Initial Project and Group Identification Document

Divide and Conquer, Version 1.0

University of Central Florida

College of Electrical and Computer Engineering

Senior Design I - Group 16

EEL 4914

Devon Anselmo - Computer Engineering
Matthew Guevara - Electrical Engineering
Lody Morillo - Electrical Engineering
Keanu Zeng - Computer Engineering

Project Narrative

All common households require a reliable front door lock to protect the inside. Even though the front door handle is very useful and accomplishes its task, in some situations, it can be a hassle.

This project is concerned with making opening a household door more of a hands-off experience. The motivation for it came from the common struggle of carrying many items, such as groceries, and trying to hold onto the items while pulling out a set of keys and manually unlocking the door. The project will make it so that a physical key does not need to be used to manually unlock the door, but rather make it a more automatic process; it would be most similar to newer car doors that communicate with the car keys and unlock automatically when they are near enough and the user touches the door handle. This door lock system will be close range, easy-to-use, relatively cheap, but still have security measures in place.

Required Specifications

- Password signal to unlock door
    - Use of RFID signal transmitter and receiver
    - Range for password signal will be ~15 feet

- Motion Sensor to accept password pattern
    - Range of motion sensor will be ~3 inches to start pattern recognition
    - Accept password signal in a short amount of time (~5 seconds)

- Ability to be opened once it has been unlocked
    - Should be able to just either push door open easily

- Standardized Door handle size
    - Should be the same size as standard door handles to easily fit on doors

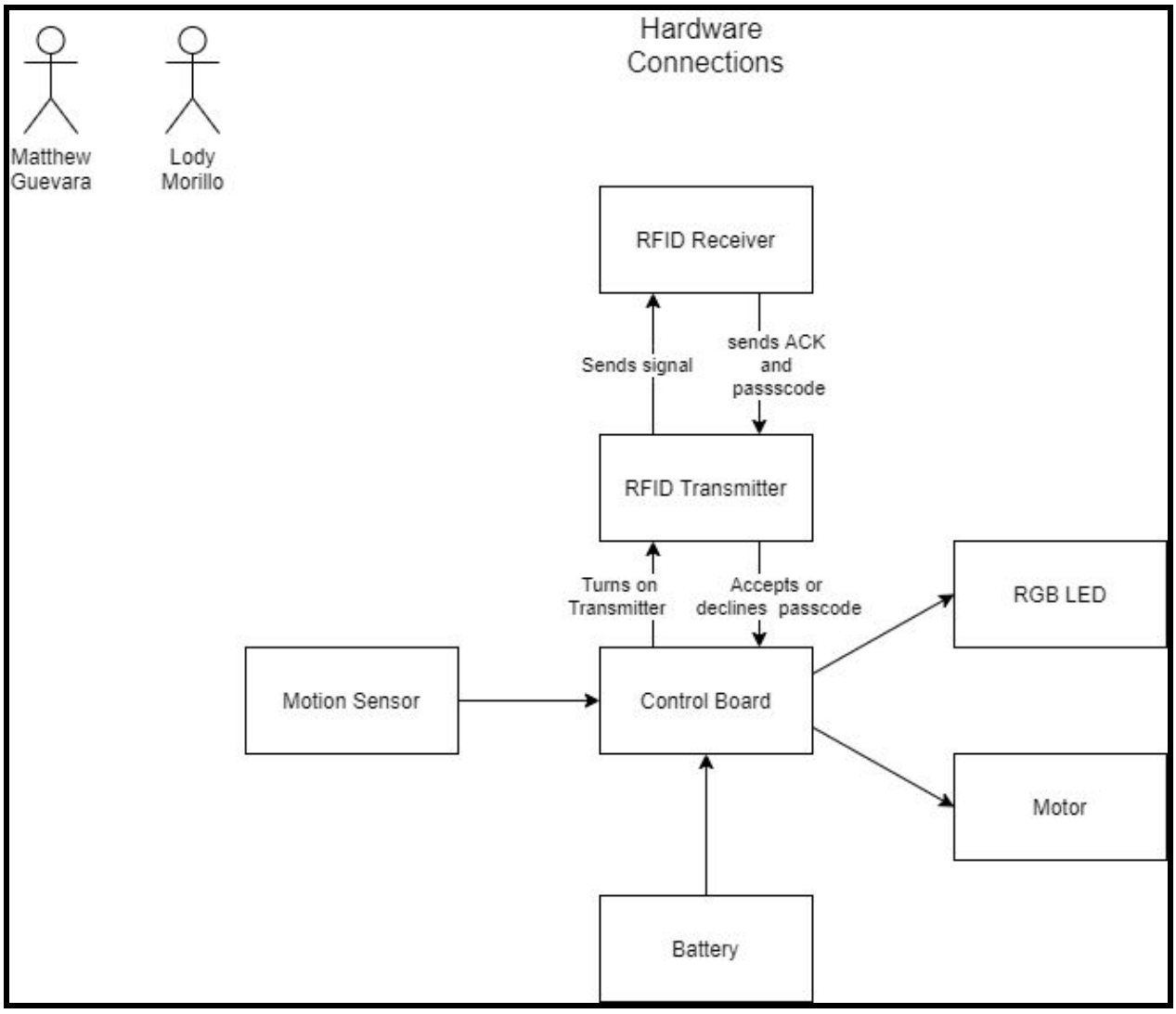
- Bracelet to hold RFID transmitter
    - Adjustable for 14-20.3cm (womens small - mens large)

- Adequate power source for door handle and bracelet
    - Both door handle and bracelet should be battery powered

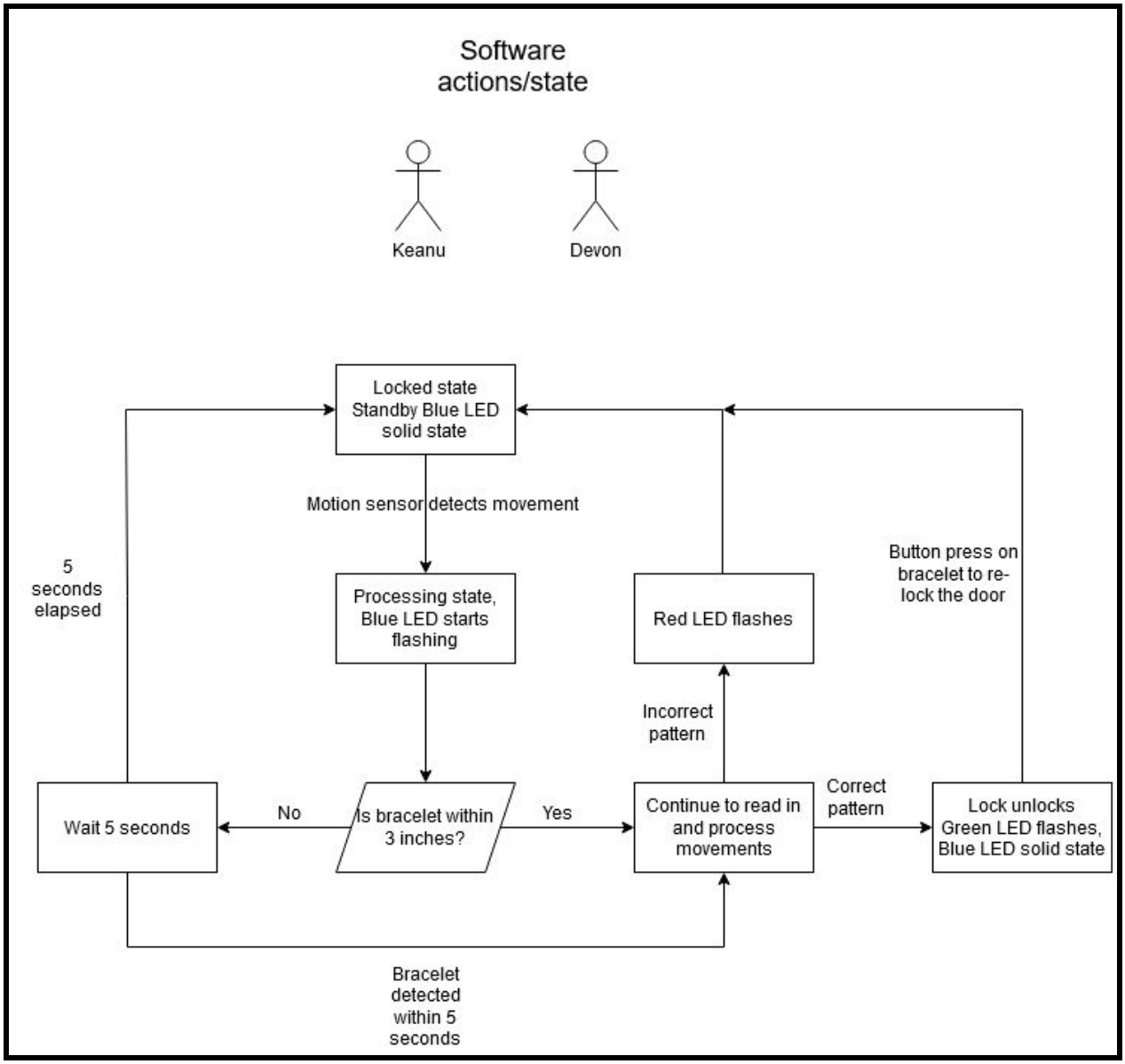
- Should still function with a key
    - In an event in which the battery dies, the door can still be opened

Block Diagrams

Group members Matthew Guevara and Lody Morillo will be in charge of the hardware and electrical connections. The RFID receiver, RFID transmitter, and control board will be researched and designed. The motion sensor, battery, motor, and any necessary LEDs will be acquired.



Group members Devon Anselmo and Keanu Zeng will be responsible for the programming of the project, to include the software state and actions.



Estimated Project budget and financing

Project Budget - $400

- Kwikset Halifax Door Handle with Modern Contemporary Slim Square Design - $26.95 on Amazon.com
- High Torque Standard Size Servo Motor - $19.95 on Adafruit.com
- RF Transmitter and receiver - $5-$10 on DigiKey.com
- FIBO STEEL Braided Adjustable Bracelets - $14.99 on Amazon.com
- PCB Manufacturing Cost - $50 on PCBway.com
- Samsung Motion Sensor in White - $24.99 on BestBuy.com
- 2-in x 12-in x 8-ft Southern Yellow Pine Lumber - $13.26 on Lowes.com
- Extra Necessities
    - Glue, Mounting Tape, Jumper Wires, LED light - $50 - $80

Project Milestones

Senior Design I

- Research project details
  - Define in-depth the projects goals, specifications, and what parameters it should meet
- Research and design lock system
  - Research how the lock system will turn a deadbolt, how it will communicate with the system responsible for reading in a “password”
- Research RFID Bracelet design
  - Research the functionality of the RFID transmitter and how to implement it on a small enough scale so that is can fit on the bracelet
- Design PCB Layout
  - Decide which exact part numbers will be used, what size they should be, how they will be configured on the board, what voltage supplies will be used
- Final Documentation
  - Incorporates all information covered above as well as how it will be carried out

Senior Design II

- Programming control board for the lock sensor
  - Referring back to any state diagrams, program the system for how it should react under given inputs
- Assemble lock system
  - Order any parts that need to be order, including the PCB board; connect all of the hardware together for prototyping
- Program and assemble RFID bracelet
  - Order parts needed for bracelet and assemble a prototype
- Diagnose communications
  - Program and test the communication between the lock and bracelet
- Redesign/Re-prototype
  - Based upon tests on the prototype, perform any necessary debugging on the software, and make any modifications to the hardware, making replacements and substitutions as needed

Project Parameters and Considerations

For our group's problem of making opening a house door a more hands-off and easier experience, we came up with several solutions, and then narrowed it down to two "best" project solutions. The first solution is to create a communication system built into the door lock, which communicates with a set of keys carried by the user. Once the keys are close enough to the door, the door can be opened regularly without the need to manually unlock it with a house key. The second solution is similar in the fact that the door lock will communicate with the keys, but now the keys are integrated into a bracelet device, and the door will also have a small motion sensor array that can be used as a pattern password to unlock the door, similar to unlocking a phone. Once the door recognizes that the bracelet is nearby and the "password" is entered correctly, the door can be opened.

This second solution was chosen mainly because of its increased complexity and customizability. The bracelet project adds more security with the "password", which can be made very complex, or turned off at the user's preference. Having this one sided motion sensing also solves a problem with the other solution, which is that if the keys are left inside the house but near the door, an outside intruder could be able to open the door. This increased complexity also allows our group to delve into more areas of research to learn more in our fields. The cost of this project would most likely be higher, but should still be cheap, so the bracelet solution is the current accepted solution to our problem.