

FINGER SCANNER DOOR LOCK SYSTEM

65020512 DOME TANVISETS

65020533 PORNPATARA BOONYAPISITSOPA

65110130 AKARAT PATTARA-ANUVONG

65110141 KUNLANITH BUSABONG

65110150 SARANYA VICHAKYOTIN

65110146 PEERAPAT BENJAPORN PONG

Purpose and Objective

PURPOSE

A fingerprint scanner door lock system is trying to solve the problem that occurs to the security of trespassing in homes, shops, and offices. Security can be fixed by using traditional locks but there are some possibilities of someone trying to open the door with a duplicate key. Using these kinds of locks is also hard to open when carrying a lot of stuff. So, we decided to use a biometric system. To create the project we will use fingerprint as the key.

OBJECTIVE

- To create a circuit which combine fingerprint scanner and RFID to control solenoid lock.
- To provide high level of security for room without physical key.
- To reduce time and effort required to gain access of door lock.
- To practice designing circuits and understanding circuit diagrams.
- To apply soldering and wiring techniques.

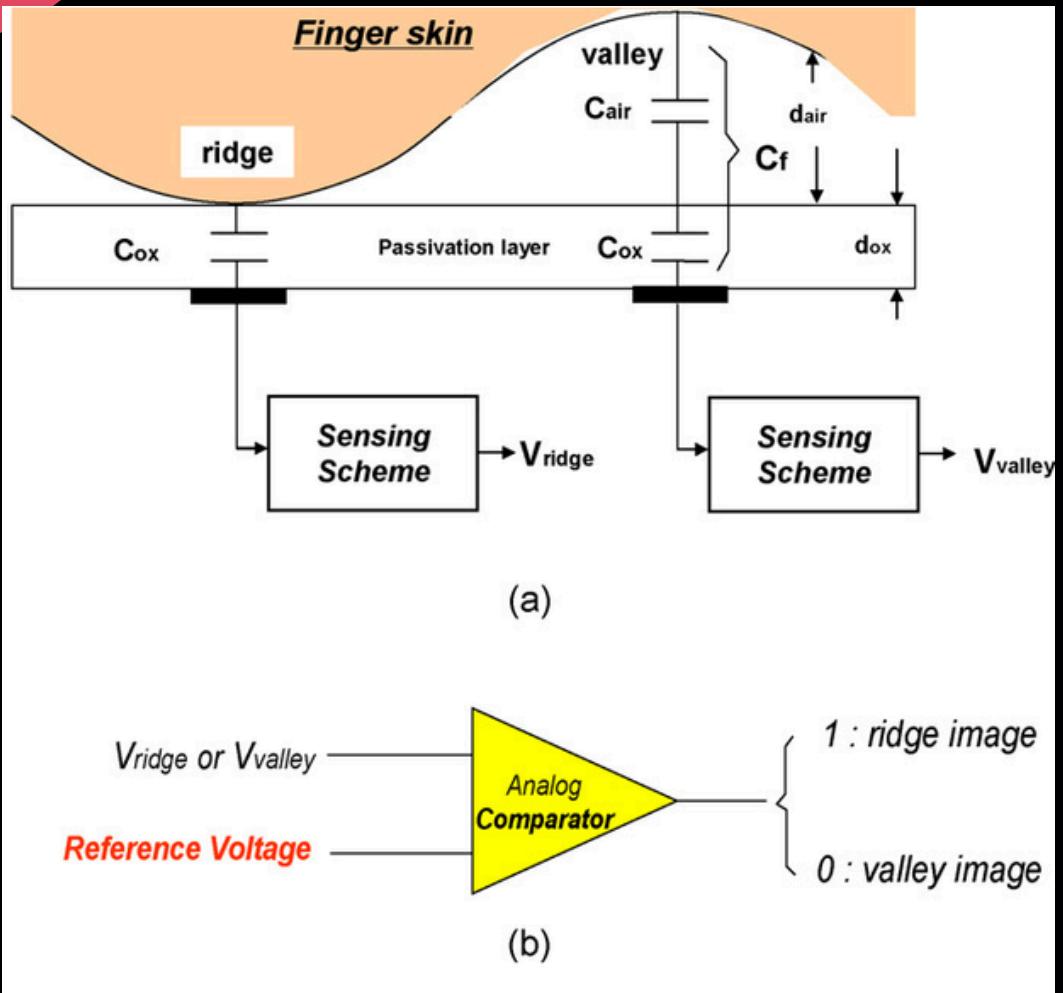
Scope of Project

- Fingerprint scanner should be able to remember at least 5 fingerprints.
- If the fingerprint is match or not match with the stored templates, the LCD should display the status.
- In case that the scanner is not able to use, the RFID keycard is the second option to unlock the system.
- The solenoid lock should activate immediately when the fingerprint is correct and locked after 5 seconds.
- Fingerprint scanner and RFID should be able to work together

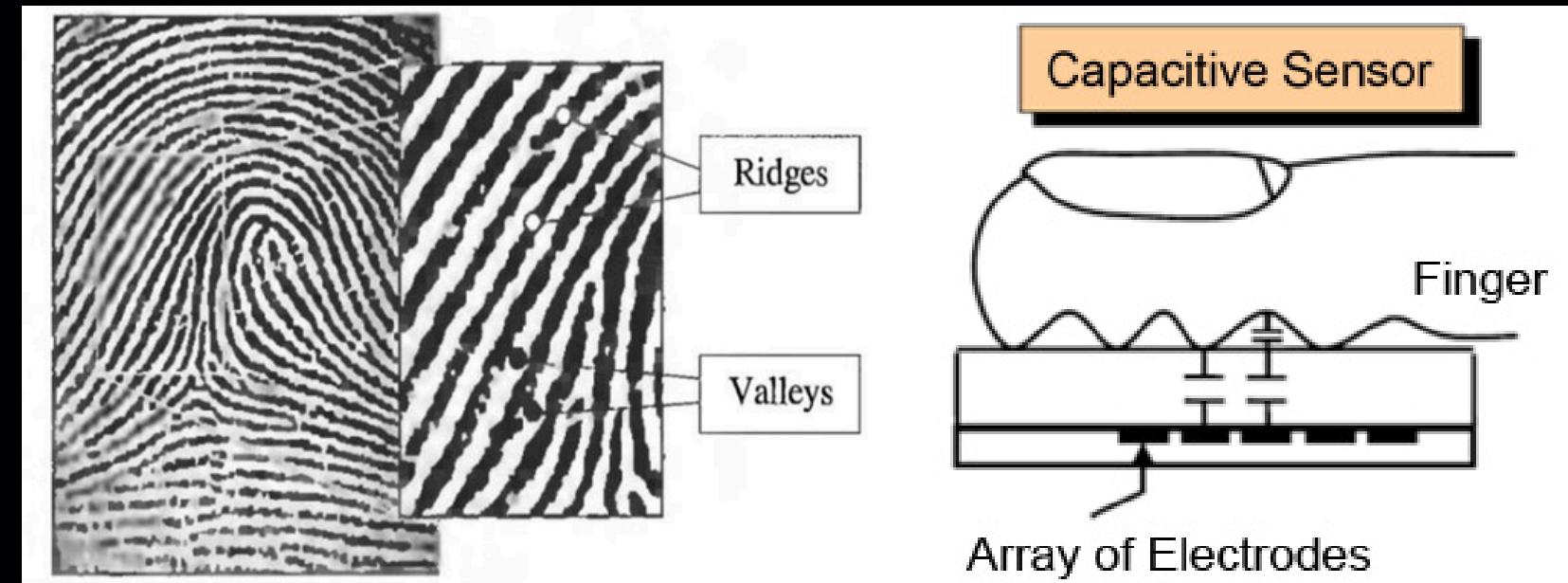
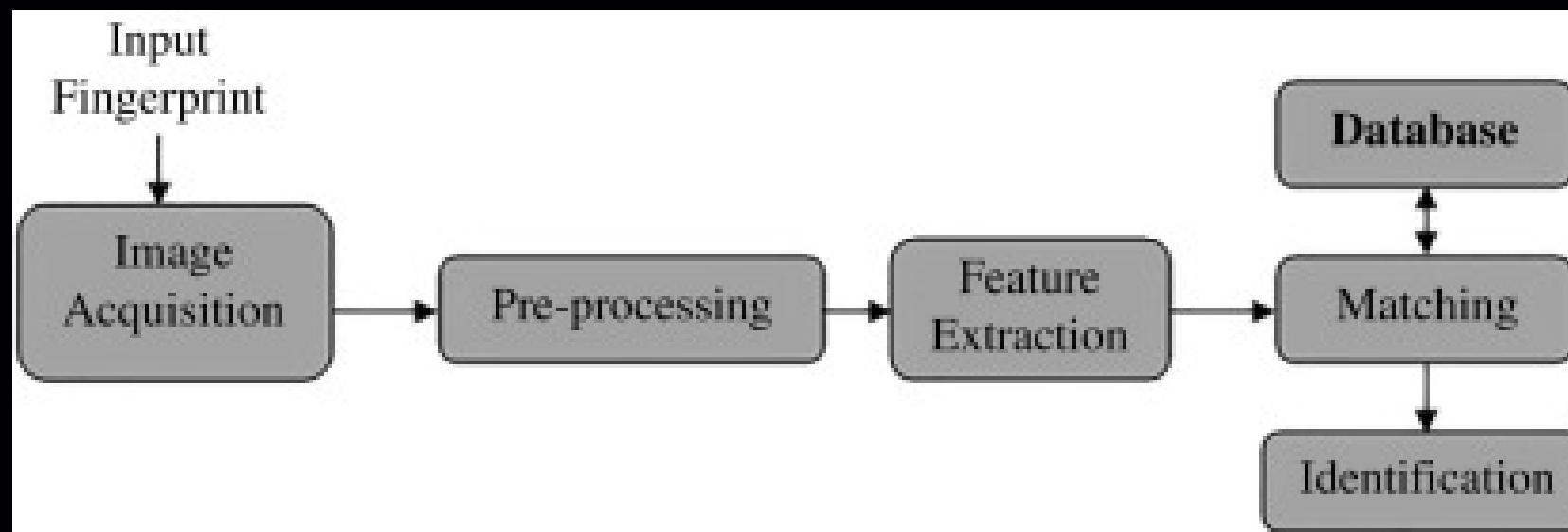


Background Research

(a) capacitive fingerprint sensing scheme



(b) detection of a ridge and valley using comparator.



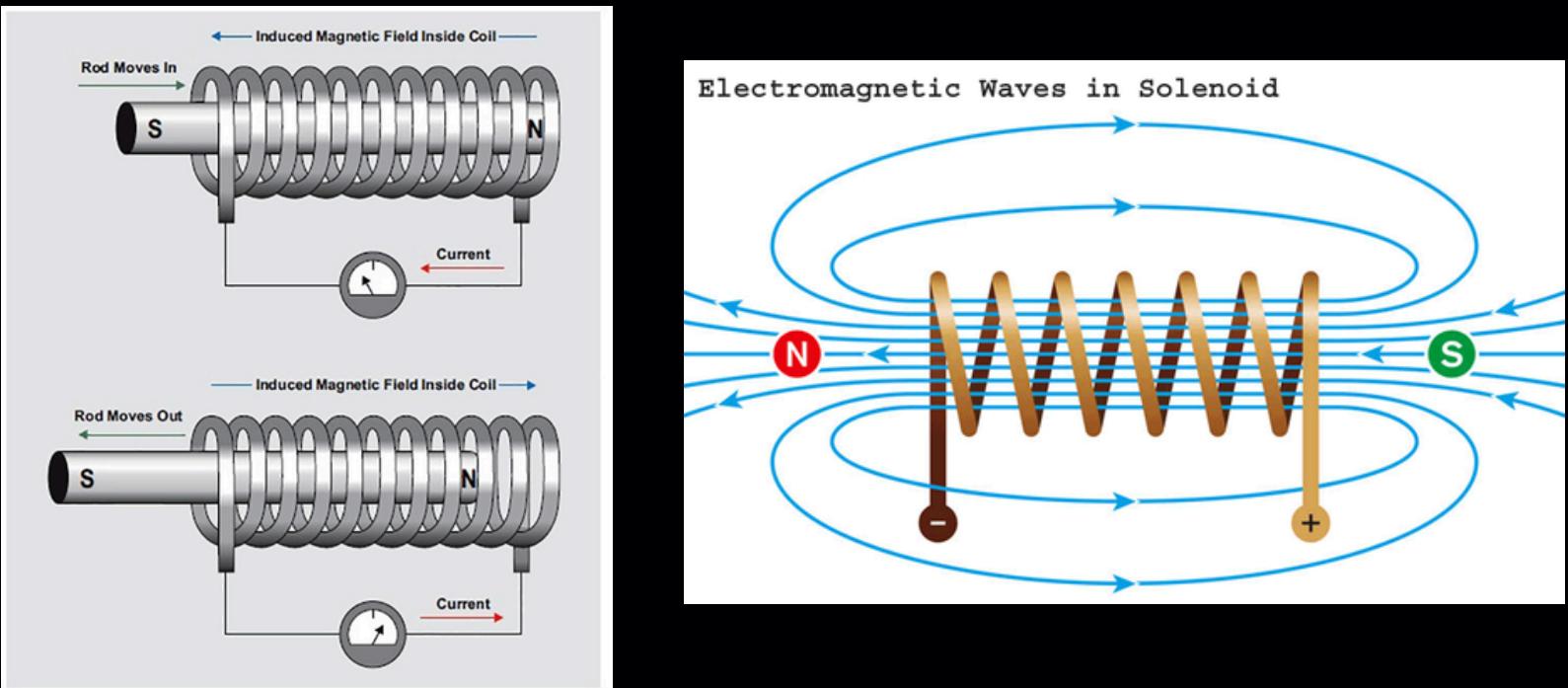
Gudino, M. (2022). How Do Fingerprint Scanners Work? Optical vs Capacitive. Arrow.com. <https://www.arrow.com/en/research-and-events/articles/how-fingerprint-sensors-work>

DY50 Fingerprint Sensor

The DY50 fingerprint scanner uses capacitive sensing to track fingerprint details using a small capacitor array circuit. Changes in capacitance caused by the fingerprint's ridges and valleys are monitored by an operational amplifier integrator system and processed by an analog-to-digital converter.

Background Research

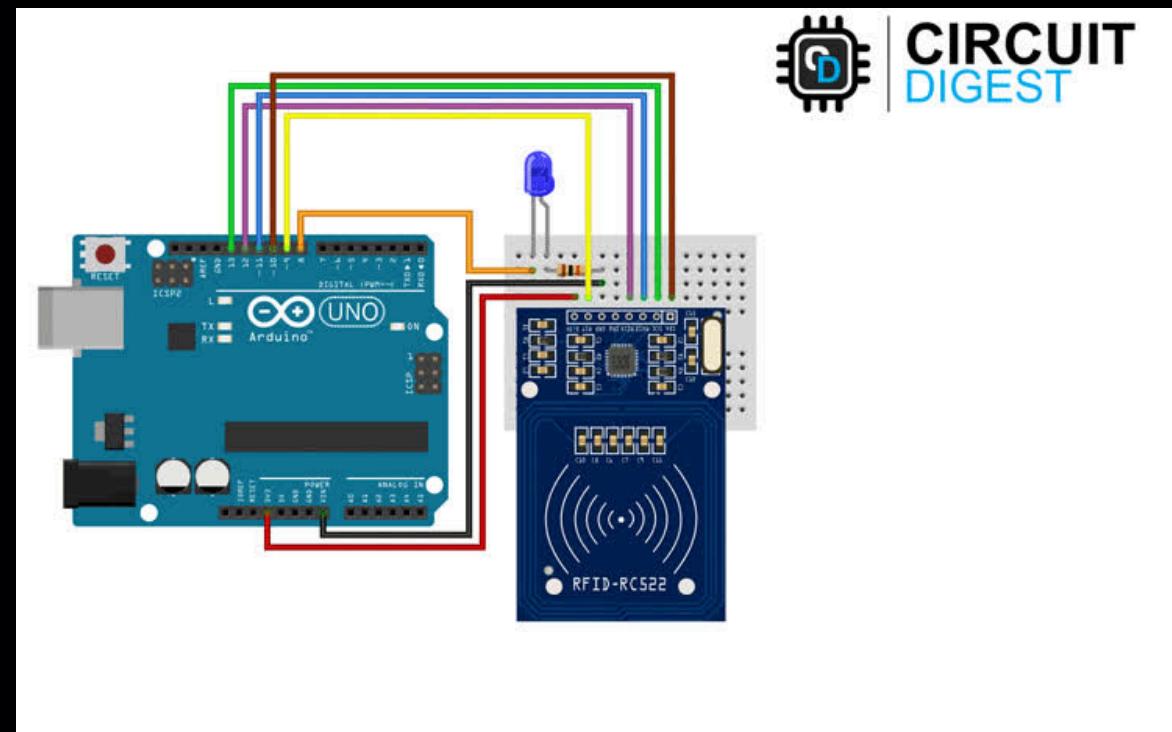
Solenoid Lock



An Introduction to Solenoids. (n.d.). <https://circuitdigest.com/article/what-is-solenoid-its-working-principle-and-types#:~:text=The%20solenoid%20simply%20works%20on,compared%20to%20the%20air%20core>

An electromagnetic solenoid controls the locking mechanism of a solenoid door lock. When an electric current flows through the solenoid, a magnetic field is created that causes an actuator connected to the locking mechanism to move, locking or unlocking the door.

RFID



Interfacing RFID Reader With Arduino. (n.d.). <https://circuitdigest.com/microcontroller-projects/interfacing-rfid-reader-module-with-arduino#:~:text=Arduino%20Code%20to%20Turn%20On%20or%20Off%20LED%20with%20RFID&text=The%20code%20is%20pretty%20simple,will%20toggle%20the%20LED%20state.>

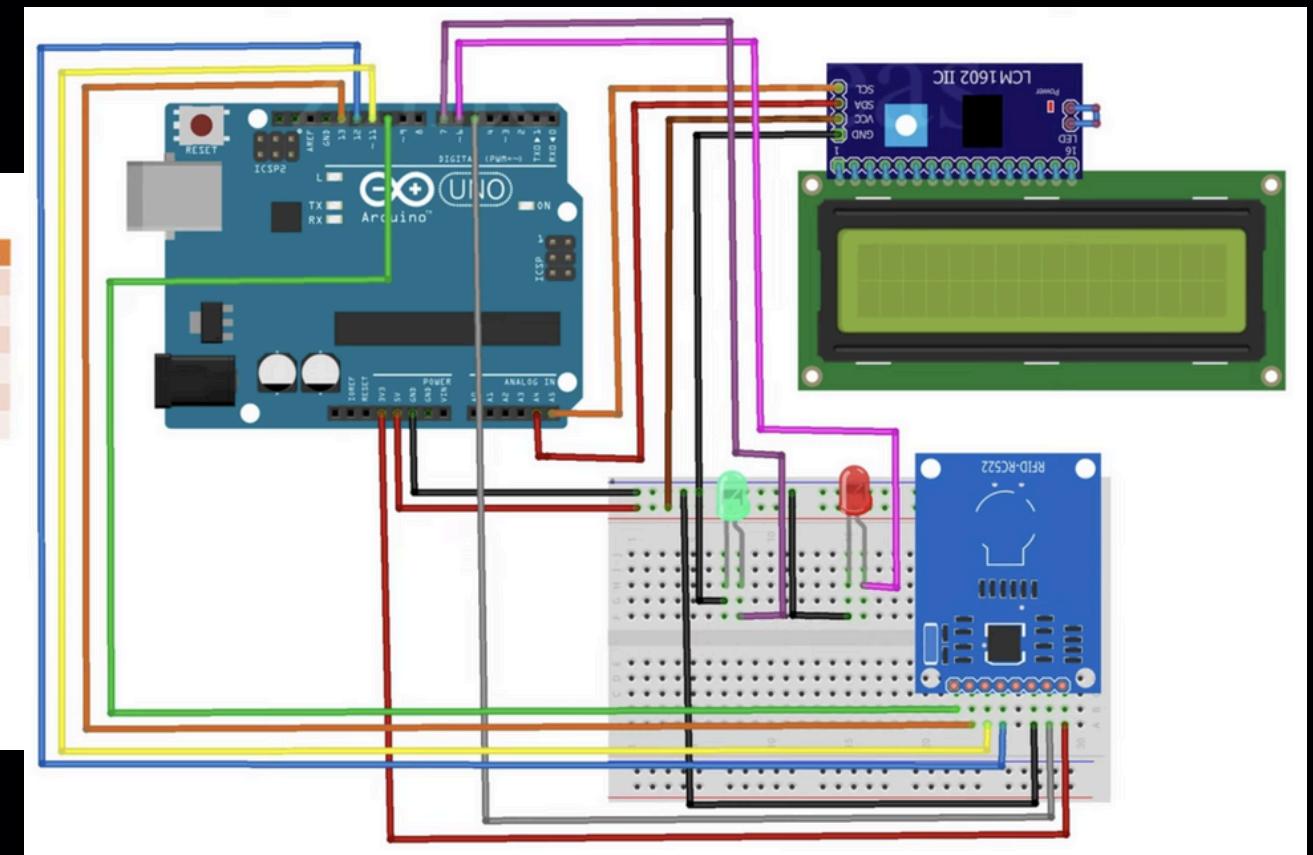
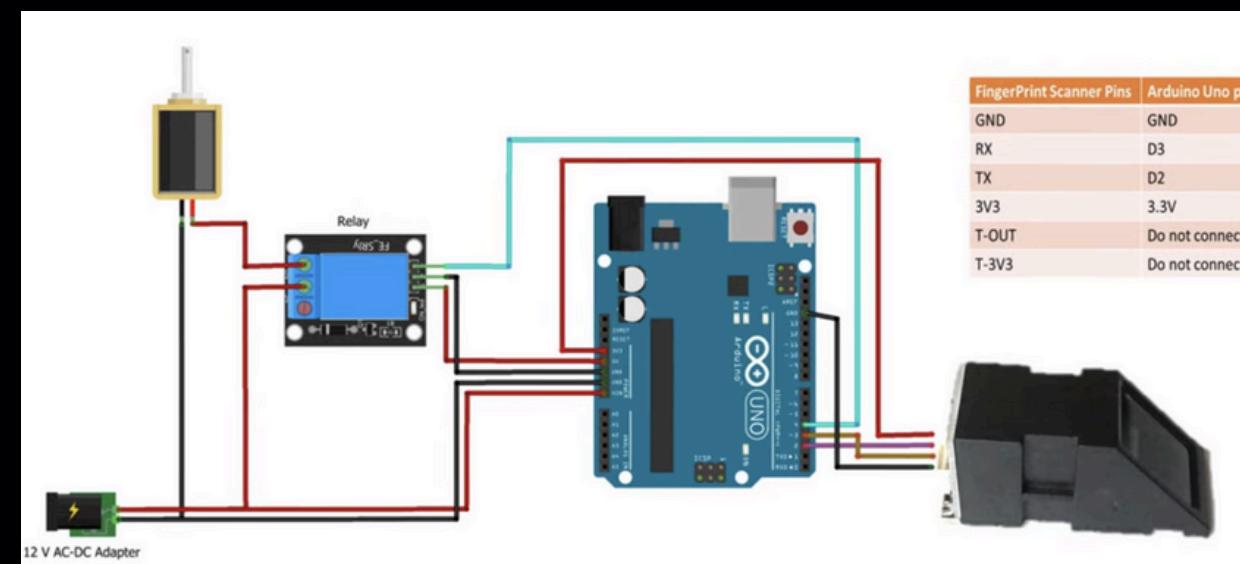
The working principle of RFID (Radio Frequency Identification) involves the use of electromagnetic fields to transfer data wirelessly between an RFID reader and an RFID tag.

Methodology



01

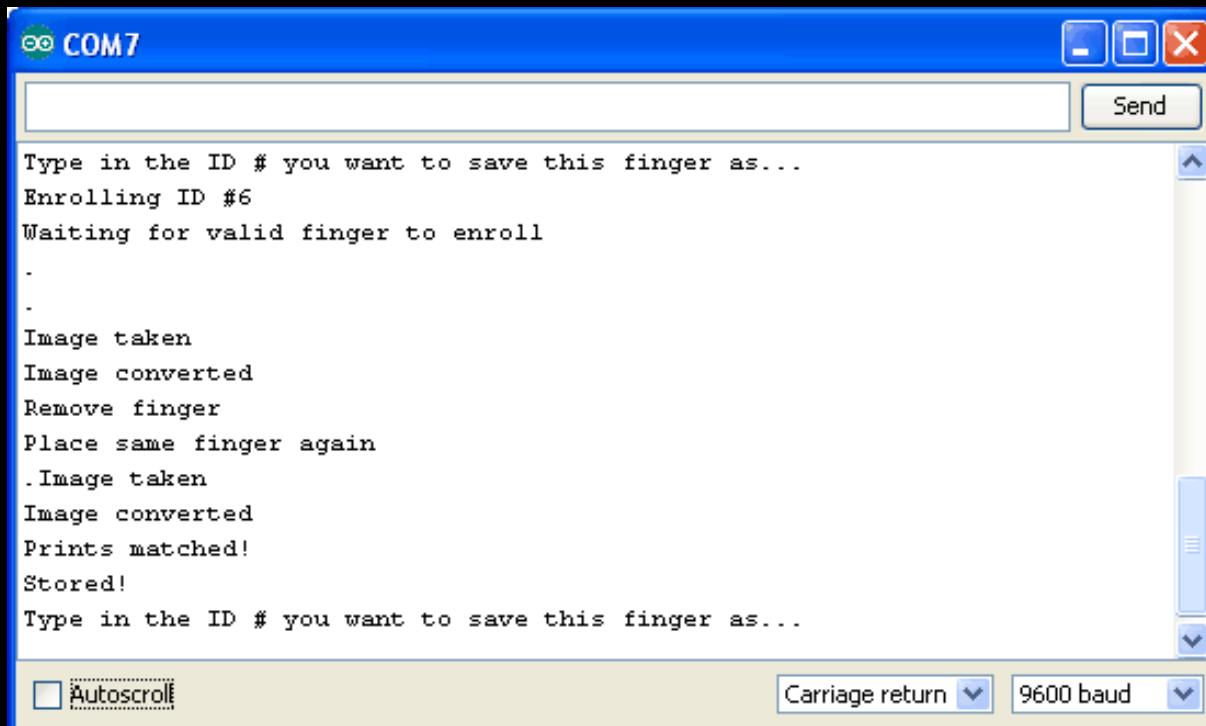
Study research and choose the right hardware parts. Purchase the necessary components, then test it.



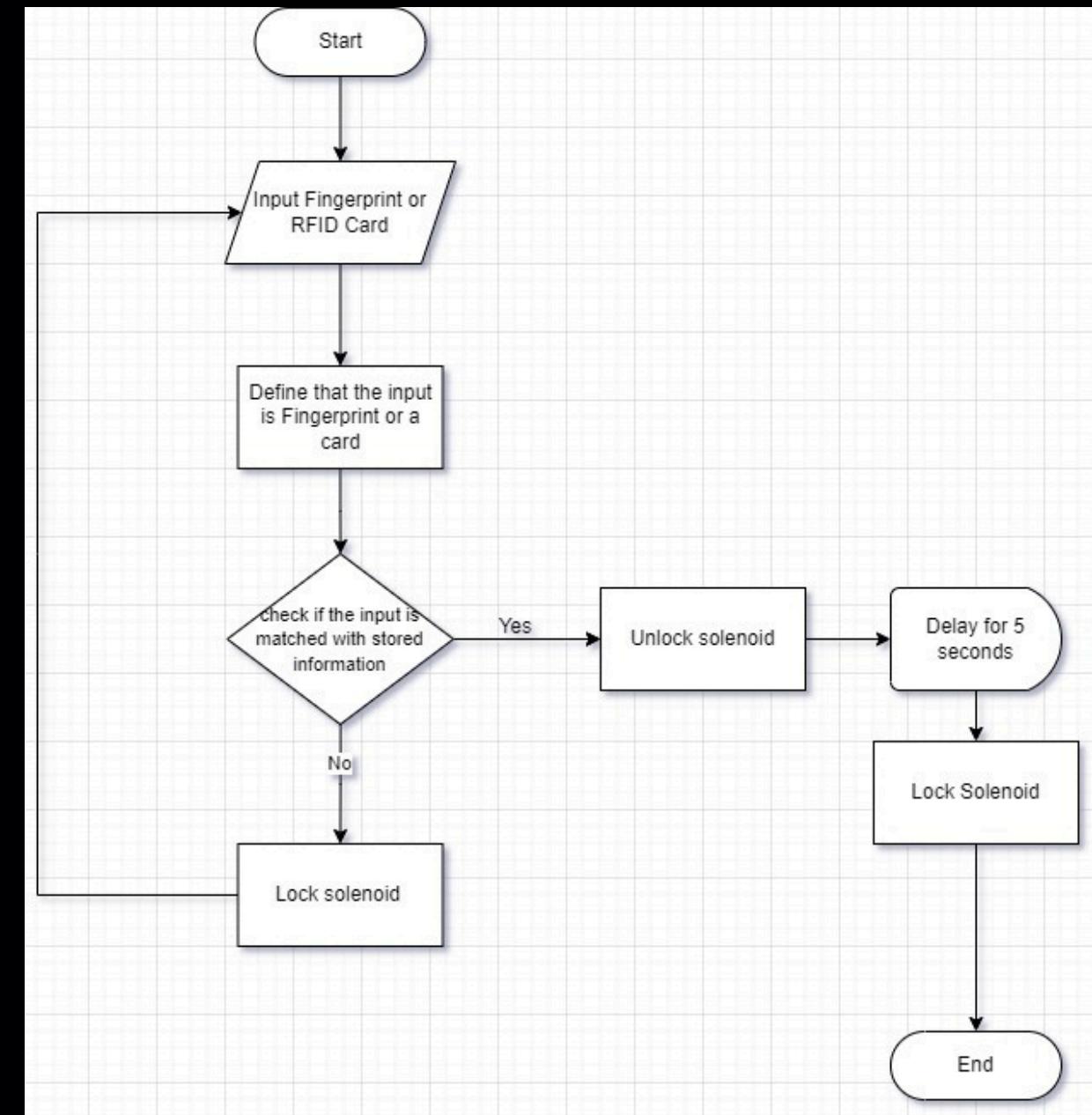
02

Create the circuit, begin wiring, and join the hardware and software. Connecting the components to the PCB with solder.

Methodology



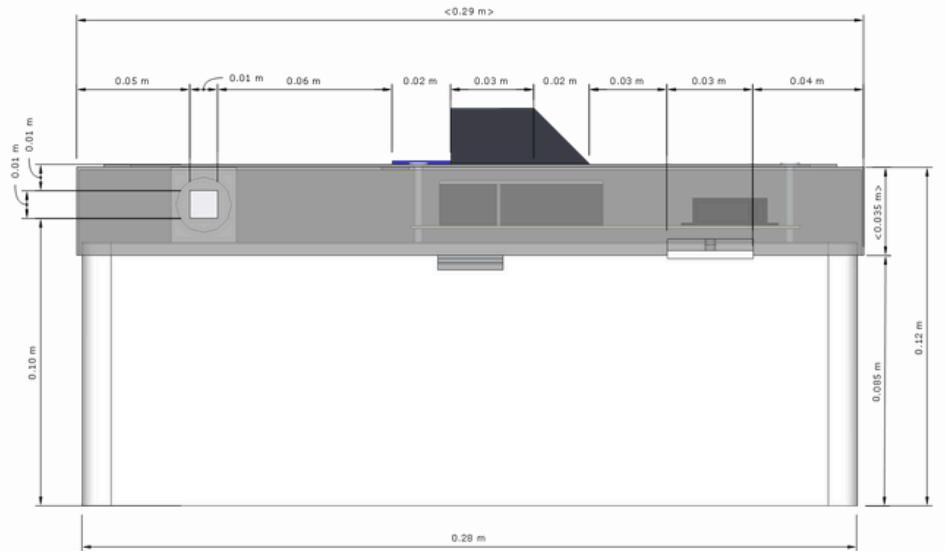
```
if (ID.substring(1) == "92 D3 D0 21" && led2 == 0 ) {
    digitalWrite(led2, HIGH);
    Serial.println("LED1 is ON..");
    led2 = 1;
    unlockSolenoid(); // Unlock solenoid when LED1 turns on
} else if (ID.substring(1) == "92 D3 D0 21" && led2 == 1 ) {
    digitalWrite(led2, LOW);
    Serial.println("LED1 is OFF..");
    led2 = 0;
    //lockSolenoid(); // Lock solenoid when LED1 turns off
} else if (ID.substring(1) == "93 14 CE 1B" && led2 == 0 ) {
    digitalWrite(led2, HIGH);
    Serial.println("LED2 is ON..");
    led2 = 1;
    unlockSolenoid(); // Unlock solenoid when LED2 turns on
} else if (ID.substring(1) == "93 14 CE 1B" && led2 == 1 )
{
    digitalWrite(led2, LOW);
    Serial.println("LED2 is OFF..");
    led2 = 0;
    //lockSolenoid(); // Lock solenoid when LED2 turns off
} else {
    serial.print("Wrong card! Please put correct card!");
}
```



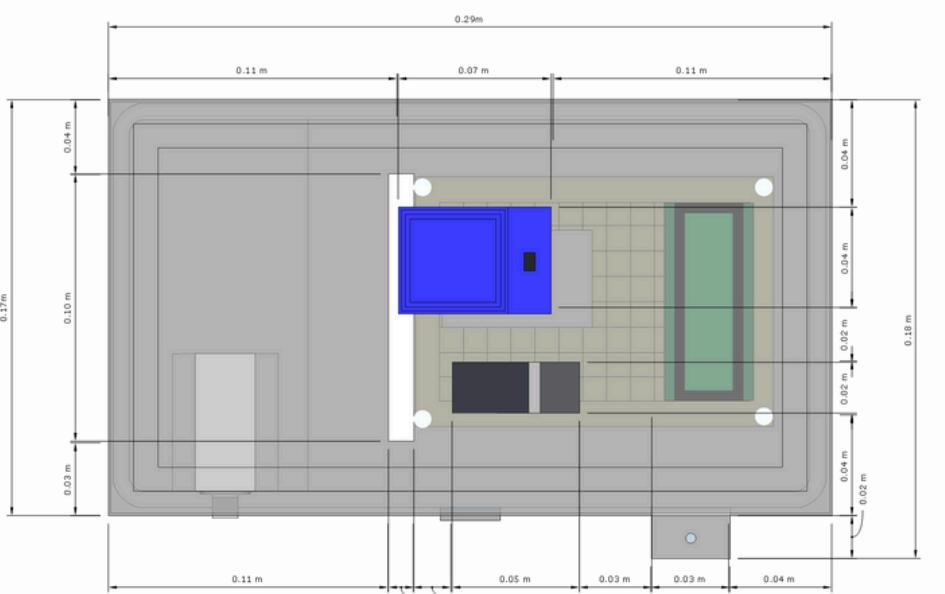
03

To test and debug a system, write code and upload it to a microcontroller.

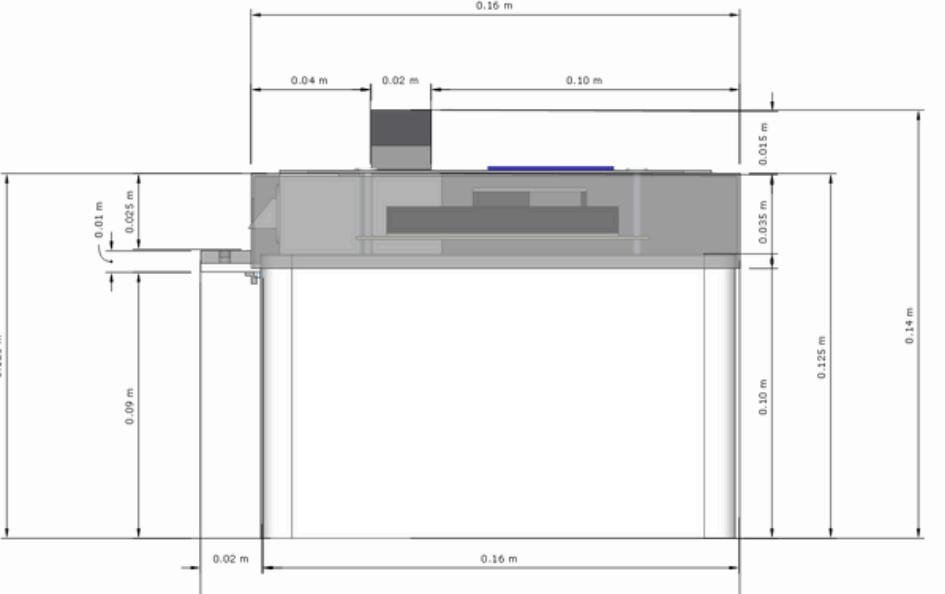
Methodology



SIDE VIEW



TOP VIEW



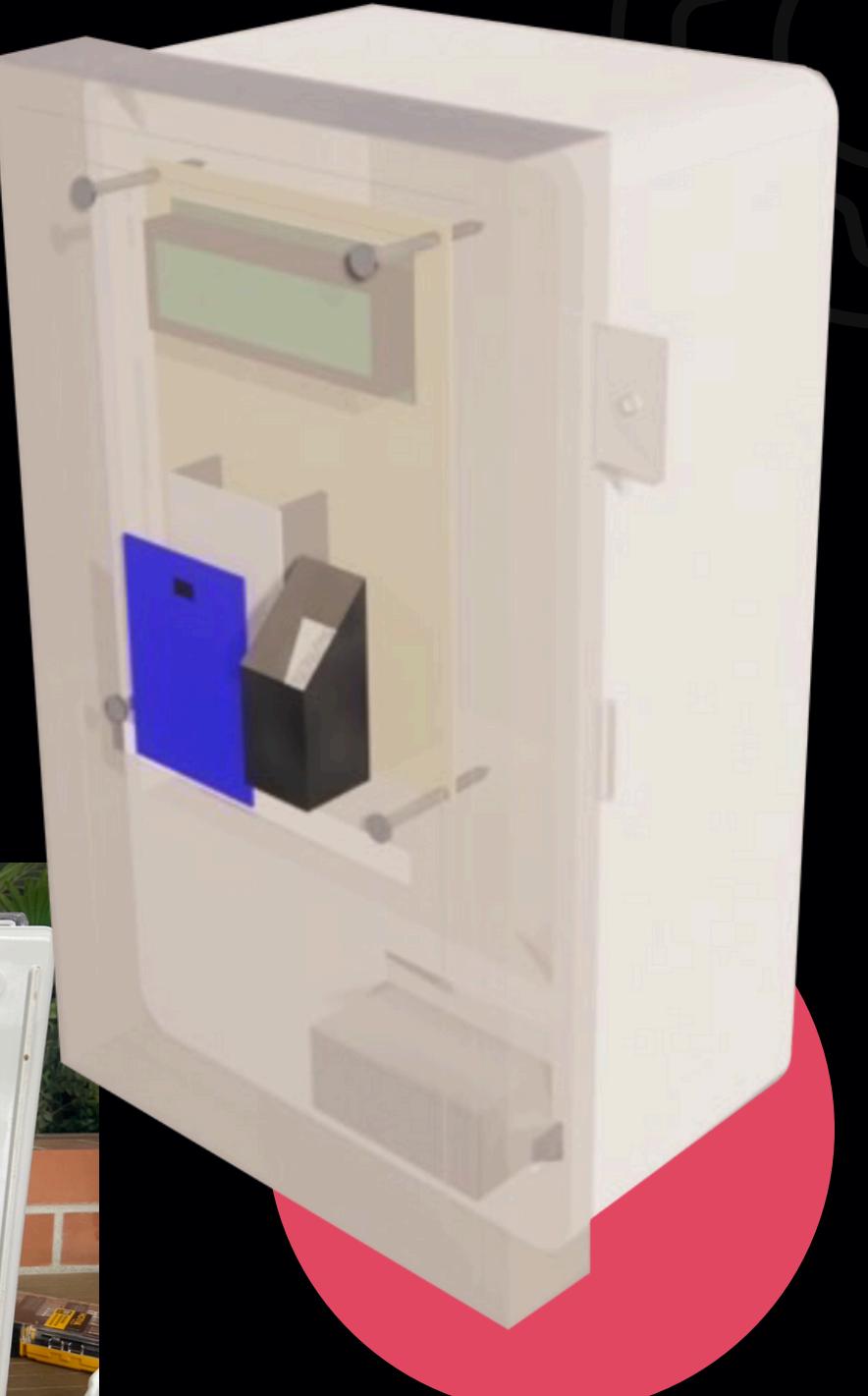
FRONT VIEW

04 Design

Take the Junction box and modify it to
be a door model |



**Strengthen the structure
to support the solenoid
lock weight.**

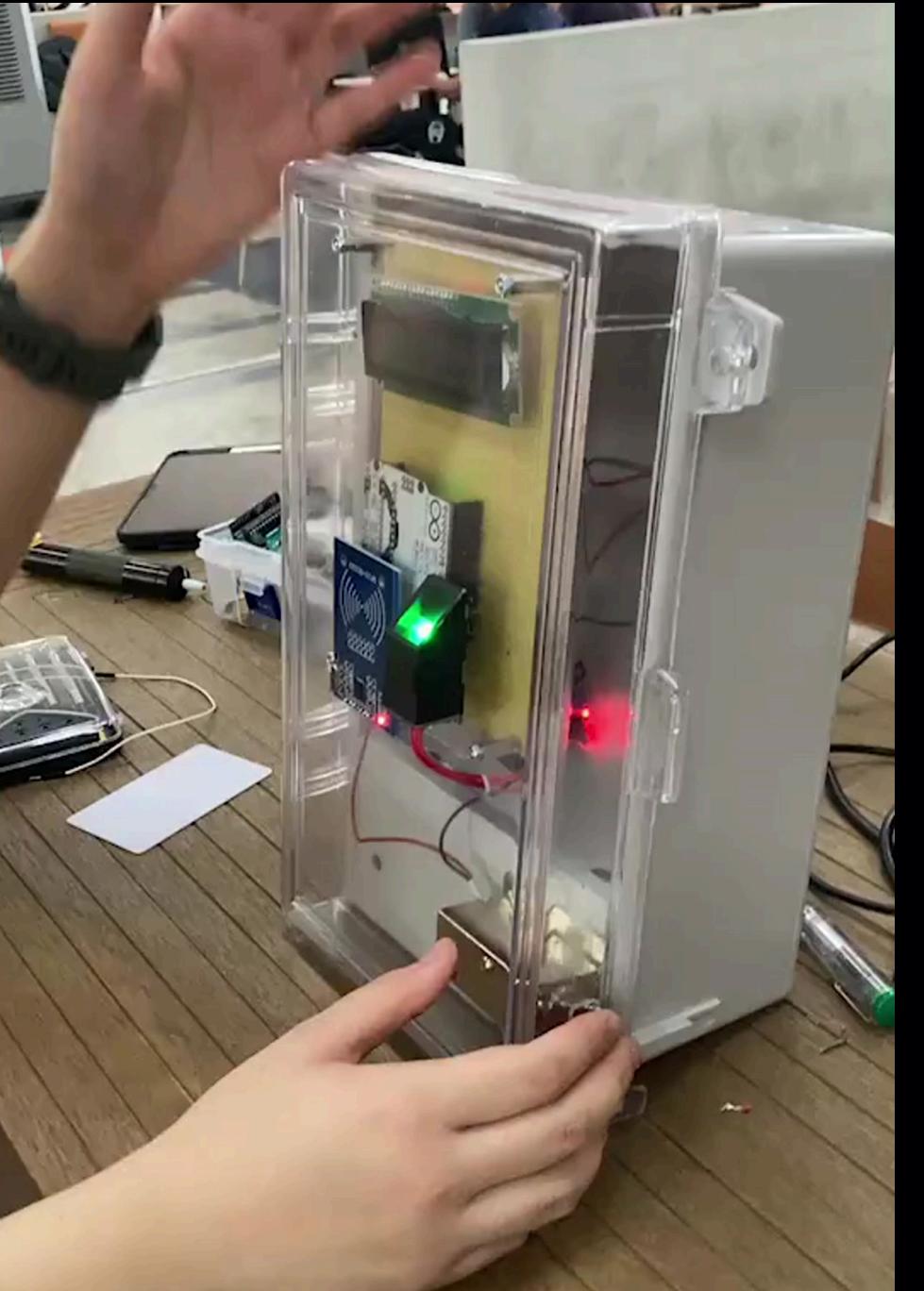


Drill holes so that
the wires can connect
the printed circuit boa

Drill a hole for the solenoid lock, can be locked with plastic cover

Holes are drilled to allow the wires to go in.

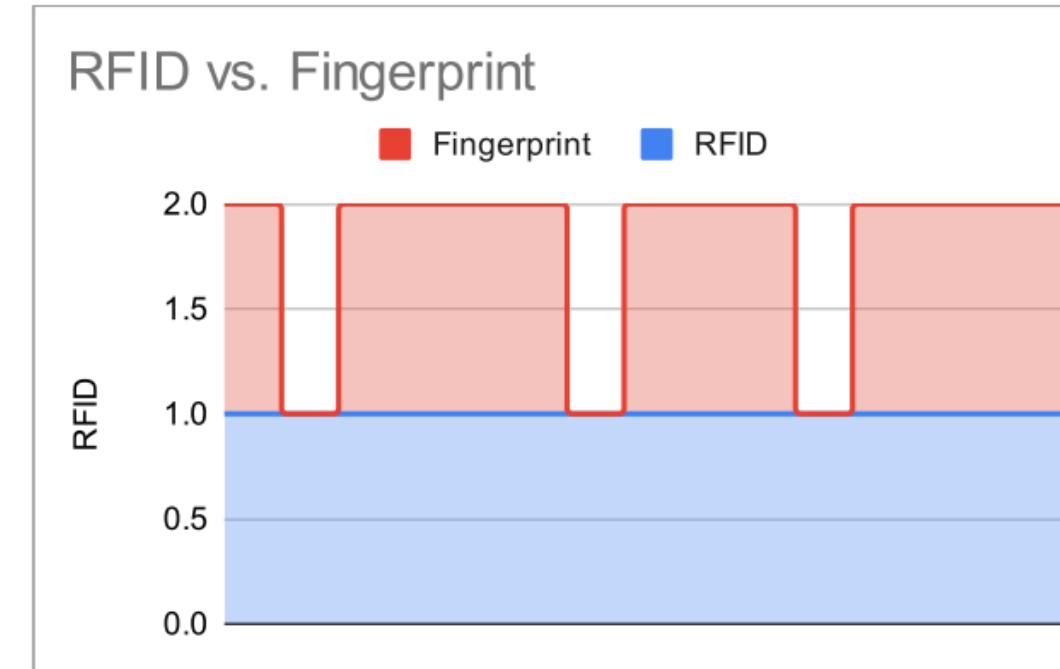
Implementation



Result Conclusion

Trial	Fingerprint	RFID
1	1	1
2	0	1
3	1	1
4	1	1
5	1	1
6	1	1
7	0	1
8	1	1
9	1	1
10	1	1
11	0	1
12	1	1
13	1	1
14	1	1
15	1	1

1 = work 0 = did not work



The performance varied depending on how many fingerprints from a given individual were being matched. The best system was accurate 98.6 percent of the time on single-finger tests, 99.6 percent of the time on two-finger tests, and 99.9 percent of the time for tests involving four or more fingers.



Bayometric
<https://www.bayometric.com/how-accurate-are-todays-fingerprint-scanners/>

How Accurate are today's Fingerprint Scanners? - Bayometric

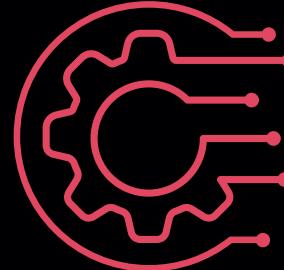
Clark, M. (2022, May 9). How Accurate are today's Fingerprint Scanners? Limitations, Errors and Their Effect on the Accuracy. Bayometric. <https://www.bayometric.com/how-accurate-are-todays-fingerprint-scanners/#:~:text=The%20performance%20varied%20depending%20on,involving%20four%20or%20more%20fingers.>

Accuracy of fingerprint scanner = 99.6% (for enroll 2 times per template)

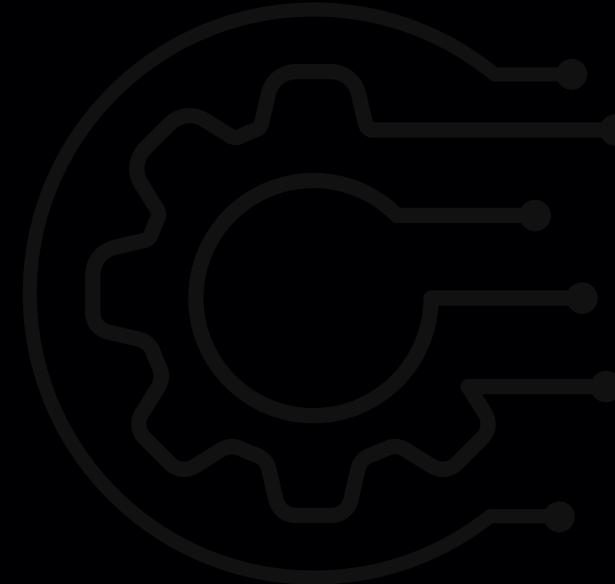
Percentage error

$$\begin{aligned} &= \frac{|Measured\ Value - True\ value|}{|True\ value|} \times 100 \\ &= \left| \frac{14-12}{12} \right| \times 100 = 16.67\% \end{aligned}$$

It can be seen that a RFID card is more accuracy than a fingerprint scanner which the accuracy is 100% and 83.33% respectively. As a result, it can be observed that the card is a good backup because it has a lower error tolerance.



LIMITATIONS



01

The LCD screen does not display when soldering.

Possible cause : power supply issues

02

Unstable performance

Possible cause :

- power supply limitations (requirement exceed)
- frequency interference / electric crosstalk (shared power source)

Solution :

- Increase the power capacity of the shared source to handle the total power needs of both devices.

FUTURE WORK



IoT for finger scanner



Machine learning and AI