Sinhgad Technical Education Society's

# SINHGAD COLLEGE OF ENGINEERING, PUNE-41

## Electronics & Telecommunication Engineering Department


## Second Year Electronics and Telecommunication

# PROJECT BASED LEARNING (PBL)

# WORK BOOK

**ACADEMIC YEAR: 2022/ 2023** **Semester: II**

**Division: A** **Batch: A4** **Group: 13**

**Project title – Fingerprint doorlock using Arduino**

**Area of study – Digital Electronics**

Sinhgad Institutes

# SINHGAD COLLEGE of ENGINEERING, PUNE-41

**Sr.No. 44/1, Vadgaon (Bk), Off Sinhgad Road, Pune – 411 041.**

## Department of E&TC Engineering

# *Certificate*

This is to certify that, following students,

| | |
|---|---|
| OM SURYAWANSHI | 204A078 |
| SUSHIL KANJE | 204A079 |
| SHRADHA TAKAWANE | 204A080 |
| SUNIDHI THOMBRE | 204A081 |
| SAKSHI UGHADE | 204A083 |
| TEJAS VAIDYA | 204A084 |

has completed all the Term Work & Practical Work in the subject of **Project-based learning (PBL)** satisfactorily in the department of E&TC Engineering as prescribed by Savitribai Phule Pune University, in the academic year 2022-2023

| | | |
|---|---|---|
| Prof.R.R.Katkar | Prof.G.A.Thakur | Dr.M.B.Mali |
| Faculty-in-charge | Co-Ordinator | HoD |

Date: / /2023

## Rules & Regulations:

1. Handle the workbook very carefully.
2. All students must enter the correct information in the workbook.
3. All entries in the PBL workbook must be verified by theconcerned Supervisor/Mentor.
4. Activities planned should be completed as per the instructions and schedule given by Supervisor/Mentor.
5. Assessment of TW for Project-Based Learning (PBL) is out of

   25 Marks which are based on attendance, regularity of completion of activities on given time and studentinvolvement.
6. Assessment of PR for PBL is out of 50 Marks which are based on idea inception, outcomes of PBL, problem-solving skills, the solution provided, final product, documentation, demonstration, contest participation, and awareness.
7. Students need to submit a final report of 5 to 10 pages in the prescribed formagiven atat the end of this workbook.

## Course Objectives:

- To emphasize project-based learning activities that are long-term, interdisciplinary and student-centric.
- To inculcate independent and group learning by solving real-world problems with the help of available resources.
- To develop applications based on electronics and communication engineering fundamentals by possibly integrating previously acquired knowledge.
- To get practical experience in all steps in the life cycle of the development of electronic systems: specification, design, implementation, and testing.
- To be able to select and utilize appropriate hardware and software tools to design and analyze the proposed system.
- To provide every student with the opportunity to get involved either individually or as a group as to develop team skills and learn professionalism.

## Course Outcomes:

CO1: Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate/set relevantaims and objectives.
CO2: Contribute to society through the proposed solution by strictly following professional ethics and safety measures.
CO3: Propose a suitable solution based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge. CO4: Analyze theresults and arrive at a valid conclusion.
CO5: Use of technology in proposed work and demonstrate learning inoral and written form.
CO6: Develop ability to work as an individual and as a team member.

## Group Information:

**Division: A** **Batch: A4** **Group:13**

| Roll No. | PRN No. | Name of Student | Mobile No. |
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## Literature survey:

Fingerprint door lock systems using Arduino have become increasingly popular in recent years due to their convenience, accuracy, and security. This literature survey aims to review the existing research on fingerprint door lock systems using Arduino Uno and to identify the current state-of-the-art in this field. This survey will cover the development of fingerprint door lock systems, Arduino Uno board's capabilities, and various fingerprint sensors used with the system. Finally, we will identify challenges and opportunities in this field for future research.

Development of Fingerprint Door Lock Systems: In the early days of fingerprint door lock systems, traditional locking mechanisms were manually operated by a key. However, as technology developed, electronic locks were introduced, which allowed access through the use of a password or a card. Later, fingerprint-based locks were developed, and these locks proved to be more reliable and secure than other forms of access control.

Arduino Uno Board's Capabilities: Arduino Uno board is an open-source hardware and software platform that is used to control the locking mechanism and fingerprint sensor in a fingerprint door lock system. It has a microcontroller that can be programmed to perform various tasks. It also has several digital and analogue input/output pins that can be used to connect various components, such as sensors, motors, and LEDs. Arduino Uno board's flexibility and versatility make it an ideal platform for creating complex electronic systems.

Fingerprint Sensors: The fingerprint sensor is a crucial component of the fingerprint door lock system. There are several types of fingerprint sensors available, such as optical, capacitive, and ultrasonic sensors. Optical sensors use light to capture the fingerprint's image, while capacitive sensors measure the capacitance of the skin's ridges and valleys. Ultrasonic sensors use high-frequency sound waves to capture the fingerprint's image. Optical sensors are the most commonly used sensors in fingerprint door lock systems. They are reliable, accurate, and relatively inexpensive. Capacitive sensors are also popular and provide a high level of accuracy.

# Weekly Planning Sheet

| Week No. | Activity Planned | Activities Completed | Signature of Students | Signature of Faculty/Mentor |
|---|---|---|---|---|
| 1 | Look for options on which projects could be made and how effective it could be | After doing a lot of research,we choose our topic i.e. Fingerprint sensor using Arduino UNO | | |
| 2 | Research on selected topic | Read lots of research papers on our topic and finally selected two journals for ourprojects. | | |
| 3 | Categorized our topic into sub parts and assigned tasks to group member | Tasks were properly completed by our group. | | |
| 4 | How to approach our project? Whether it should be software based or hardware based | Finally, we decided to do it on software.<br>Software to be used<br>1. Arduino ide | | |

Signature of PBL Co-ordinator

# Weekly Planning Sheet

| Week No. | Activity Planned | Activities Completed | Signature of Students | Signature of Faculty/Mentor |
|---|---|---|---|---|
| 5 | Research on selected topics and required electronic components for design the system | Read lots of datasheets, research articles for different electronic components and finally selected electronic components for our project | | |
| 6 | Learn about Arduino and Arduino ide software | Initialization, program development, hexcode generation and program execution all the terminologies studied | | |
| 7 | Prepare the schematic diagram, schematic circuitry on proteus software | By using the tinker cad software analysis of schematic diagram, schematic circuitry completed | | |
| 8 | Interfacing of all components to perform on electronic system (hardware based) | With the help of connecting wires, jumper wires connected all peripherals to microprocessor as per schematic diagram | | |

Signature of PBL Co-ordinator

# Weekly Planning Sheet

| Week No. | Activity Planned | Activities Completed | Signature of Students | Signature of Faculty/Mentor |
|---|---|---|---|---|
| 9 | Programming our Arduino | All group members collectively took part in the programming and it wascompleted properly | | |
| 10 | Preparation of report | We should design the report which consists material, datasheet and informationon components which may be arranged in the proper PBL report format, by that method we prepared our report | | |
| | | | | |
| | | | | |

Signature of PBL Co-Ordinator

# FINGERPRINT DOORLOCK USING ARDUINO

*A Report submitted in partial fulfilment of the requirements to complete Term Work& Practical work of Project Based Learning (PBL) in the department of*

## E&TC ENGINEERING

*As prescribed by*

## SAVITRIBAI PHULE PUNE UNIVERSITY


*By*

| | |
|---|---|
| **OM SURYAWANSHI** | **72286771K** |
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*Under the Guidance of*

**Prof. ROHINI KATKAR**

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**Second-Year Engineering Department**

## Sinhgad College of Engineering

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## CONTENTS

# ACKNOWLEDGEMENT

We are feeling very humble in expressing our gratitude. It will be unfair tobind the precious help and support that we got from many people in a few words.But words are the only media of expressing one's feelings and my feeling of gratitude is absolutely beyond these words. It would be my pride to take this opportunity to say thanks.

Firstly, we would thank our beloved guide **Prof.R.R.Katkar** for her valuable guidance, patience and support; She was always there to force us a bit forward to get the work done properly and on time. She has always given us the freedom to do mini-project work and the chance to work under his supervision.

We would like to express our sincere thanks to **Prof.G.A.Thakur** Project-based Learning (PBL COORDINATOR), Department of E&TC, for his constant encouragement in the fulfilment of the PBL work. We would also like to express our sincere thanks to **Dr. M. B. Mali, Head,** Department of E&TC for his cooperation and useful suggestions. We would also like to thank **Dr. S. D. Lokhande, Principal, of Sinhgad College of Engineering.** He always remains a source of inspiration for us to workhard and dedicatedly.

It is the love and blessings of our families and friends which drove us to complete this project work.

Thank you all!

# ABSTRACT

A fingerprint door lock system using Arduino Uno is a biometric security solution that provides access control by scanning and comparing fingerprint patterns. The system consists of an Arduino Uno board, a fingerprint sensor module, a servo motor, and a relay module.

The fingerprint sensor module captures the fingerprint image and converts it into a digital template, which is then compared with the stored fingerprint data in the database. If the fingerprint matches, the system sends a signal to the servo motor, which unlocks the door.

The system can be programmed to store multiple fingerprints, allowing access for authorized individuals. The Arduino Uno board acts as the main control unit that processes the data from the sensor and controls the motor and relay module.

The fingerprint door lock system using Arduino Uno provides a high level of security compared to traditional key-based locks as fingerprints are unique to each individual, making it difficult to duplicate or forge. Additionally, the system is cost-effective, easy to install, and user-friendly. It can be used in a variety of settings, such as homes, offices, and commercial buildings.

# LIST OF FIGURES

# LIST OF PHOTOGRAPHS

# CHAPTER 1
# INTRODUTION

# INTRODUCTION

A fingerprint door lock is a security solution that provides access control to a building or room using biometric authentication. This technology has gained popularity in recent years due to its convenience, accuracy, and reliability. An Arduino-based fingerprint door lock system is an electronic device that utilizes the Arduino microcontroller board to control the locking mechanism and fingerprint sensor. Arduino is an open-source hardware and software platform that is easily programmable and customizable, making it an ideal platform for creating complex electronic systems. The Arduino-based fingerprint door lock system typically consists of a fingerprint sensor, an Arduino board, a motor or solenoid to control the lock, and a power supply. The fingerprint sensor captures the user's fingerprint, which is then processed and compared with a database of authorized users' fingerprints stored in the Arduino's memory. If the user's fingerprint matches an authorized fingerprint, the lock mechanism is activated, allowing the user to enter. One advantage of using an Arduino-based system is that it is relatively low-cost compared to commercial fingerprint door locks. Additionally, the system can be easily customized to meet specific security needs, such as restricting access to certain individuals or time periods.

However, the Arduino-based fingerprint door lock system also has some limitations. For example, it may not be as secure as a commercial system due to the potential for hackers to exploit vulnerabilities in the system's programming. Additionally, the system may require some technical knowledge to set up and maintain.

Overall, the Arduino-based fingerprint door lock system is a reliable and convenient security solution that can be customized to meet specific security needs. With proper implementation and maintenance, it can provide a high level of security for homes and businesses.

# BACKGROUND

The first fingerprint door lock systems were developed in the 1990s and early 2000s and were primarily used in high-security applications such as government and military installations. However, with the advent of more affordable and reliable fingerprint recognition technology, fingerprint door lock systems have become increasingly popular in commercial and residential applications, as they provide a convenient and secure alternative to traditional key-based access control systems.

Today's fingerprint door lock systems typically use capacitive sensors to scan the unique features of an individual's fingerprint, such as the ridges and valleys, and compare them to a database of pre-registered fingerprints. If the scanned fingerprint matches an authorized user, the door lock is unlocked, providing secure and convenient access control without the need for keys or keycards. Some systems also incorporate additional features such as PIN codes, proximity sensors, and remote access control, to provide enhanced security and convenience.

# HARDWARE REQUIRED

Types of components required-

a) Arduino UNO
b) Fingerprint scanner
c) Servo motor
d) Jumper wires
e) Power supply(charger)
f) Wooden block

## a) Arduino UNO-

**FIG 1.1 ARDUINO UNO**

The Arduino-Uno is a microcontroller board based on the ATmega328 (datasheet). It has14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it toa computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USBto-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2)programmed as a USB-to-serial converter.

## b) Fingerprint scanner-

**FIG 1.2 FINGERPRINT SENSOR**

- A fingerprint scanner is a biometric device that captures and analyzes the unique patterns of a person's fingerprints to verify their identity. It is commonly used in access control systems, such as in fingerprint door locks, as well as in mobile devices and other applications.
- A fingerprint scanner works by capturing an image of the fingerprint and converting it into a digital template. This template is then compared to a database of authorized fingerprints to determine if there is a match. The scanner can detect and measure various characteristics of the fingerprint, such as the ridges, valleys, and minutiae points, to create a unique identifier for each person.
- Fingerprint scanners can be of different types, such as optical, capacitive, or ultrasonic. Optical scanners use light to capture the image of the fingerprint, while capacitive scanners use electrical currents to detect the fingerprint's ridges and valleys. Ultrasonic scanners use high-frequency sound waves to create a 3D image of the fingerprint.
- Fingerprint scanners are highly secure and reliable, as each person's fingerprints are unique and difficult to replicate. They offer fast and convenient access control, without the need for keys or passwords. However, they can be affected by factors such as dirt, moisture, and injuries to the fingers, which can affect the accuracy of the reading

## C.) SERVO MOTOR:


**FIG 1.3 SERVO MOTOR**

- A servo motor is a type of rotary actuator that can rotate to a specific angle or position based on the input signal it receives. It is commonly used in various applications such as robotics, industrial automation, and control systems.
- •A servo motor consists of a motor, a feedback device, and a control circuit. The motor is typically a DC motor or a brushless DC motor, and the feedback device is usually a potentiometer or an encoder. The control circuit receives a signal from the input device, such as a microcontroller or a sensor, and uses the feedback signal to control the rotation of the motor to a precise position.
- Servo motors are available in various sizes and torque ratings, depending on the specific application. They can rotate continuously or in a limited range of motion, depending on the type of servo motor. Some servo motors can rotate up to 360 degrees, while others are designed for limited rotation, such as 180 degrees or 90 degrees. Servo motors offer high precision and accuracy in controlling the position and speed of the motor shaft. They can also provide high torque output and fast response times, making them suitable for applications that require high performance and reliability. Overall, servo motors are versatile and widely used in many different industries and applications, and offer a reliable and precise solution for controlling the rotation of a shaft.

**FIG 1.4 JUMPER WIRE**

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

Though jumper wires come in a variety of colours, the colours don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colours can be used to your advantage in order to differentiate between types of connections, such as ground or power.

## SOFTWARE REQUIRED

a) **Arduino ide-**


## 1.2 Arduino ide

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systemssuch as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuine and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

# SPECIFICATIONS AND FEATURES

Fingerprint door lock systems, also known as biometric door locks, use an individual's unique fingerprint as a means of authentication to unlock doors. These systems provide enhanced security and convenience compared to traditional lock and key mechanisms. Here are some common features and specifications you can expect from a fingerprint door lock system:

Fingerprint Recognition: Fingerprint door locks utilize advanced fingerprint scanning technology to identify and authenticate individuals based on their unique fingerprint patterns. They typically employ capacitive or optical sensors to capture high-resolution images of fingerprints.

Multiple User Support: Most fingerprint door locks can store and recognize multiple fingerprints, allowing access for multiple users such as family members, employees, or authorized individuals.

Access Methods: In addition to fingerprint recognition, many systems offer alternative access methods for added flexibility. These may include keypad entry, proximity cards, RFID (Radio Frequency Identification) cards, or smartphone connectivity through Bluetooth or Wi-Fi.

# CHAPTER 2
# LITERATURE SURVEY

# LITERATURE SURVEY

Fingerprint door lock systems using Arduino have become increasingly popular in recent years due to their convenience, accuracy, and security. This literature survey aims to review the existing research on fingerprint door lock systems using Arduino Uno and to identify the current state-of-the-art in this field. This survey will cover the development of fingerprint door lock systems, Arduino Uno board's capabilities, and various fingerprint sensors used with the system. Finally, we will identify challenges and opportunities in this field for future research.

Development of Fingerprint Door Lock Systems: In the early days of fingerprint door lock systems, traditional locking mechanisms were manually operated by a key. However, as technology developed, electronic locks were introduced, which allowed access through the use of a password or a card. Later, fingerprint-based locks were developed, and these locks proved to be more reliable and secure than other forms of access control.

Arduino Uno Board's Capabilities: Arduino Uno board is an open-source hardware and software platform that is used to control the locking mechanism and fingerprint sensor in a fingerprint door lock system. It has a microcontroller that can be programmed to perform various tasks. It also has several digital and analogue input/output pins that can be used to connect various components, such as sensors, motors, and LEDs. Arduino Uno board's flexibility and versatility make it an ideal platform for creating complex electronic systems.

**Fingerprint Sensors:** The fingerprint sensor is a crucial component of the fingerprint door lock system. There are several types of fingerprint sensors available, such as optical, capacitive, and ultrasonic sensors. Optical sensors use light to capture the fingerprint's image, while capacitive sensors measure the capacitance of the skin's ridges and valleys. Ultrasonic sensors use high-frequency sound waves to capture the fingerprint's image.

Optical sensors are the most commonly used sensors in fingerprint door lock systems. They are reliable, accurate, and relatively inexpensive. Capacitive sensors are also popular and provide a high level of accuracy. Ultrasonic sensors are relatively new and offer some advantages over other types of sensors, such as the ability to capture fingerprints even when the user's hands are wet or dirty.

**Challenges:** One of the major challenges in developing a fingerprint door lock system using Arduino Uno is the system's vulnerability to hacking or other security breaches. The system's programming is crucial, and any errors or vulnerabilities in the code can compromise the system's security.

Additionally, environmental factors, such as temperature and humidity, can affect the accuracy and reliability of the fingerprint sensor.

Another challenge is the cost of the system. Although the Arduino Uno board is relatively inexpensive, the cost of other components, such as the fingerprint sensor and motor or solenoid used to control the lock, can be high. Finally, the system may not be user-friendly for individuals who are not familiar with the Arduino platform, as it requires technical knowledge to set up and maintain.

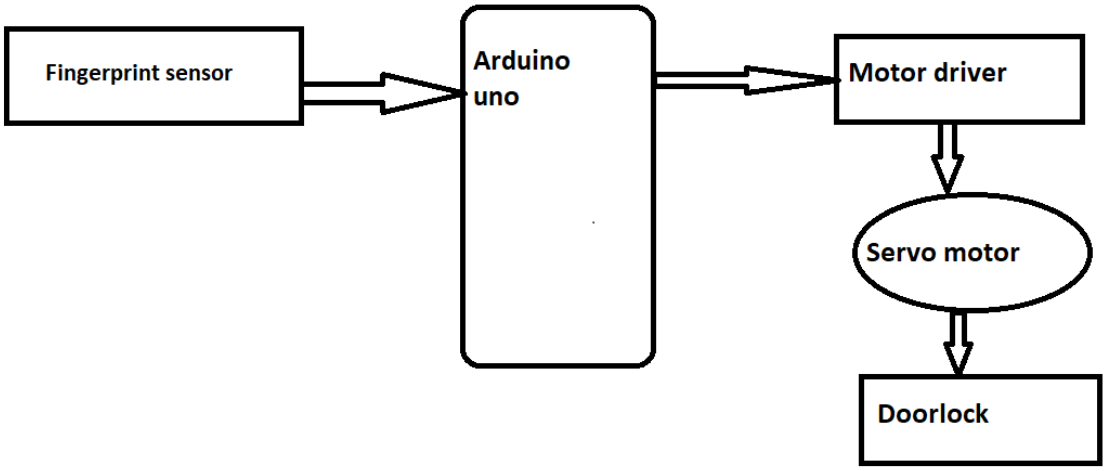
**Opportunities:** Despite these challenges, there are several opportunities for future research in this field. For example, researchers can explore new methods for improving the system's security, such as using machine learning algorithms to detect and prevent hacking attempts. Additionally, researchers can develop new fingerprint sensors that offer higher accuracy and reliability in various environmental conditions.

Another opportunity is to develop a user-friendly interface that does not require technical knowledge to operate. This can be achieved by developing a smartphone app that can be used to control the lock or by integrating the lock with other smart home systems, such as Amazon Alexa or Google Home.

**Conclusion:** In conclusion, fingerprint door lock systems using Arduino Uno board are an innovative and secure solution for access control. However, there are still several challenges that need to be addressed, such

# CHAPTER 3
# DESIGN AND DEVELOPMENT

## Block diagram and a brief explanation




### 3.1 Block Diagram of Finger Print Door Lock

The fingerprint sensor captures an image of the user's fingerprint and converts it into a digital signal that is processed by the microcontroller. The microcontroller compares the captured fingerprint against a database of authorized fingerprints to determine if the user is allowed access. If the fingerprint matches an authorized fingerprint, the microcontroller sends a signal to the lock controller to unlock the door.

The lock controller is responsible for controlling the lock mechanism, which can be an electric strike, an electromagnetic lock, or a deadbolt. The lock controller receives the signal from the microcontroller and releases the lock to allow the user to enter. If the fingerprint does not match an authorized fingerprint, the lock remains locked and access is denied

# ALGORITHM

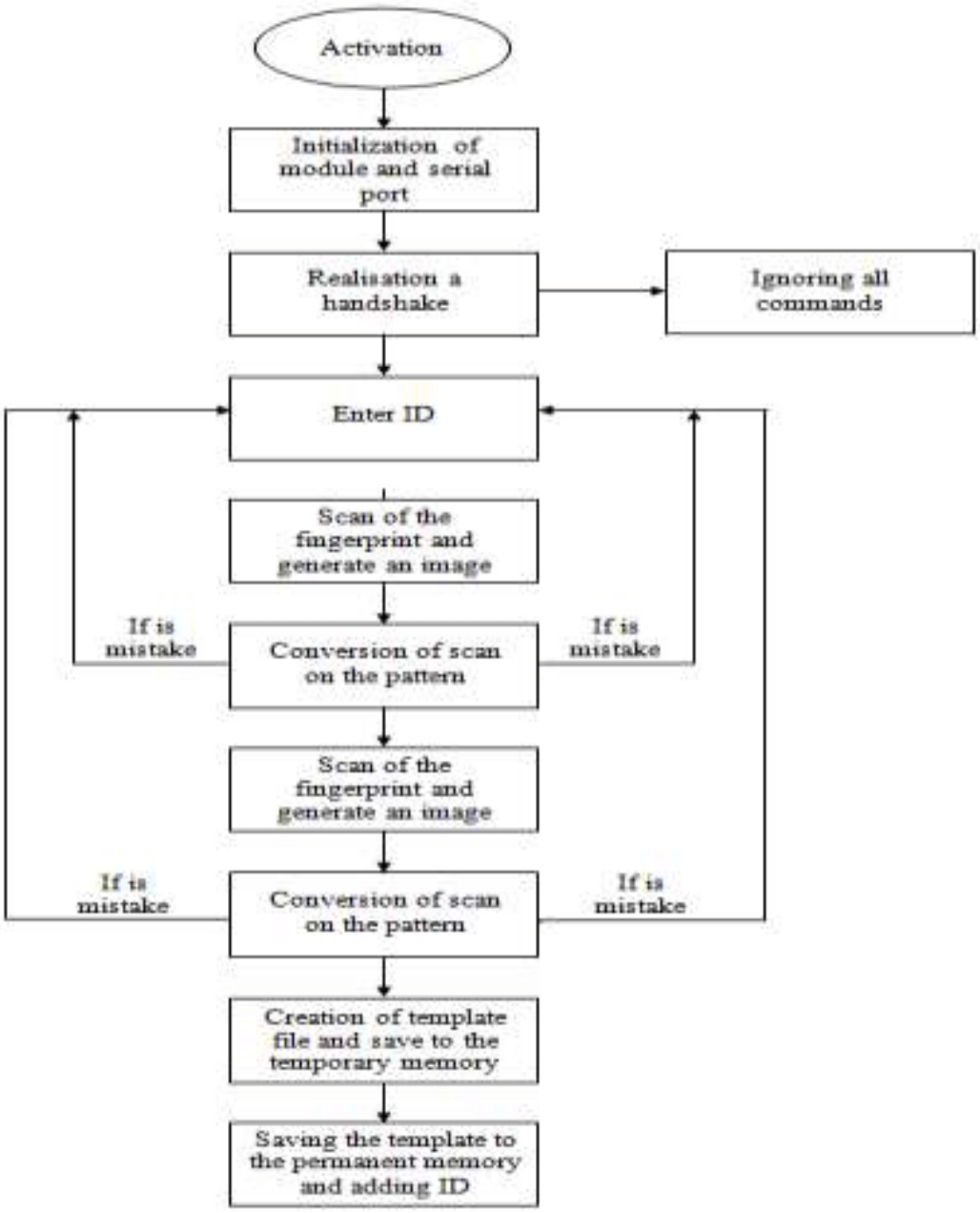
```
#include <Adafruit_Fingerprint.h>
#include <SoftwareSerial.h>
#include <Servo.h> //Add servo library
int getFingerprintIDez();
Servo servo1; //Define servo name / object
#define servoPin 9 //Define pin number to which servo motor is connected
#define durationTime 3000 //Define the time it remains in the open position of the door
lock (miliseconds)
#define servoMin 0 //Open position
#define servoMax 90 // Closed position
SoftwareSerial mySerial(2, 3);
Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);
void setup()
{
while (!Serial); // For Yun/Leo/Micro/Zero/...
Serial.begin(9600);
Serial.println("Adafruit finger detect test");
servo1.attach(servoPin); //Define pin number of the servo
servo1.write(servoMax); //The position of the servo at the start of the program
// set the data rate for the sensor serial port
finger.begin(57600);
if (finger.verifyPassword()) {
Serial.println("Found fingerprint sensor!");
} else {
Serial.println("Did not find fingerprint sensor :(");
while (1);
}
Serial.println("Waiting for valid finger...");
}
void loop() // run over and over again


{
getFingerprintIDez();
delay(50); //don't ned to run this at full speed.
}
uint8_t getFingerprintID() {
uint8_t p = finger.getImage();
switch (p) {
```

```
case FINGERPRINT_OK:
Serial.println("Image taken");
break;
case FINGERPRINT_NOFINGER:
Serial.println("No finger detected");
return p;
case FINGERPRINT_PACKETRECIEVEERR:
Serial.println("Communication error");
return p;
case FINGERPRINT_IMAGEFAIL:
Serial.println("Imaging error");
return p;
default:
Serial.println("Unknown error");
return p;
}
// OK success!
p = finger.image2Tz();
switch (p) {
case FINGERPRINT_OK:
Serial.println("Image converted");
break;
case FINGERPRINT_IMAGEMESS:
Serial.println("Image too messy");
return p;
case FINGERPRINT_PACKETRECIEVEERR:
Serial.println("Communication error");
return p;
case FINGERPRINT_FEATUREFAIL:
Serial.println("Could not find fingerprint features");
return p;
case FINGERPRINT_INVALIDIMAGE:
Serial.println("Could not find fingerprint features");
return p;
default:
Serial.println("Unknown error");
return p;
}// OK converted!
p = finger.fingerFastSearch();
if (p == FINGERPRINT_OK) {
Serial.println("Found a print match!");
} else if (p == FINGERPRINT_PACKETRECIEVEERR) {
Serial.println("Communication error");
return p;
} else if (p == FINGERPRINT_NOTFOUND) {
Serial.println("Did not find a match");
return p;
```

```
} else {
Serial.println("Unknown error");
return p;
}
// found a match!
Serial.print("Found ID #"); Serial.print(finger.fingerID);
Serial.print(" with confidence of "); Serial.println(finger.confidence);
}
// returns -1 if failed, otherwise returns ID #
int getFingerprintIDez() {
uint8_t p = finger.getImage();
if (p != FINGERPRINT_OK) return -1;
p = finger.image2Tz();
if (p != FINGERPRINT_OK) return -1;
p = finger.fingerFastSearch();
if (p != FINGERPRINT_OK) return -1;
servo1.write(servoMin); //If the fingerprint is correct open the door lock
delay(durationTime); //Keep the lock open for the defined duration
servo1.write(servoMax); //take the lock OFF again
// found a match!
Serial.print("Found ID #"); Serial.print(finger.fingerID);
Serial.print(" with confidence of "); Serial.println(finger.confidence);
return finger.fingerID
```

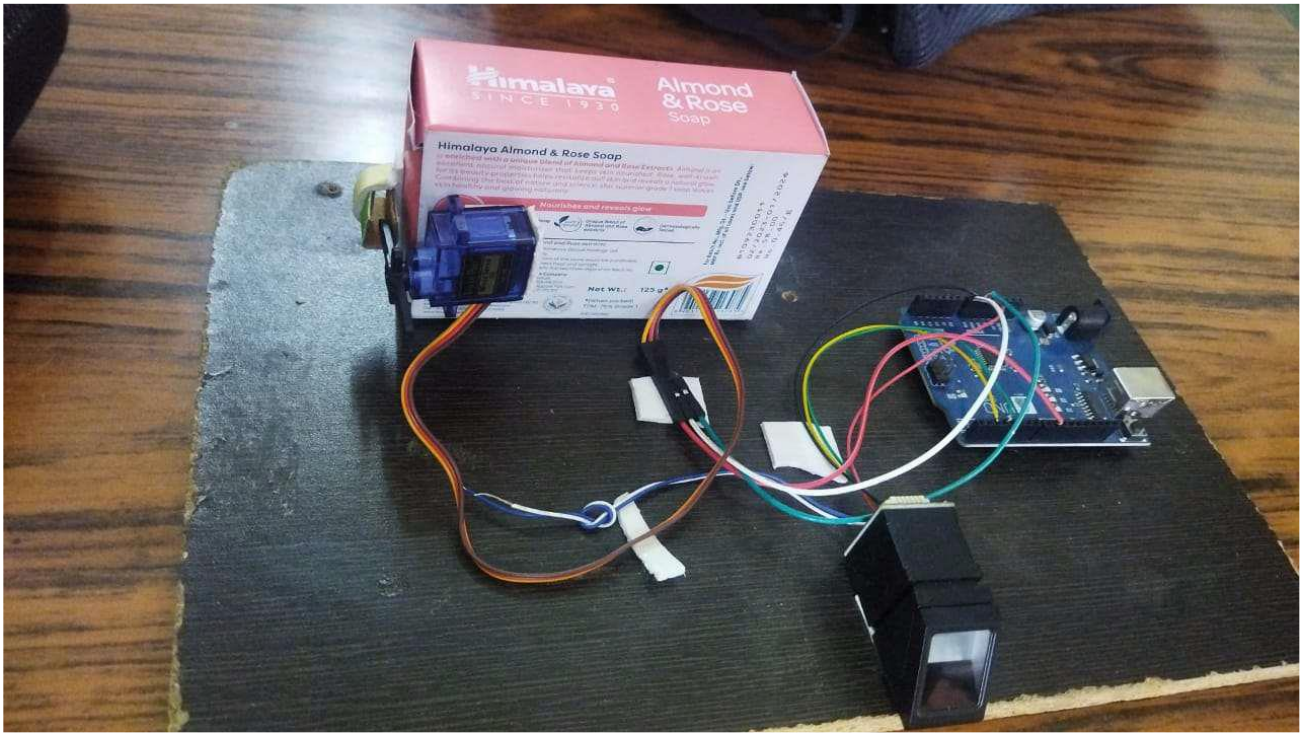
# FLOWCHART




**3.2 Flowchart**

# CHAPTER 4
# RESULT

# RESULTS




## 4.1 Result

# CHAPTER 5
# CONCLUSION

# ADVANTAGES

- There are several merits of using a fingerprint door lock system, including:

- **Enhanced Security:** A fingerprint door lock system offers advanced security features compared to traditional key and lock systems. It is nearly impossible to duplicate a fingerprint, making it an extremely secure and reliable method of authentication.
- **Convenience:** With a fingerprint door lock system, there is no need to carry keys or memorize passcodes. Simply scan your fingerprint and the door unlocks, providing quick and easy access.
- **Access Control:** Fingerprint door lock systems allow you to control who has access to your property. You can easily add or remove authorized users, and even set different access levels for different people, depending on their role or responsibility.
- **Audit Trail:** A fingerprint door lock system can also provide an audit trail of who accessed the door and when. This can be particularly useful in situations where security breaches need to be investigated.
- **Durability:** Fingerprint door lock systems are typically made of durable materials, such as stainless steel or reinforced plastic, that can withstand heavy use and extreme weather conditions.
- Overall, a fingerprint door lock system offers enhanced security, convenience, access control, audit trail, and durability. It is an excellent choice for anyone looking to upgrade their security system and provide easy and secure access to their property.

# APPLICATIONS

- **Home Security:** Can be used as a layer of protection in you're home to provide a sense of security.
- **Business Security:** Different types of business can be secured where precious things are being used. For Example Jewellery Stores
- **Hospital Security:** Can be used in hospitals to serve as an additional layer of security
- **Hotel Security:** It can also be used to provide security in hotels and only allowed authorized access to authorized people only**.**

# FUTURE SCOPE

- The future scope for fingerprint door lock systems is significant, as this technology is continually evolving and advancing. Here are some potential areas of growth and development:
- **Increased security:** Fingerprint door lock systems are already highly secure, but there is always room for improvement. In the future, we can expect even more sophisticated biometric authentication methods and algorithms to be developed, ensuring that only authorized users can gain access.
- **Integration with smart home technology**: As more homes become "smart," we can expect fingerprint door lock systems to integrate seamlessly with other smart home devices and systems, such as lighting, heating, and security cameras.
- **Mobile app integration:** Many modern fingerprint door lock systems can be controlled via mobile apps, but this functionality will likely become even more advanced in the future. For example, users may be able to remotely grant access to their homes to trusted visitors, or receive notifications when someone tries to gain unauthorized access.
- **Improved durability and longevity:** Fingerprint door lock systems are already durable and long-lasting, but as technology advances, we can expect them to become even more robust and reliable
- **Lower cost:** As with any technology, the cost of fingerprint door lock systems is likely to decrease over time, making them more accessible to a wider range of consumers.

# APPENDIX

# APPENDIX A

| COMPONET | PRICE |
|---|---|
| 1. ARDUINO UNO | 750/- |
| 2. FINGERPRINT SENSOR | 200/- |
| 3. SERVOMOTOR | 50/- |
| 4. JUMPER WIRES | 50/- |

# APPENDIX B

# Arduino® UNO R3

Product Reference Manual
SKU: A000066


## Description

The Arduino UNO R3 is the perfect board to get familiar with electronics and coding. This versatile microcontroller is equipped with the well-known ATmega328P and the ATMega 16U2 Processor.
This board will give you a great first experience within the world of Arduino.

## Target areas:

Maker, introduction, industries

## Features

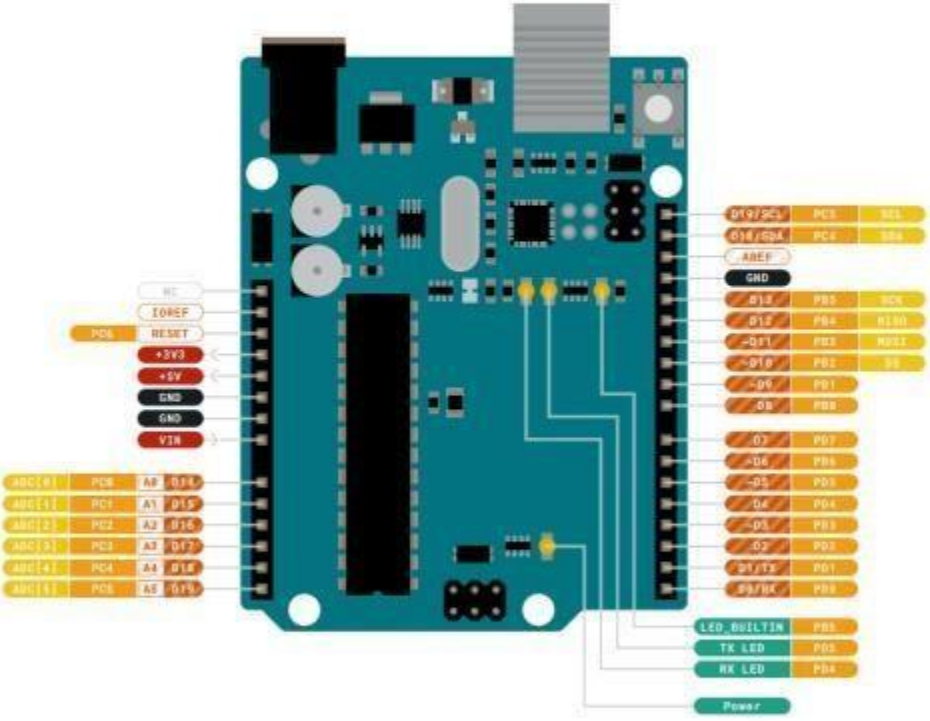
- **ATMega328P** Processor
  - **Memory**
    - AVR CPU at up to 16 MHz
    - 32KB Flash
    - 2KB SRAM
    - 1KB EEPROM
  - **Security**
    - Power On Reset (POR)
    - Brown Out Detection (BOD)
  - **Peripherals**
    - 2x 8-bit Timer/Counter with a dedicated period register and compare channels
    - 1x 16-bit Timer/Counter with a dedicated period register, input capture and compare channels
    - 1x USART with fractional baud rate generator and start-of-frame detection
    - 1x controller/peripheral Serial Peripheral Interface (SPI)
    - 1x Dual mode controller/peripheral I2C
    - 1x Analog Comparator (AC) with a scalable reference input
    - Watchdog Timer with separate on-chip oscillator
    - Six PWM channels
    - Interrupt and wake-up on pin change
  - **ATMega16U2 Processor**
    - 8-bit AVR® RISC-based microcontroller
  - **Memory**
    - 16 KB ISP Flash
    - 512B EEPROM
    - 512B SRAM
    - debugWIRE interface for on-chip debugging and programming
  - **Power**
    - 2.7-5.5 volts

# CONTENTS

### 4.6 Board Recovery

All Arduino boards have a built-in bootloader which allows flashing the board via USB. In case a sketch locks up the processor and the board is not reachable anymore via USB it is possible to enter bootloader mode by double-tapping the reset button right after power up.

## 5 Connector Pinouts




*Pinout*

# REFERENCE


- **Websites:**
- https://www.kisi.io/blog/fingerprint-door-locks - Kisi blog on fingerprint door locks.
- https://www.safety.com/fingerprint-door-locks/ - Safety.com article on fingerprint door locks.
- **Authors:**
- David Ludlow - TechRadar writer and reviewer of home security systems.
- Craig Lloyd - writer for How-to-Geek and author of articles on home security and smart home technology.
- Johnathan Walton - writer for Security Baron with a focus on home security technology and systems.