 10/19/13
RFID			Sat 10/19/13
Sensors			Sat 10/19/13
⊿ **Software**	**27 days**	**Sun 9/15/13**	**Sat 10/19/13**
Android SDK			Sat 10/19/13
OpenCV SDK			Sat 10/19/13
Webserver/Database			Sat 10/19/13
⊿ **Design**	**38 days**	**Sun 10/20/13**	**Tue 12/10/13**
⊿ **Hardware**	**38 days**	**Sun 10/20/13**	**Tue 12/10/13**
Lock System			Tue 12/10/13
Camera Subsystem			Tue 12/10/13
⊿ **Software**	**38 days**	**Sun 10/20/13**	**Tue 12/10/13**
Database			Tue 12/10/13
Image Processing			Tue 12/10/13
Mobile Application			Tue 12/10/13
⊿ **Prototype**	**61 days**	**Mon 1/6/14**	**Mon 3/31/14**
⊿ **Hardware**	**61 days**	**Mon 1/6/14**	**Mon 3/31/14**
Lock System			Mon 3/31/14
Camera Subsystem			Mon 3/31/14
⊿ **Software**	**61 days**	**Mon 1/6/14**	**Mon 3/31/14**
Database			Mon 3/31/14
Image Processing			Mon 3/31/14
Mobile Application			Mon 3/31/14
Testing	**14 days**	**Tue 4/1/14**	**Fri 4/18/14**