Fall 2018
CS 362 Arduino Final Project
Final Write-up Due: 11/30/2018

# Arduino Smart Lock

**Group Members:** Jhon Nunez, Christian Dominguez

**Introduction**

A door lock that locks and unlocks a door by entering a specific numeric code. The lock will also have the capacity to enter your fingerprint to grant access. Lastly, we will make our lock even smarter by giving it the capacity to unlock the door with your smartphone via Bluetooth.

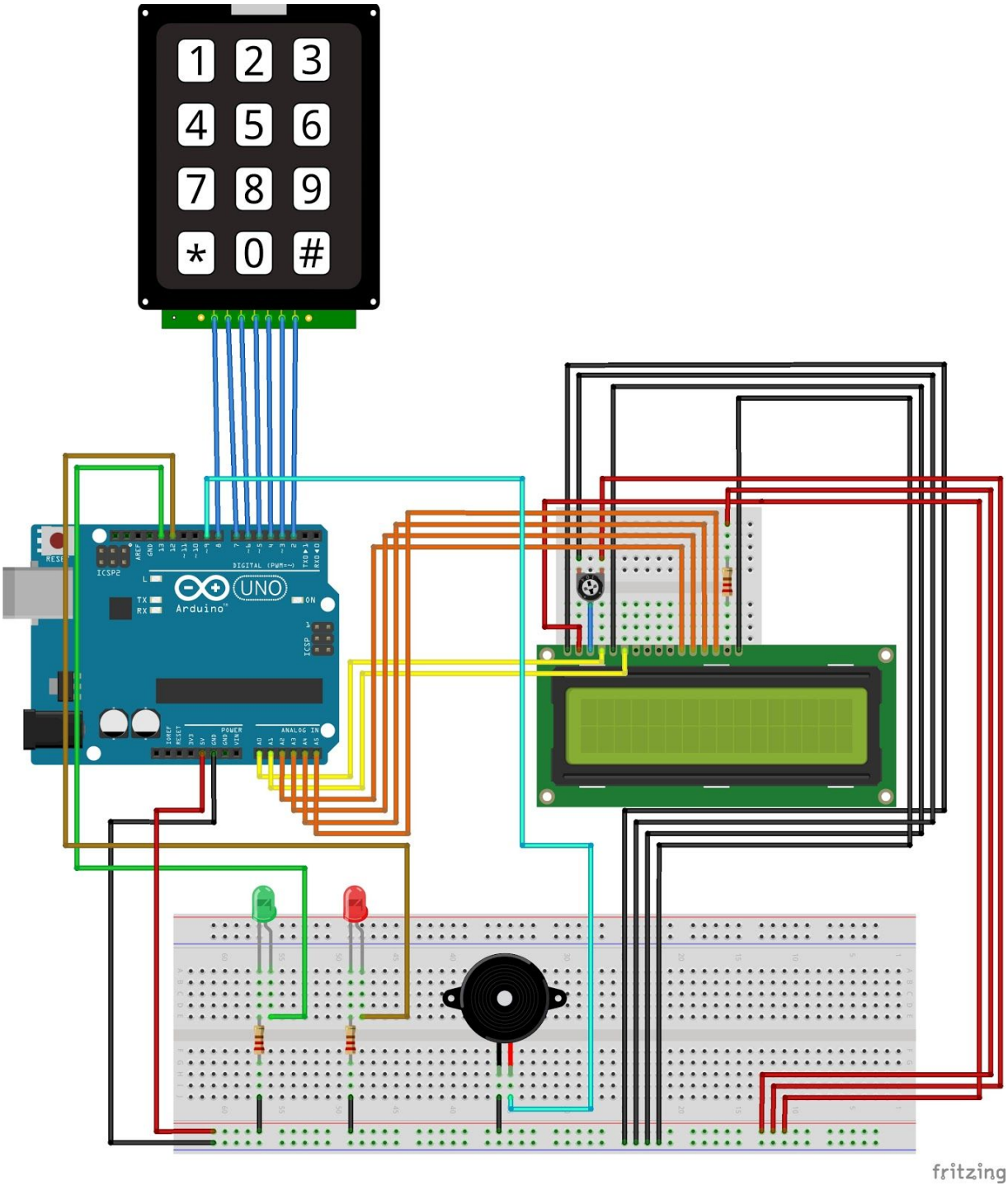
**Materials**

2 Arduinos Uno
2 9V Battery
Breadboard
LCD Display and Potentiometer
4x4 matrix keypad
Buzzer
Red and Green LED lights
Servo Motor or any other electric lock
Bluetooth Module
All resistors and connecting wires
Soldering iron and supplies

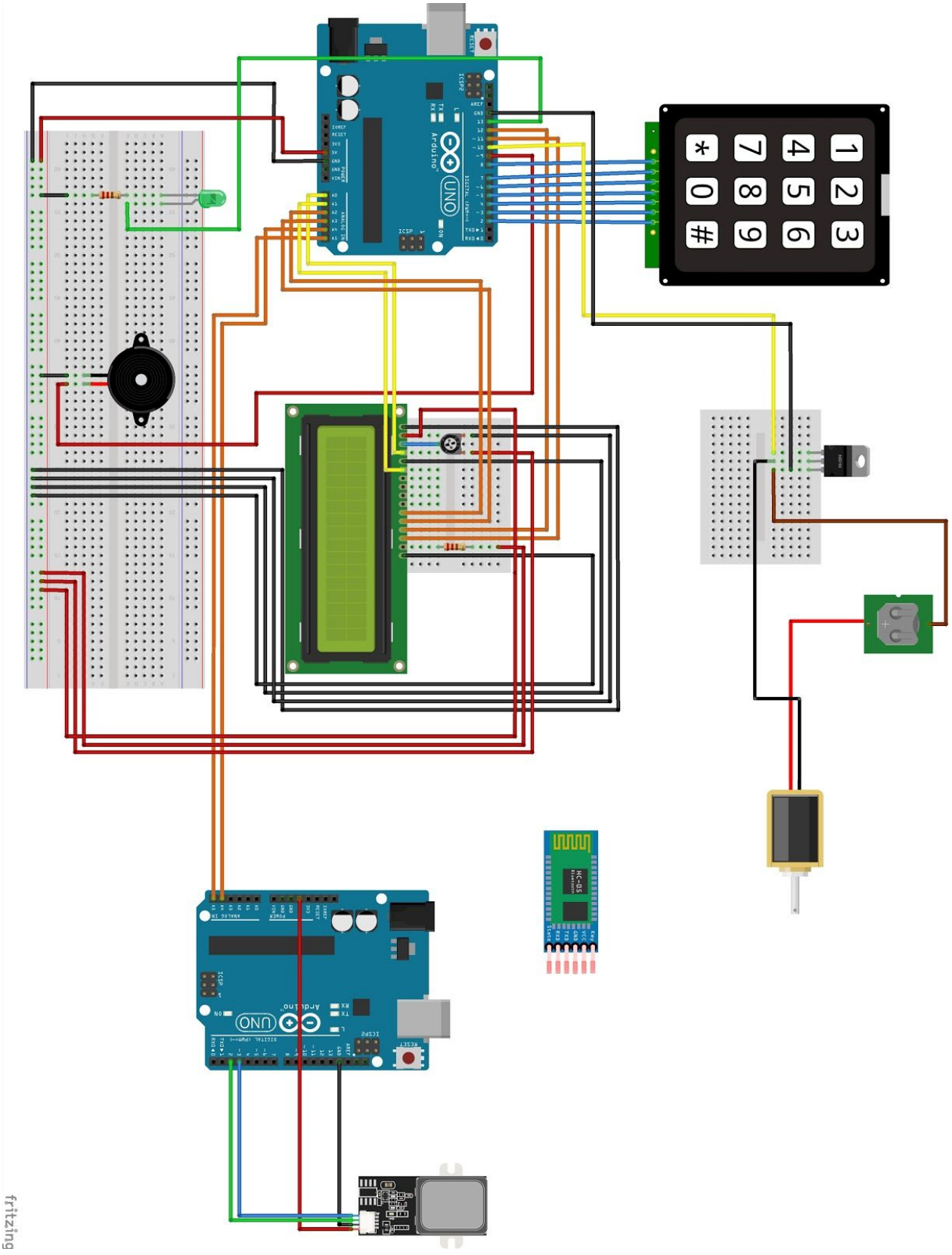
**More Information:**

1. Our system will consist of 2 Arduino Uno microcontrollers.
    a. The following will be connected to the first controller: 4x4 keypad, the LCD display, Buzzer and LED light indicators. We will use the breadboard to connect most of the devices together.
    b. The following will be connected to the second controller: Bluetooth module, lock, and fingerprint scanner.
2. Power
    a. Our devices will each be connected to its own 9V Battery that will give power to our entire system.
    b. We will use the appropriate resistors when necessary.
3. Our “house” with a door and lock:
    a. We plan to make the “house” out of wood and add a door with a bolt that is uses to lock.
    b. This bolt will unlocked in the various ways listed in the introduction.
    c. We also plan to add a sensor that will detect when the door is closed and it will automatically lock itself.

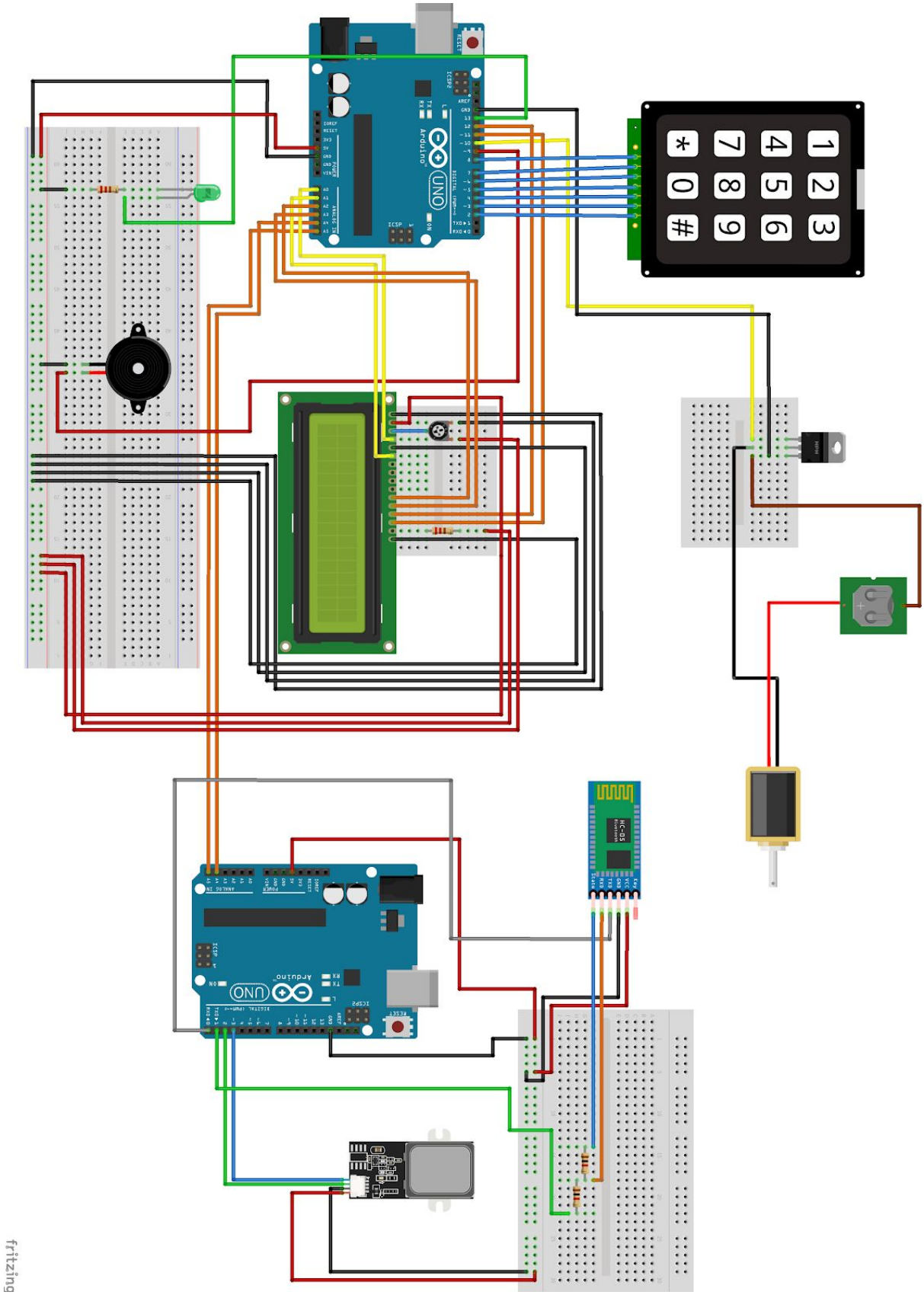
**Prototype Sketch (PHASE ONE)**



**Prototype Sketch (PHASE TWO)**



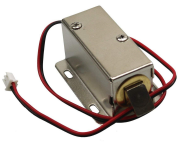
**Final Prototype Sketch**



**Official Components**

Adafruit 3x4 phone-style matrix keypad

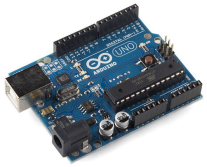
Electronic cabinet lock



Arduino Bluetooth Module

Optical Fingerprint Reader

2 Arduino Uno’s

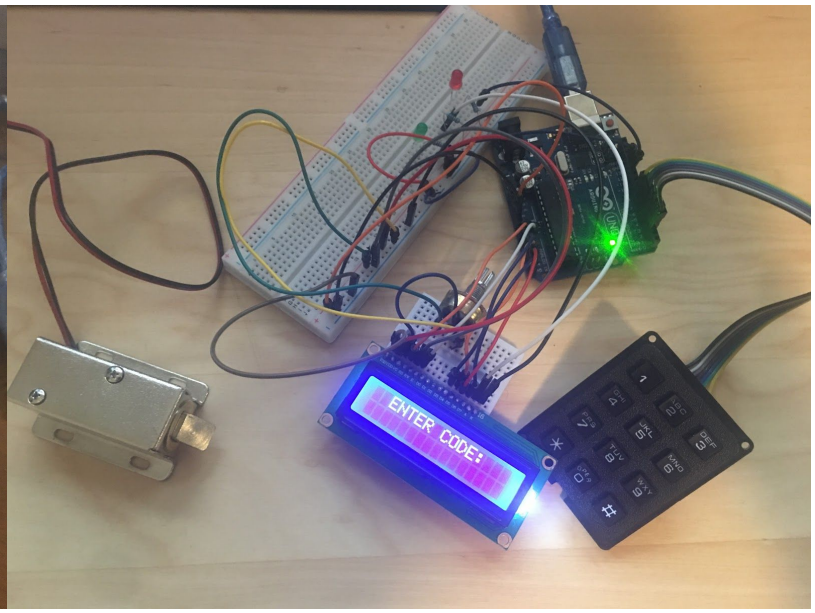


Liquid crystal display and potentiometer


Buzzer, LEDs, 9V batteries



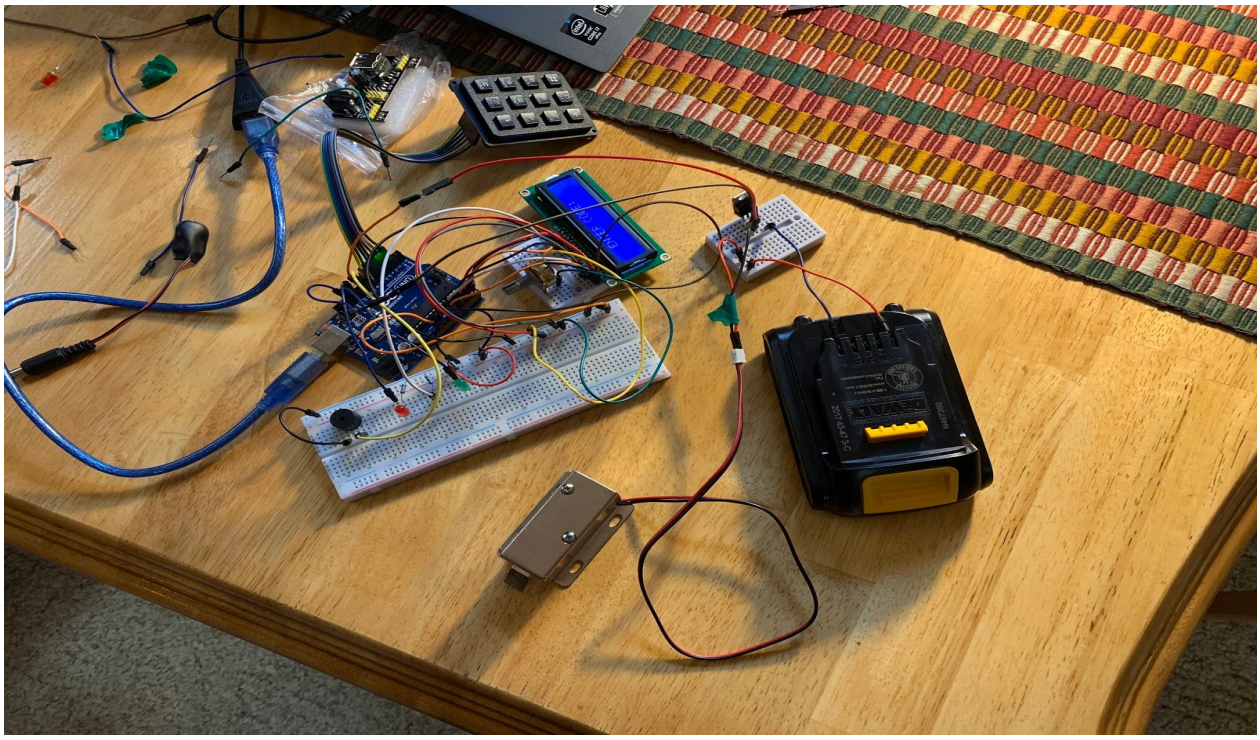

20V battery for the lock




**First Meeting (10/28/18) <u>PHASE ONE</u>**

**Objective:** Configure manual keypad code access

**Comments:** Our first meeting consisted of a considerable amount of brainstorming and the discovery of several obstacles that we must overcome to complete this project. For starters, we changed the design of our "house" from 4 walls and a door to just a single wall with a door in order to save time. We have yet to figure out how to get our Arduino to communicate with our lock due to a complication, therefore, we have decided to get every method of communication (keypad, fingerprint sensor, Bluetooth) working before anything else. Consequently, we dedicated this meeting to our first method of unlocking: the keypad. The pictures above illustrate the completion of that goal. The user can enter 4 numbers for each attempt at unlocking. If the code entered is incorrect, the red LED will light up, the buzzer will emit a low pitched noise,  and an appropriate message will be displayed on the LCD. If the code entered is correct, the green LED will light up, the buzzer will emit a high pitched noise, and an appropriate message will be displayed on the LCD.



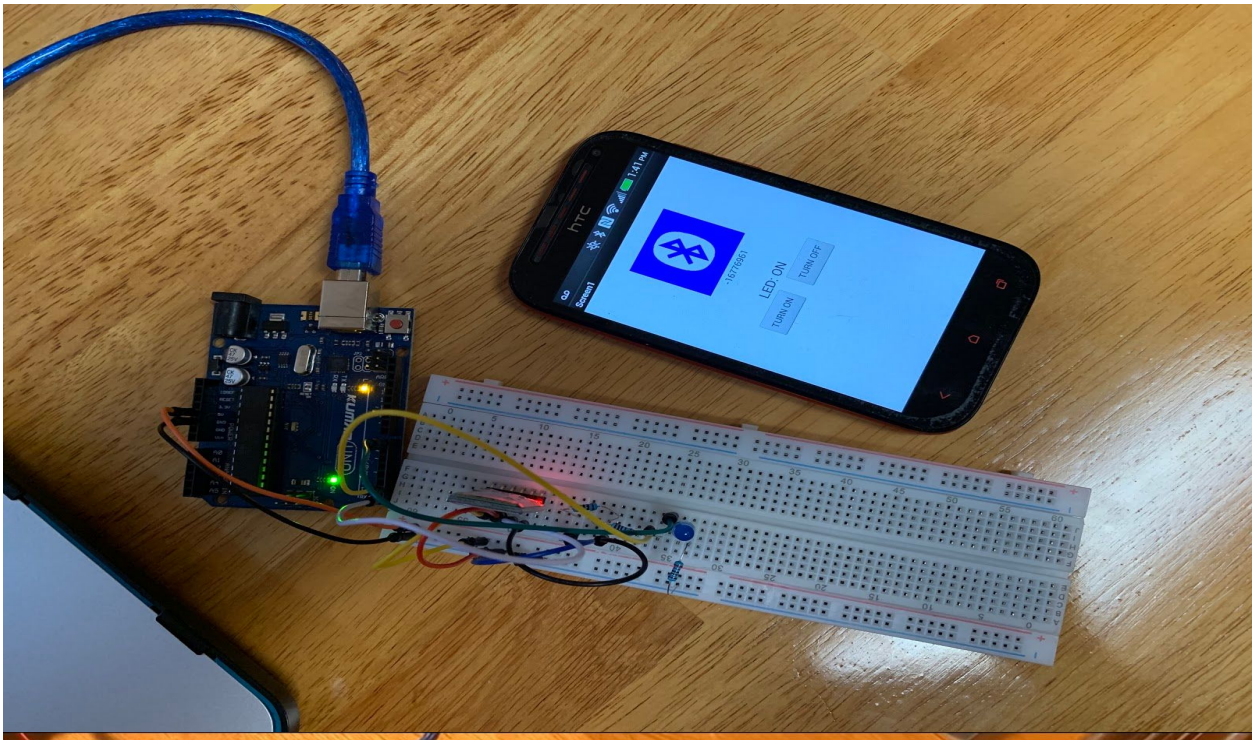
**Second Meeting (11/11/18) <u>PHASE TWO</u>**

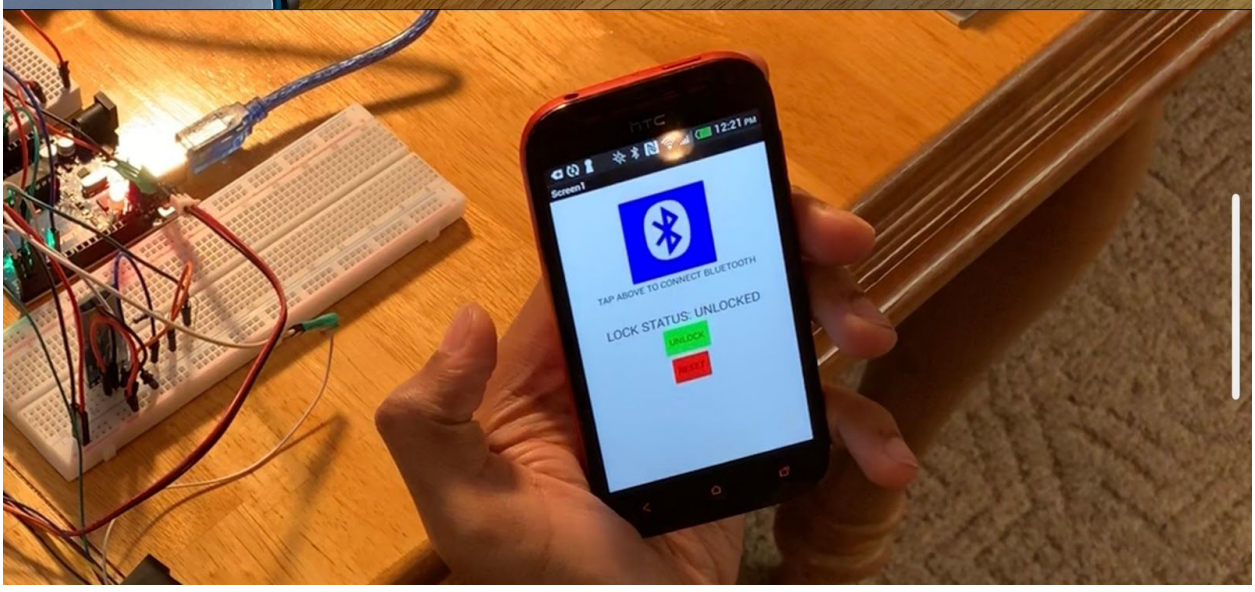
**Objective:** Get lock to unlock when the correct code is entered by communicating with the Arduino and start setting up fingerprint sensor.

**Comments:** The major accomplishment of this meeting was finally getting our lock to unlock with the input in receives from the Arduino, which in turn receives input from the keypad. The main problem we faced in getting the lock to work was getting the sufficient voltage the lock needed to engage. According to the lock specifications, the lock only needs 12V to function properly. So we connected two 9V batteries in order to get to that threshold but that was not enough. Consequently, we tried three 9V batteries. This worked, but it was not a dependable power source because it would only work half of the time. Therefore, in order to move forward with our project, we needed to decide if we were going to get a completely new lock or get a stronger and more reliable power source. As you can see in the image above, we decided to try a 20V battery pack from a drill and this became our solution. The only

drawback to this is that the battery pack is very bulky compared to the rest of our materials and will be difficult to integrate in our final design.

As for our fingerprint sensor, we have the connection set up with our second arduino and have the code needed in order to register a fingerprint and then check if the finger is a valid fingerprint that has been previously registered. The issue that we have encountered with this is that our code to register a fingerprint does not properly save the fingerprint so there is no way to check if the fingerprint is valid.



**Third Meeting (11/18/18) PHASE THREE**

**Objective:** Figure out how to add the bluetooth unlock functionality and finish implementing our fingerprint sensor

**Comments:** This meeting was extremely successful due to the addition of the fingerprint and bluetooth unlocking methods. Improving on our approach from the last meeting, we decided to change code for the fingerprint sensor in order to attempt a different method of saving the image of a fingerprint and using that to unlock the lock. First we made sure that the code would check if a fingerprint sensor was connected to the Arduino and then print the appropriate message to the serial monitor. Then, using code that we got from a tutorial website we print a message when the fingerprint sensor takes the image, converts it to the proper format, and searches for a match. Finally, if a match is found, the program returns the ID number with which the fingerprint was originally saved. Once a match is found, the program will run a function called: “unlock()” that will write the code needed to unlock the lock, as if we were unlocking the door with the keypad. Subsequently, we then moved on to working on the bluetooth connection and the phone application that we would use. Setting up the bluetooth module was easy enough, simply connect it to a power source and ground and connect its data pins to the Tx and Rx pins on the arduino. Once powered, the module emitted a bluetooth signal that we connected to our phone. We found a tutorial on Youtube that taught us how to make an app using the MITAppCreator. This tutorial turned an LED on/off using two buttons and also had a button in order to connect your phone to the bluetooth module. After emulating what they did in the tutorial and learning how we could make our own app, we proceeded to do so. Our application has the same button in order to connect via bluetooth, however, we only needed button in order to unlock the door. In order for the lock status on the app to match the state of the lock, we added a reset button that would reset the in-app lock status to locked after the door had been closed. The pictures above are of the app from the tutorial(top) and of our app(bottom).

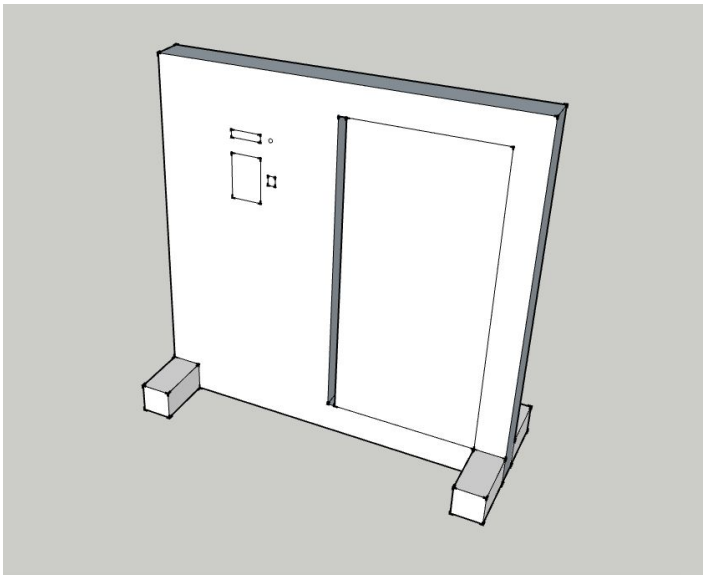

**Fourth Meeting (11/25/18) <u>PHASE FOUR</u>**

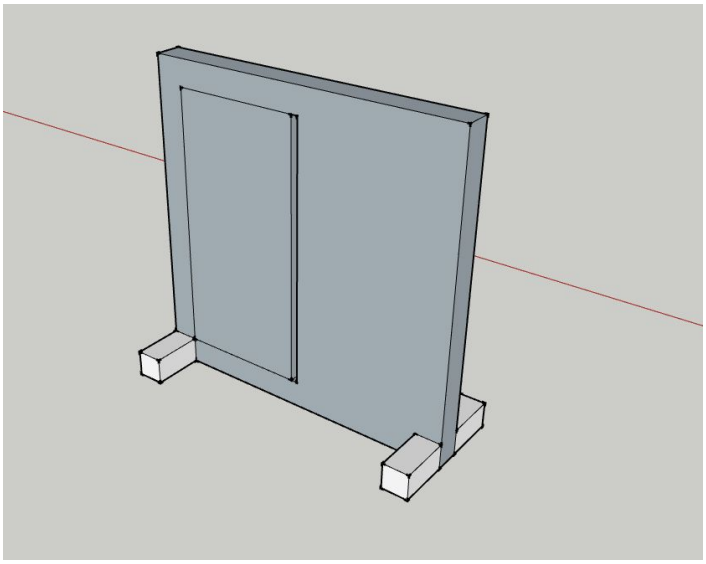
**Objective:** Start to build our door and brainstorm where on the door to place our Arduinos, wires, power source, etc.

**Comments:** Our meeting began with planning what supplies we would need to build our door and determining our budget. We then continued with a trip to Home Depot, where we made every attempt to stay within our budget and still buy everything we needed to build our door. We bought plywood, 1x2 inch wooden beams, door hinges, and a handle for our door. As shown in the pictures above, we used the pieces of plywood for the front and back of our door and we used the wooden beams as the door frame. That e most challenging part was making the door frame. Due to the thinness of the wood, drilling through them would cause them to crack and, subsequently, break. Putting screws through the middle of the beam was not a problem, however, the problem came when we attempted drill through one of the ends of a beam. Consequently, we decided to try using nails instead of screws in the most fragile parts of the wooden beam. This was a major improvement as it did not crack the wood, which

would consequently weaken the structural integrity of the door frame. After the door frame was built, we then continued to paint it and the door. We had originally thought of storing all of the components of our project in a compartment that would be build behind the door frame but decided against it because of it might tip the door to one side. Therefore, we decided to place our project components within the door frame and cut a hole that would allow us to access it if we needed to troubleshoot anything. Finally, we nailed the door to the frame and tested it out multiple times. Once we had fixed any issues, we recorded the last bit of footage we needed in order to make our video.

**3D Door Model**





**Door Model**

**Schedule**

| Week Of: | Objective |
|---|---|
| ~~October 14 - October 20~~ | ~~Get supplies and start working out logistics~~ |
| ~~October 21 - October 27~~ | ~~Connected keypad to one of the Arduinos and wrote the code that enables us to display the numbers on the LCD~~ |
| ~~October 28 - November 3~~ | ~~Figure out how to unlock the lock and how much voltage is needed for it~~ |
| ~~November 4 - November 10~~ | ~~Add fingerprint sensor unlock functionality~~ |
| ~~November 11 - November 17~~ | ~~Add unlock via bluetooth functionality~~ |
| ~~November 18 - November 24~~ | ~~Build our door and test out all of our unlocking methods combined~~ |
| ~~November 25 - December 1~~ | ~~Record the 5 minute video of our project~~ |
| ~~December 2 - December 8~~ | ~~Turn in project~~ |

**Sources:**

https://electrosome.com/door-lock-arduino/

Key code
https://www.youtube.com/watch?v=GteMrHri6r8

Bluetooth App
https://www.youtube.com/watch?v=8gzh95w4Hmk
https://www.youtube.com/watch?v=E-1w7dL3Cps
https://www.youtube.com/watch?v=8gzh95w4Hmk
https://www.youtube.com/watch?v=o-YVvxYiSuk

Fingerprint
https://www.youtube.com/watch?v=SMmj_qAbyeM

LOCK
https://www.youtube.com/watch?v=i1u-Abo_nEI
https://www.youtube.com/watch?v=0mYwr933rz8