Spring 2022 Senior Design 1

Smart Security System (3S)

Department of Engineering and Computer Science

University of Central Florida

Initial Project and Group Identification - Divide and Conquer

Group 22

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Section 2: Project Motivation

It's every homeowner's dream to discover an all-in-one security system. While the world has become increasingly more digital, most home locks have not. A majority of homes still operate on the traditional deadbolt lock, which can easily be picked by anyone with a simple kit. The Smart Security System (3S) is a comprehensive security system that can keep you and your personal belongings safe. Never again will you have to call a locksmith to get back into your own home or have to wait for your package to be refunded because it was stolen off your porch. With multi-factor security, 3S offers a variety of methods to unlock your door. This includes facial recognition, fingerprint scan, pin code, and access through a phone application. 3S even offers single-use access codes to be used by delivery workers so your packages can remain safe from package theft. A single-use access code can be accessible for letting guests in without having to come to the door. Additional security measures will be put in place to keep you and your homes safe, such as an alarm system and motion detector that sends alerts to your phone.

We noticed after surveying the landscape of existing products the need for a product like 3S. A similar system currently on the market is the Ring Video Doorbell. It is a doorbell monitoring system that has some of the features we plan to implement, like motion-sensing and application availability. 3S differs from Ring in that it is a lock system rather than a doorbell system. Furthermore, all features in the 3S system will be accessible to consumers with no subscription plan. This will allow users to be able to use a cheaper yet safer alternative to the Ring Video Doorbell.

Ring Doorbell

Another product similar to 3S is the Google Nest Doorbell; Google's attempt at a home security monitoring system. It has many features such as a camera, doorbell, sound detection and familiar face detection. It can also be set up wired to configure with an existing doorbell system

or be set up to run wirelessly. Google has made it possible to integrate the doorbell with the rest of the Google Nest environment. Like the Nest Doorbell, 3S has a Camera monitoring system, face detection, and app integration. However, unlike the Nest Doorbell, 3S allows for multiple unlock methods and gives the user an unlock log report. It additionally differs in that it is a door locking security system compared to Nest Doorbell which only offers video and audio monitoring. Through this comparison between the two systems, we can see clearly that 3S is the more cost-effective option than the Nest Doorbell. The Nest Doorbell only offers Doorbell monitoring of your existing system while 3S steps up the security of your system.

The Nest Doorbell also has the capability to interface with the Yale electronic door lock. The Yale lock is a keyless smart lock, similar to 3S, that incorporates a digital keypad. Yale allows for a passcode you can give to people you trust, that you can disable at any time. It also offers self-locking features, and the ability to lock/unlock through a phone application. With 3S, we will combine features from both the Nest Doorbell and Yale Lock to enhance safety and security.

Nest Doorbell interfaced with Yale electronic Lock

Our goal is to create a reliable low-cost security system with multiple methods of home/ package safety for the consumers of tomorrow. We want to challenge the current security market by creating a new security set up with an app and hardware systems interface. In doing so, we would keep the system as user-friendly as possible while keeping it as secure as possible. We will achieve these goals by creating a lightweight security system that can be placed in desired monitoring areas (e.g home, shed, garage), distributing power to electronic hardware, and establishing a connection between the lock and phone application. It is also a goal for us to keep

costs of hardware low while maintaining quality in order to make this product accessible to low-income families.

Section 3: Requirement Specifications

- 5 methods to unlock
    - Can unlock through a physical lock via 4 to 6 digit PIN number
    - Ability to unlock remotely via mobile application
    - Ability to unlock through fingerprint scan on physical lock
    - Ability to detect learned faces through device camera
    - NFC/contactless access
- One Electromagnetic lock
    - Will automatically lock when the door is closed
- Integrated with mobile application
- Device must be always-online to connect to mobile application
- Simple and user-friendly UI/design
- IR motion detector that can detect people up to 5 meters
- Can produce single-use PIN numbers for guest entry
- App will store unlock attempts in a viewable log with a timestamp
- Controlled by Raspberry Pi Model 4 at 5 Volts
- 12x8x8 inches wooden design to house components during prototyping

Section 4: House of Quality

Correlations	
Positive	+
Negative	−
No Correlation	

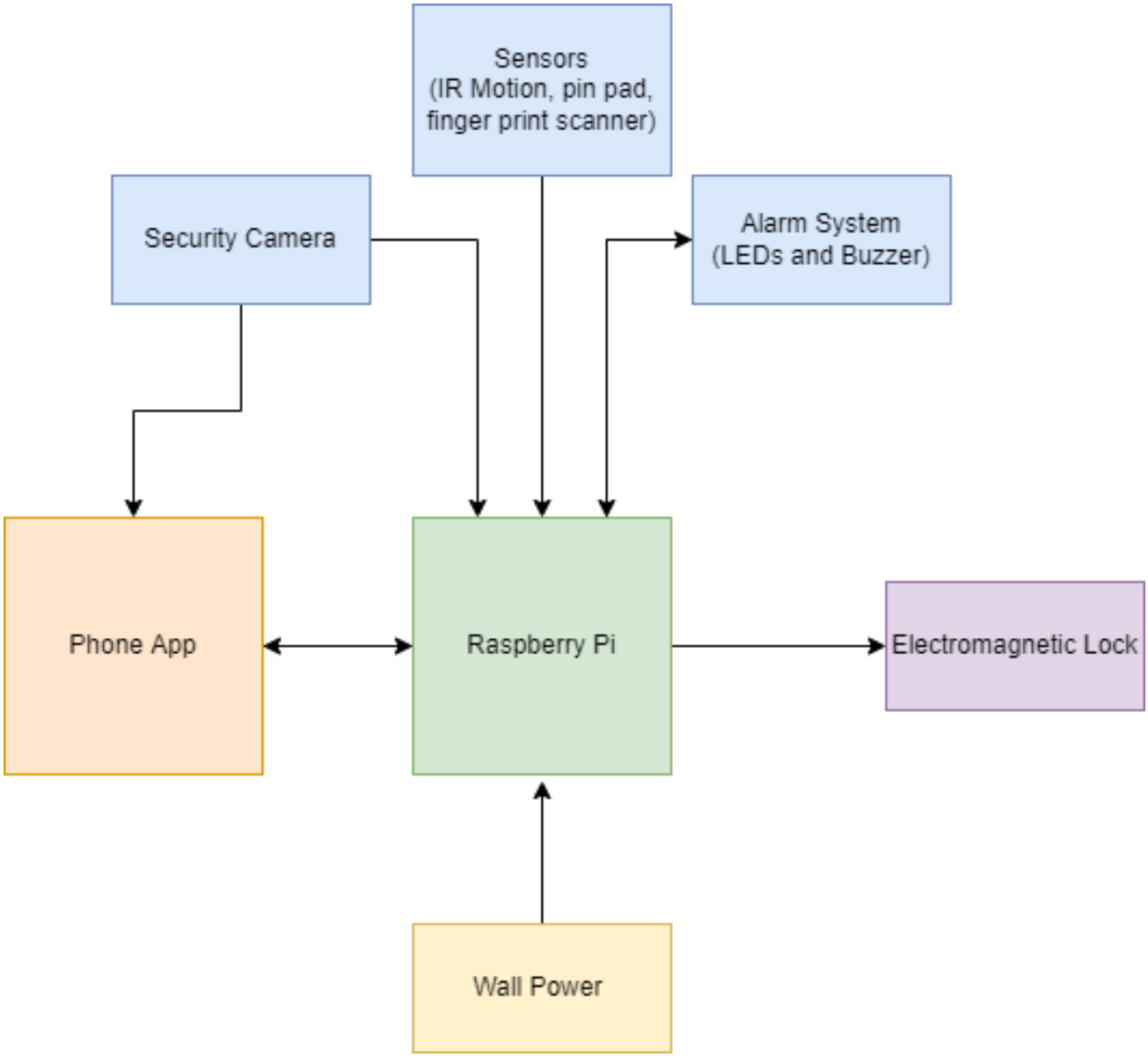
Relationships	
Strong	●
Moderate	○
Weak	▽

Direction of Improvement	
Maximize	▲
Target	◇
Minimize	▼

Category	Weight	Customer Requirements (Explicit and Implicit) \ Engineering Requirements		Size	Power Usage	Security Protection	Cost	Sensors	Microcontroller
				-	-	+	-	+	+
Quality of Product	6	Good User Experience	+	○	▽	●	○	●	▽
	5	Robustness	+	○	○	●	○	○	▽
	5	Multiple Options	+	●	●	●	●	●	▽
User Preferences	9	Cost	-	○	●	○	●	●	●
	6	Smart Phone Application	+	▽	▽	▽	▽	○	●
	8	User Interface	-	▽	▽	▽	▽	▽	▽
	7	Intallation Ease	+	●	▽	▽	▽	○	○

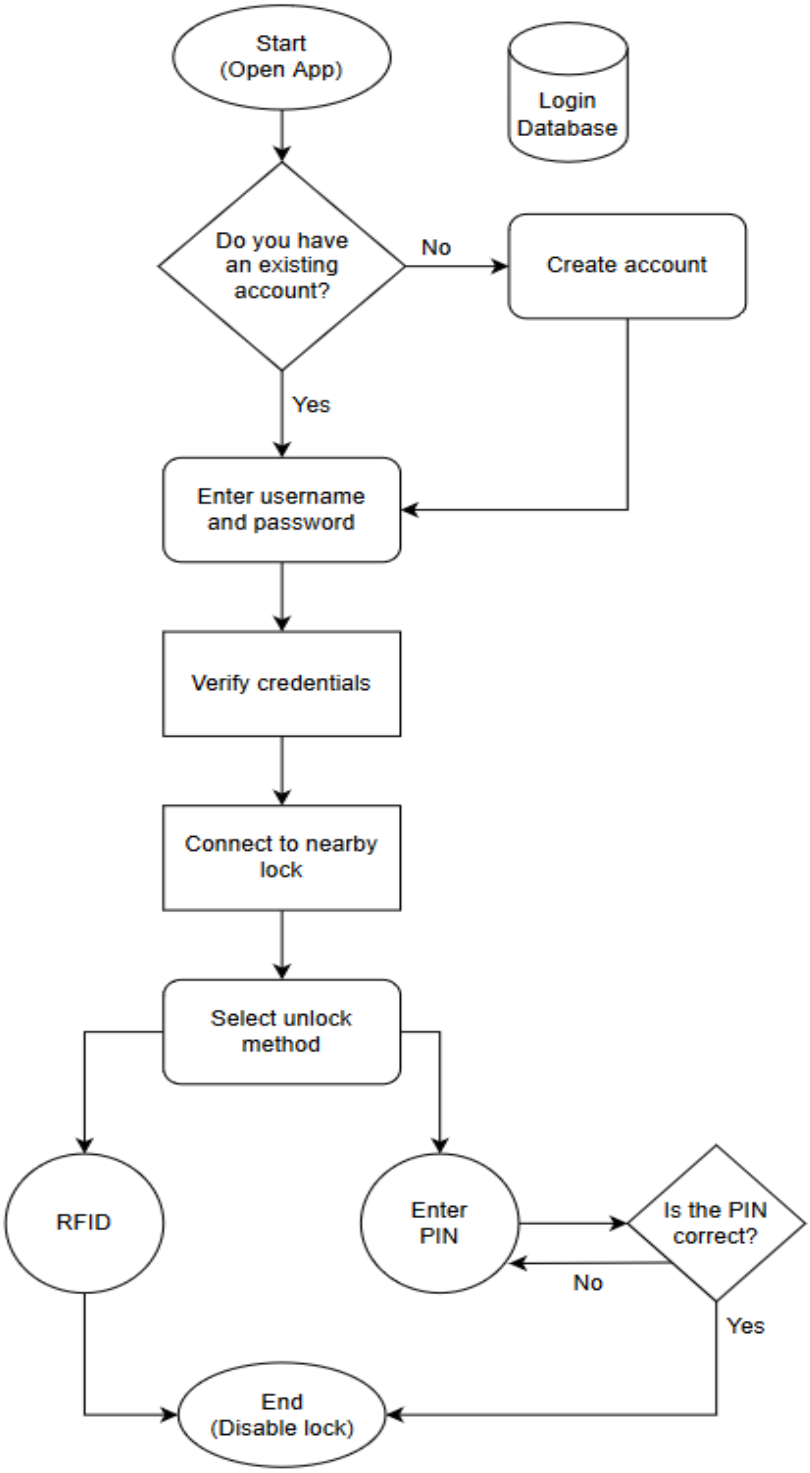
Section 5: Block Diagrams

Hardware:



Relationship Between Hardware Components

Software Flow (Mobile App):



Logic of Mobile Application

Section 6: Budget and Financing

Part Description	Quantity Needed	Estimated Price
Raspberry Pi 4	1	$40
Assorted Wires, LEDs, Buzzer, and other electrical components	-	$0
Camera with microphone	1	$23
Fingerprint Sensor	1	$21
Electromagnetic Lock	1	$11.50
Pin Pad	1	$0
NFC Reader	1	$9
IR Motion Sensor	1	$8
Hardwood for Prototype	1	$20

Total Cost	$132.50
Number of Team Members	4
Amount Funded per member	$33.13

Section 7: Project Milestones

Senior Design 1:

Milestone	Duration	Dates
Brainstorm	1 Week	January 14
Select Project	1 Week	January 21
Divide and Conquer	2 Weeks	February 4

Research	4 Weeks	March 4
Table of Contents	1 Week	March 11
60 Pages Due	2 Weeks	March 25
Edit Draft	3 Weeks	April 15
Finalize Report	1 Week	April 22
Submit Final Report	1 Week	April 29

Senior Design 2:

Milestone	**Duration**	**Dates**
Source Remaining Parts	2 Weeks	September 2
Build Prototype	4 Weeks	September 30
Test and Troubleshoot	3 Weeks	October 21
Finalize Prototype	3 Weeks	November 11 (Tentative)
Final Report	2 Weeks	November 25 (Tentative)
Final Presentation	1 Week	December 2 (Tentative)