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JAIN INSTITUTE OF TECHNOLOGY

Davanagere-577003, KARNATAKA

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FINAL YEAR B.E. (2024 – 2025)

A Project Report

On

"FINGERPRINT ACTIVATED VEHICLE STARTING SYSTEM"

UNDER THE GUIDANCE OF

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CERTIFICATE

This is to certify that the Project work entitled **"Fingerprint Activated Vehicle Starting System"** carried out by **Ms. Akshatha H (4JD21EC004), Ms. Chandrika N S (4JD21EC012), Ms. Priya P H (4JD21EC034), Ms. Ruchitha C (4JD21EC040)** are bonafied students of **Bachelor of Engineering in Electronics and Communication** of the **Visvesvaraya Technological University, Belagavi** during the year 2024-2025.

It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the project report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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Although a single sentence hardly suffices, We would like to thank almighty God for blessing us with his grace and taking our endeavour to a successful culmination.

We express our gratitude to our guide **Mrs. Rajeshwari H M, Dept. of E&CE, JIT, Davanagere,** for her valuable guidance and continual encouragement and assistance throughout the project work**.** We greatly appreciate the freedom and collegial respect. We are grateful to her for discussions about the technical matters and suggestions concerned to our topic.

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DECLARATION

We, AKSHATHA H (4JD21EC004), CHANDRIKA N S (4JD21EC012), PRIYA P H (4JD21EC034) and RUCHITHA C (4JD21EC040) students of final year B.E in Electronics & Communication Engineering, Jain Institute of Technology, Davanagere hereby declare that the dissertation entitled **"FINGERPRINT ACTIVATED VEHICLE STARTING SYSTEM"** has been carried out in a batch and submitted in the partial fulfillment of the requirement for the award of Bachelor's Degree in Electronics & Communication Engineering under Visvesvaraya Technological University, Belagavi during the academic year **2024-2025**.

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Abstract

The fingerprint-based vehicle starter system presents an innovative approach to enhance automotive security and convenience. This system utilizes biometric authentication to enable vehicle ignition, replacing traditional key-based mechanisms. By integrating a fingerprint scanner with the vehicle's electronic control unit (ECU), the system ensures that only authorized users can start the vehicle, significantly reducing the risk of theft.

The design includes a high-precision fingerprint sensor that captures and processes the user's biometric data, which is then matched against a secure database of authorized fingerprints. In addition to providing robust security, the system can be augmented with features such as user profiles for personalized vehicle settings and remote access capabilities through mobile applications.

This abstract outlines the system's architecture, including hardware components, software algorithms, and user interface considerations. The fingerprint-based vehicle starter system not only enhances safety but also aligns with the growing trend of smart technology integration in the automotive industry, providing a seamless and efficient user experience. Future work will focus on improving the system's accuracy and response time, ensuring it meets the demands of modern vehicle operation.

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CHAPTER 1

INTRODUCTION

In the contemporary world, automobiles are a big part of daily life. It is fundamentally necessary for every family. The history of automobile started with the invention of wheel and has been advancing ever since. The automobile we know today evolved as a result of the development of the steam engine. In the past, vehicles were ignited by crank shaft mechanisms. Leaving that regular technique behind came in the idea of lighting the vehicles utilizing key. Push start buttons are taking the place of keys right now. The primary objective here is to eliminate the traditional use of keys for vehicle start-up. Since the introduction of biometrics in the 18th century, technological advancements in security have reached new heights. The Greek words "Bio" and "Metrics," where "Bio" means "life," and "Metrics" means "to measure," are what give rise to the field of biometrics.

Nowadays, there is a lot of emphasis placed on vehicle security because of the rise in vehicle thefts. Handling the keys to the automobiles is another problem. Keys must be carried, and losing or misplacing them will be a severe problem. This issue has a remedy that involves a fingerprint-authenticated vehicle starter system. Biometric-based security, is now being used by almost all automobile manufacturers. In comparison to other biometric sensors, fingerprint sensors are relatively inexpensive.

Fingerprint-Activated Vehicle Starting System is an advanced security technology designed to enhance the safety and convenience of vehicles. It replaces traditional keys or keyless fobs with biometric authentication, using the vehicle owner's fingerprint as a unique identifier to start the engine. This system leverages fingerprint recognition technology, which is highly secure as no two fingerprints are alike, ensuring that only authorized individuals can access and start the vehicle.

The technology typically involves a fingerprint scanner integrated into the car’s dashboard or ignition system. When the owner places their finger on the scanner, it quickly matches the fingerprint with the stored data and, if verified, allows the engine to start. This innovation reduces the risk of car theft, eliminates the need for physical keys, and simplifies vehicle access. It can also be paired with other smart features, such as personalized settings for seat positions, climate control, and entertainment systems based on the user's profile.

Fingerprint recognition technology allows access to only those whose fingerprints that are pre stored in the memory. Stored fingerprints are retained even in the event of complete power failure or battery drain. These eliminates the need for keeping track of keys or remembering a combination password, or PIN. It can only be opened when an authorized user is present, since there are no keys or combinations to be copied or stolen, or locks that can be picked. The fingerprint based lock therefore provides a wonderful solution to conventionally encountered inconveniences. This report focuses on the use of fingerprints to unlock locks, as opposed to the established method of using keys. In order to prevent unauthorized access to these devices, passwords and other pattern based authentication method are being used in recent time. However, password-based authentication has an intrinsic weakness in password leakage.

Biometric systems have overtime served as robust security mechanisms in various domains. Fingerprints are the oldest and most widely used form of biometric identification. A critical step in exploring its advantages is to adopt it for use as a form of security in already existing systems, such as vehicles.

In the 21st century, the uses of biometric based systems have seen an exponential growth. This is because of tremendous progress in this field making it possible to bring down their prices. Biometrics is becoming a new state of the art method for security systems. Biometrics are used to provide secured access to major functioning systems like ATM, cellular phones, cars, laptops, offices, and other things that need authorized access. Biometric have made significant changes in security systems making them more secure than before, efficient and cheap. The biometric fingerprint security system is widely used. Each person's finger is different so this is more secure.

The vehicle security is more important in these days. More vehicles are stolen and it cannot be found back. Security system like fingerprint system can reduce this theft, especially in cars. Fingerprint sensor and Arduino is combined together. The starting system of the vehicle is modified.

1.1 PROBLEM STATEMENT

As vehicle theft continues to rise, traditional key-based ignition systems are increasingly vulnerable to unauthorized access and security breaches. Many vehicle owners seek more secure and convenient alternatives to standard keys, which can be lost, stolen, or duplicated. Additionally, existing keyless entry systems may still be susceptible to relay attacks and hacking.

1.2 OBJECTIVES

- Durability and Maintenance: Design the fingerprint scanner and associated components to be durable and resistant to wear, with easy maintenance and the ability to update software as needed.
- Data Privacy and Security: Implement robust data encryption and storage methods to protect fingerprint data an user information, ensuring compliance with privacy regulations.
- Cost-Effectiveness: Strive for a cost-effective solution that provides value to both manufacturers and consumers, facilitating widespread adoption of the technology.
- Multi-User Support: Enable the system to accommodate multiple user profiles, allowing for shared vehicle access while maintaining individual security settings and preferences.
- User-Friendly Design: Create an intuitive user interface that allows for quick and seamless fingerprint scanning, ensuring a smooth and convenient experience for vehicle owners.

1.3 MOTIVATIONS

- Rising Vehicle Theft Rates**:** With car theft becoming increasingly prevalent, there is a pressing need for more secure methods of vehicle access that reduce the likelihood of unauthorized use.
- Consumer Demand for Convenience: Modern consumers prioritize convenience in their daily lives. A fingerprint-activated system offers a keyless experience, eliminating the hassle of searching for keys and providing instant access.
- Advancements in Biometric Technology**:** The rapid progress in biometric recognition technology makes it feasible to implement reliable and efficient fingerprint scanners in vehicles, enhancing both security and user experience.

CHAPTER 2

LITERATURE SURVEY

- "**Omidiora E.O**" mainly focuses on the replacement of keys with the biometric specially fingerprint based lock system in the vehicles because fingerprints are the oldest and most widely used form of biometric identification.[1]
- "**Jain A K and Ross A**" focused on the importance of security biometric data to prevent misuse from the paper "Biometric Recognition security and privacy concerns" published in 2008.[2]
- "**Khanna V**" mainly focused on how to implement fingerprint recognition to secure access to devices including vehicles from the paper "fingerprint based security system" published in the year 2015.[3]
- "**Roy P, Das S and Mitra P**" improving sensor design and enhancing system robustness by the paper "Real world challenges in fingerprint based authentication system" published in 2019.[4]
- "**AjinkyaKawale"** mainly focused on Fingerprint based locking system by the paper "International Journal of scientific & Engineering Research" published in the year 2013.[5]
- "**Arpit Agarwal and Ashish Patidar"** mainly focused on the smart authentication for smart phones from the paper International Journal of computer science and Information Technologies in the year 2014.[6]
- "**Prashanthkumar R, Sagar V.C., Santhosh S, SiddharthNambiar"** mainly focused on the two wheeler vehicle security system by the paper "International Journal of Engineering science and Engineering Technologies" published in the year 2013.[7]
- "**Mudholkar"** mainly focused on the Biometric authentication technique for intrusion detection system using fingerprint recognition by the paper "International Journal of Computer science, Engineering and Information Technology (IJCSEIT) published in the year 2012.[8]
- **"Karthikeyan.A & Sowndharya.J"** mainly focused on the Fingerprint Based Ignition System by the paper "International Journal of Computational Engineering research" published in the year 2012.[9]

CHAPTER 3

METHODOLOGY

The Arduino UNO acts as the brain of the system, processing data and managing operations. Relay Module Controls the vehicle's ignition system, only activating if the fingerprint is authenticated Relay Module Controls the vehicle's ignition system, only activating if the fingerprint is authenticated Power Supply a stable energy source supports the entire system. Integration of the system integrates hardware components and software (Arduino IDE) to enable a smooth, automated ignition process.

Authentication of the fingerprint scanner communicates with the microcontroller to verify identities, preventing unauthorized access.

3.1 BLOCK DIAGRAM

In the design of this fingerprint based vehicle starting system, signals are generated by the Arduino to appropriate module circuit. The whole system is aimed to be constructed in a plastic casing to enhance heat evacuation and working efficiency of the system. The Arduino reads the state of the input buttons which could be either a 1 or a 0. The signal Arduino gets from the input button tells what to work on at that time. This project is aimed to replace the push-button in vehicle ignition and create a more reliable and secured way of starting the ignition with fingerprint pattern only.

The Arduino environment has been designed to be easy to use for beginners who have no software or electronics experience. With Arduino, you can build objects that can respond to and/or control light, sound, touch, and movement. Arduino has been used to create an amazing variety of things, including musical instruments, robots, light sculptures, games, interactive furniture, and even interactive clothing. Arduino is used in many educational programs around the world, particularly by designers and artists who want to easily create prototypes but do not need a deep understanding of the technical details behind their creations.

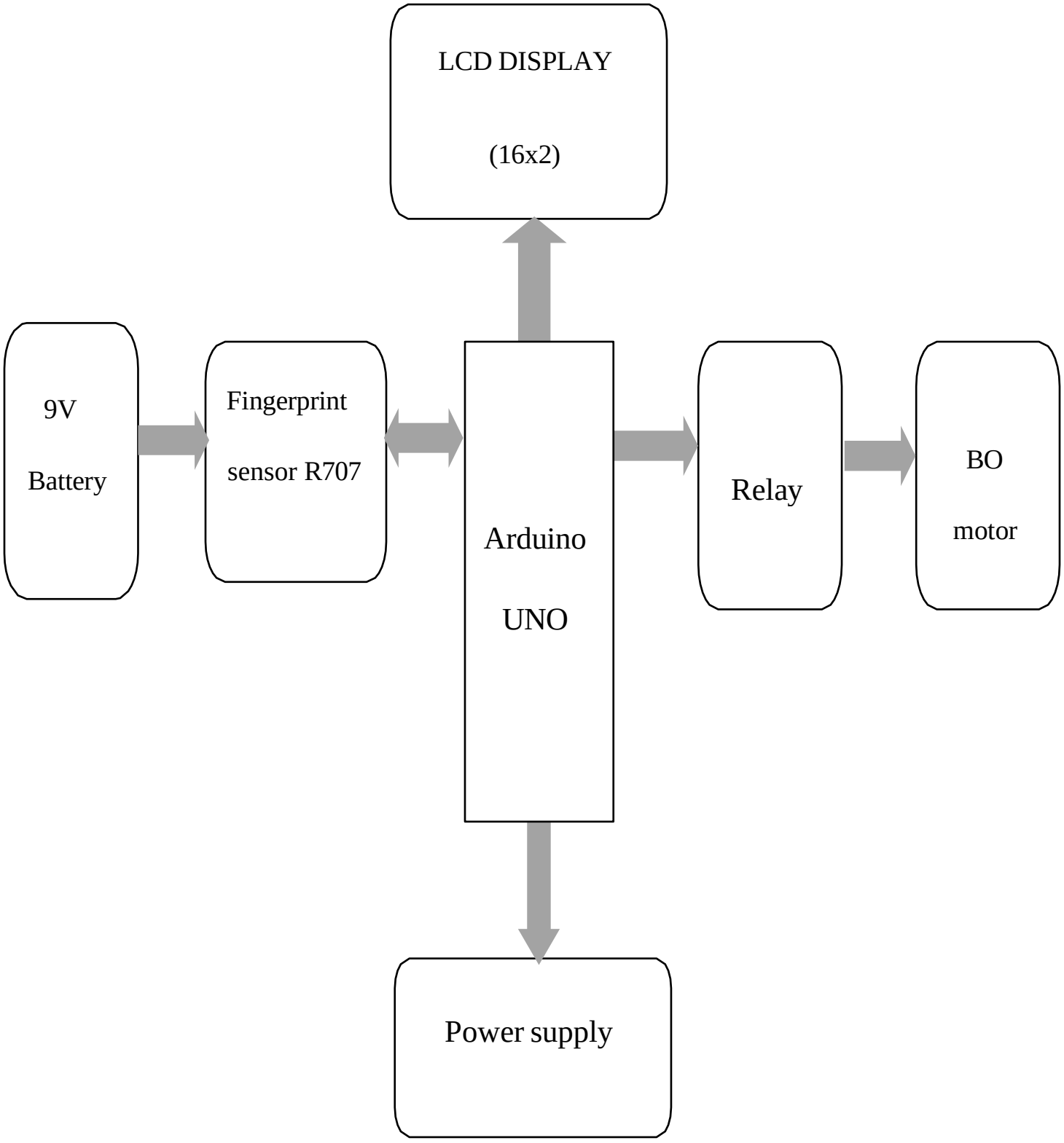

Figure 3.1 Block diagram of Fingerprint activated vehicle starting system

Fingerprint Scanner: Captures the fingerprint of the user.

Microcontroller/Processor: Processes the fingerprint data and manages system operations.

Data from the fingerprint scanner, Control signals to other components.

Authentication Module: Compares scanned fingerprint data against the database. Access granted or denied signal.

User Interface: Displays messages (e.g., "Access Granted," "Access Denied").

Control signals from the microcontroller.

Relay: Activates the vehicle's starting mechanism (e.g., ignition).

Power Supply: Provides power to the entire system. Power to all components.

Integration of the system integrates hardware components and software (Arduino IDE) to enable a smooth, automated ignition process.

Authentication of the fingerprint scanner communicates with the microcontroller to verify identities, preventing unauthorized access.

CHAPTER 4

HARDWARE AND SOFTWARE REQUIREMENTS

4.1 HARDWARE REQUIREMENTS

- Arduino UNO Board,
- 16X2 LCD Screen,
- I2C Module,
- BO motors,
- Relay,
- Fingerprint scanner module R307,
- 9V Radio battery.

4.1.1 Arduino UNO Board:

The Arduino UNO is a standard board of Arduino. Here UNO means ‘one’ in Italian. It was named as UNO to label the first release of Arduino Software. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

Microcontroller type: ATmega328

Operating Voltage of Arduino: 5V

Supply Voltage for the board: 7-12V

Maximum supply voltage (not rec): 20V

Digital I/O Pin11: 14 (of which 6 provide PWM output)

Analog Input Pins: 6

DC Current per I/O Pin: 40 mA

DC Current for 3.3V Pin in board: 50 mA

Flash Memory of microcontroller: 32

KBSRAM: 2

KBEEPROM of Arduino UNO: 1 KB

Clock Speed of Arduino: 16 MHz

The fingerprints of only the authorised persons are enrolled for further verification into the microcontroller. The microcontroller controls the fingerprint sensor when an authorized person is scanned it allows the relay to contact and supply power to ignition system.

Free hardware are devices whose specifications and diagrams are publicly accessible, so anyone can replicate them. This means that Arduino offers the base so that any other person or company can create their own boards, being able to be different from each other but equally functional when starting from the same base.

Free software is a computer program whose code is accessible by anyone so that whoever wants to use can use and modify it. Arduino offers the Arduino IDE (Integrated Development Environment) platform, which is a programming environment with which anyone can create applications for Arduino boards, so that they can be given all kinds of utilities

The Arduino microcontroller has communication ports and input / output ports. with which we can connect different types of peripherals on the board. The information of these peripherals that you connect will be transferred to the microcontroller, which will be in charge of processing the data that comes through them.

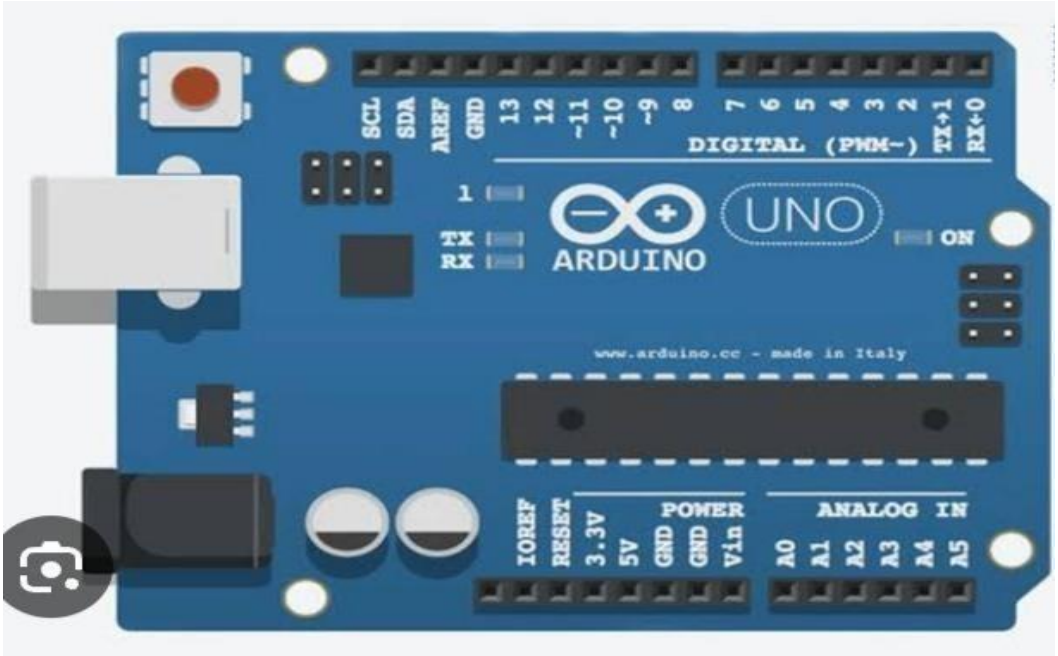

Figure 4.1 Arduino UNO Board

4.1.2 16x2 LCD Screen:

A 16x2 LCD (Liquid Crystal Display) is a widely used alphanumeric display module that can display 16 characters per row on two rows, hence the name "16x2." These displays are commonly used in embedded systems, microcontroller projects, and other electronics projects because of their simplicity and ease of interfacing.

Display: 16 characters per line, 2 lines.

Character size: Each character is usually 5x8 dots.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. .A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

Controller: Most 16x2 LCD modules are based on the HD44780 controller.

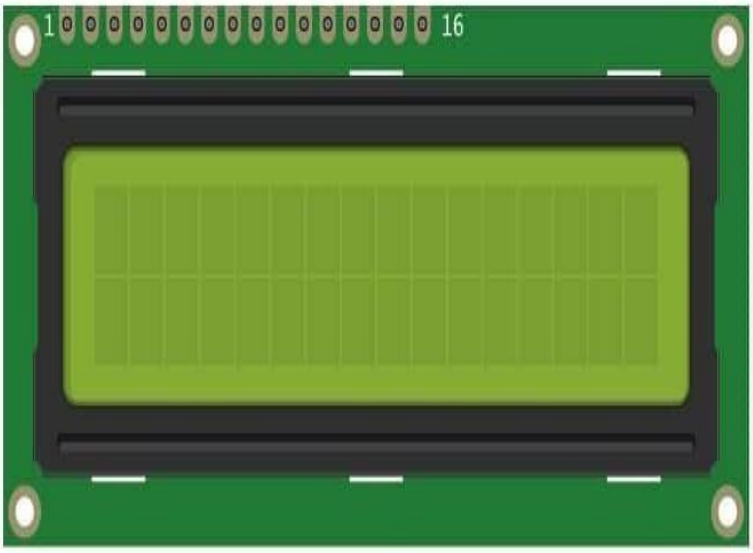

Figure 4.2 16x2 LCD Screen

4.1.3 I2C module:

I²C (Inter-Integrated Circuit) is a synchronous, multi-master, multi-slave serial communication protocol used to connect low-speed peripherals to a microcontroller or microprocessor. It was developed by Philips Semiconductor (now NXP) in the 1980s .

The I2C protocol involves using two lines to send and receive data: a serial clock pin **(SCL)** that the Arduino Controller board pulses at a regular interval, and a serial data pin **(SDA)** over which data is sent between the two devices. Both lines are open-drain and require pull-up resistors.

In I2C, there is one controller device, with one or more peripheral devices connected to the controllers SCL and SDA lines.

As the clock line changes from low to high (known as the rising edge of the clock pulse), a single bit of information is transferred from the board to the I2C device over the SDA line. As the clock line keeps pulsing, more and more bits are sent until a sequence of a 7 or 8 bit address, and a command or data is formed.

Key features and specifications of I2C modules include:

- Operating voltage: 5V DC
- I2C control using PCF8574
- Up to 8 modules can be connected on a single I2C bus
- I2C address range: 0x20 to 0x27 (default address is 0x20, adjustable via onboard jumper pins).
- Backlit display (blue with white characters)
- Size: 80x36x20mm

Some common speeds:

Standard mode: 100 kbps

Fast mode: 400 kbps

Fast mode plus: 1 Mbps

High-speed mode: 3.4 Mbps

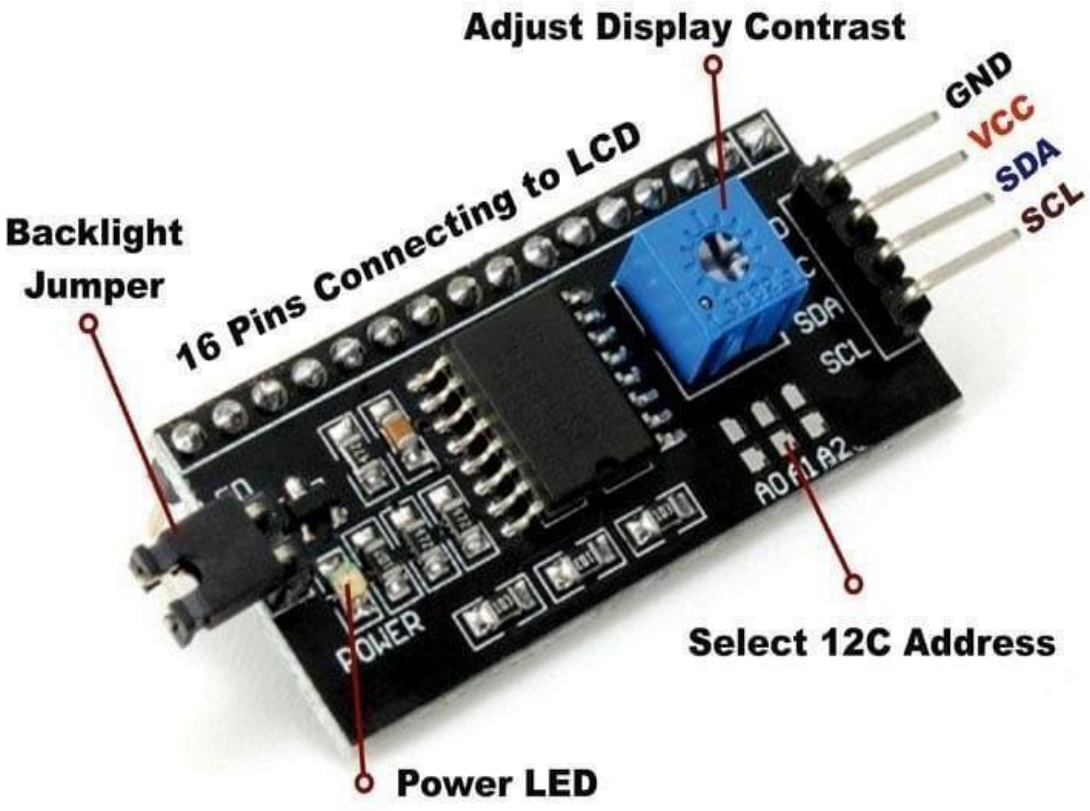

Figure 4.3 I2C module

4.1.4 BO motors:

A **BO motor** is a small, lightweight, and low-cost DC motor commonly used in robotics and hobby projects. The name "BO" stands for **Battery Operated** because these motors are designed to run on small batteries (like 3V to 12V), making them perfect for simple DIY applications

BO motors are a type of DC motor designed to provide high torque output commonly used in robotics and other electronics projects they are known for their efficiency and reliability, making them a popular choice for DIY enthusiasts and professionals like.

They are operated at a relatively low voltage typically between 3-12V DC and BO motors are designed to be compact and light weight, making them easy to integrate into various projects.

The BO Geared DC Motor is a type of electric motor that is commonly used in various applications such as robotics, automation, and hobby projects. The motor consists of a DC

(Direct Current) motor and a gearbox, which provides the motor with the ability to produce higher torque output than a regular DC motor. The gearbox is designed to reduce the speed of the motor while increasing its torque output. The BO Geared DC Motor typically has a metal gearbox with gears made of high-quality materials such as steel, brass, or bronze.

The BO Geared DC Motor is available in various sizes and power ratings, depending on the specific application requirements. They are often used in applications where precise speed control and high torque output are required, such as in robotics, automation, and machinery. These motors are usually controlled using a motor driver, which provides the necessary voltage and current to drive the motor. They can be controlled using various types of motor drivers such as H-bridge or PWM (Pulse Width Modulation) motor controllers

A BO motor can be measured with the unit called RPM. What's RPM? That's Revolution Per Minute. It indicates how many complete turns the shaft makes in one minute.

Higher the RPM = higher the speed but lower the torque

Lower the RPM = lower the speed but higher the torque

Figure 4.4 BO motor

4.1.5 Relay:

A relay is an electrically operated switch that uses an electromagnet to mechanically open or close circuits. It allows low-power control signals (like from a microcontroller) to switch high-power devices like motors, lights, or appliances. Relays are commonly used in automation, protection systems, and electronic control circuits. They come in various types, such as electromechanical relays and solid-state relays, and typically have normally open (NO) and normally closed (NC) contacts.

The relay module with a single channel board is used to manage high voltage, current loads like solenoid valves, motor, AC load & lamps. This module is mainly designed to interface through different microcontrollers like PIC, Arduino.

The features of the 5V relay include the following,

- Normal Voltage is 5V DC
- Normal Current is 70mA
- AC load current Max is 10A at 250VAC or 125V AC
- DC load current Max is 10A at 30V DC or 28V DC
- It includes 5-pins & designed with plastic material
- Operating time is 10msec
- Release time is 5msec
- Maximum switching is 300 operating per minute

Figure 4.5 Relay

4.1.6 Fingerprint sensor R307:

The R307 Fingerprint Sensor is an optical biometric sensor designed for secure access control systems and identification purposes. It uses optical technology to scan and capture fingerprints, which are stored in an internal database with a capacity of up to 1000 fingerprints. The sensor communicates via UART, making it easy to interface with microcontrollers like Arduino and Raspberry Pi. It supports fingerprint enrollment, matching, and deletion operations, and is powered by a 3.6V to 6V supply. The R307 is commonly used in applications such as biometric door locks, attendance systems, and other security-focused embedded systems due to its ease of use, fast response, and affordability.

A fingerprint sensor is an electronic device used to capture a digital image of the fingerprint pattern. The captured image is called a live scan. This live scan is digitally processed to create a biometric template which is stored and used for matching. Optical fingerprint imaging involves capturing digital image of the print using visible light. This type of sensor is, in essence, a specialized camera. The top layer of the sensor, where the finger is placed, is known as the touch surface. Beneath this layer is a light-emitting phosphor layer which illuminates the surface of the finger.

R307 Fingerprint Module consists of optical fingerprint sensor, high-speed DSP processor, high-performance fingerprint alignment algorithm, high-capacity FLASH chips and other hardware and software composition, stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.

FEATURES:

- Perfect function: independent fingerprint collection, fingerprint registration, fingerprint comparison (1: 1) and fingerprint search (1: N) function.
- Small size: small size, no external DSP chip algorithm, has been integrated, easy to install, less fault.
- Ultra-low power consumption: low power consumption of the product as a whole, suitable for low-power requirements of the occasion.
- Anti-static ability: a strong anti-static ability, anti-static index reached 15KV above.

- Application development is simple: developers can provide control instructions, self fingerprint application product development, without the need for professional knowledge of fingerprinting.
- Adjustable security level: suitable for different applications, security levels can be set by the user to adjust.
- Finger touch sensing signal output, low effective, sensing circuit standby current is very low, less than 5uA.

Figure 4.6 Fingerprint sensor R307

4.1.7 9V Radio Battery:

A 9V radio battery is a rectangular-shaped battery commonly used in small electronic devices like radios, smoke detectors, and remote controls. It typically has a voltage of 9 volts and consists of six 1.5V cells inside. These batteries are available in various chemistries, including alkaline, lithium, and rechargeable (NiMH) types. Alkaline 9V batteries are widely used for their long shelf life, while lithium versions offer a higher energy density. Rechargeable 9V batteries are environmentally friendly and can be recharged multiple times.

Industrial batteries translate chemical energy into electricity. They come in a variety of sizes and shapes to fit a wide range of applications. All batteries have positive and negative terminals, marked (+) and (-) respectively, and two corresponding electrodes. The electrodes must not touch each other. They are separated by the electrolyte, which facilitates the flow of electric charge between the electrodes. Finally, a collector conducts the charge to the battery's exterior and through the load.

When a battery is inserted into an electrical device, the device completes the circuit between the two terminals and triggers electrochemical reactions within the battery.

Figure 4.7 9V battery

4.2 SOFTWARE REQUIREMENTS

ARDUINO IDE 2.3.2

Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules.

It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.

It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code

This version in addition to a more modern editor and a more responsive interface it features auto completion, code navigation, and even a live debugger.

The Arduino Software (IDE) makes it easy to write code and upload it to the board offline. We recommend it for users with poor or no internet connection. This software can be used with any Arduino board.

There are currently two versions of the Arduino IDE, one is the IDE 1.x.x and the other is IDE 2.x. The IDE 2.x is new major release that is faster and even more powerful than the IDE 1.x.x. and it includes advanced features to help users with their coding and debugging.

The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.

Key Features of Arduino IDE:

Code Editor: The Arduino IDE provides a simple text editor where you can write your code in C/C++. It includes basic syntax highlighting and auto-indentation to make coding easier.

Compilation: The IDE compiles your code into machine-readable format (binary code) that can be uploaded to the Arduino board.

Libraries: Arduino IDE supports a wide range of libraries that make it easy to extend the functionality of the microcontroller, such as adding support for sensors, motors, displays, etc.

Serial Monitor: The IDE includes a serial monitor for communication between your Arduino and your computer. This is particularly useful for debugging and sending/receiving data from the Arduino.

Cross-Platform: The Arduino IDE is available on Windows, macOS, and Linux, allowing it to work across different operating systems.

Board Manager: It supports a variety of Arduino boards and allows easy installation of new board definitions through the Board Manager.

Sketches: In Arduino terminology, programs are called sketches. The IDE lets you write, save, and organize sketches easily.

Upload to Board: The IDE allows you to upload your code to an Arduino board via a USB cable or over a network (with compatible boards).

Figure 4.8 Arduino IDE

CHAPTER 5

WORKING AND IMPLEMNTATION

WORKING

1.Fingerprint Sensor:

A fingerprint scanner captures the fingerprint of the user. These scanners typically use optical, capacitive, or ultrasonic technology to read the unique ridges and patterns on a finger.

2. Microcontroller/Processor:

The fingerprint data is sent to a microcontroller or processor, which compares it with the fingerprints stored in its memory. If the fingerprint matches, the system proceeds.

3. Authentication:

If the fingerprint matches an authorized one, the system sends a signal to activate the ignition system of the vehicle. If there’s no match, the vehicle remains locked.

4. Ignition Control:

The microcontroller communicates with the vehicle's ignition system to either allow or restrict engine startup.

5. Integration with Other Systems:

This system can be integrated with a car's central locking, alarm, and immobilizer systems for added security.

IMPLEMENTATION

1. Components Required:

Fingerprint scanner module (e.g., R305, GT-521F32).

Microcontroller (e.g., Arduino, Raspberry Pi).

Relay module to control the ignition circuit.

Power supply for the system.

Wiring and connectors.

2. Circuit Design:

The fingerprint scanner is connected to the microcontroller, which processes fingerprint data. The microcontroller is also linked to a relay module that controls the vehicle's ignition circuit. A stable power supply ensures reliable operation.

3. Software Programming:

The microcontroller is programmed to perform fingerprint enrollment, storage, and verification. Libraries such as Adafruit_Fingerprint for Arduino can be used to interface with the fingerprint module. The program checks fingerprints against the stored database and activates the relay to start the vehicle when an authorized fingerprint is detected.

4. Integration with Vehicle:

The relay module is connected to the vehicle's ignition system. When a valid fingerprint is detected, the relay closes the circuit, enabling the engine to start.

5. Additional Features:

Optional features like a backup passcode, GSM/GPS modules for tracking, and retry limits for failed attempts can be integrated to enhance functionality and security.

CHAPTER 6

RESULT

The result which we expect from our project is that the vehicle will be initiated only by the authorized person scans his/her finger on the finger print module then the vehicle gets started. If any other person put finger on the module, the data provides the unauthorized person and vehicle will not start it displays unauthorized person. Here the design of the hardware components are done and processed by the Arduino UNO. The software implementation is done by Arduino IDE tool.

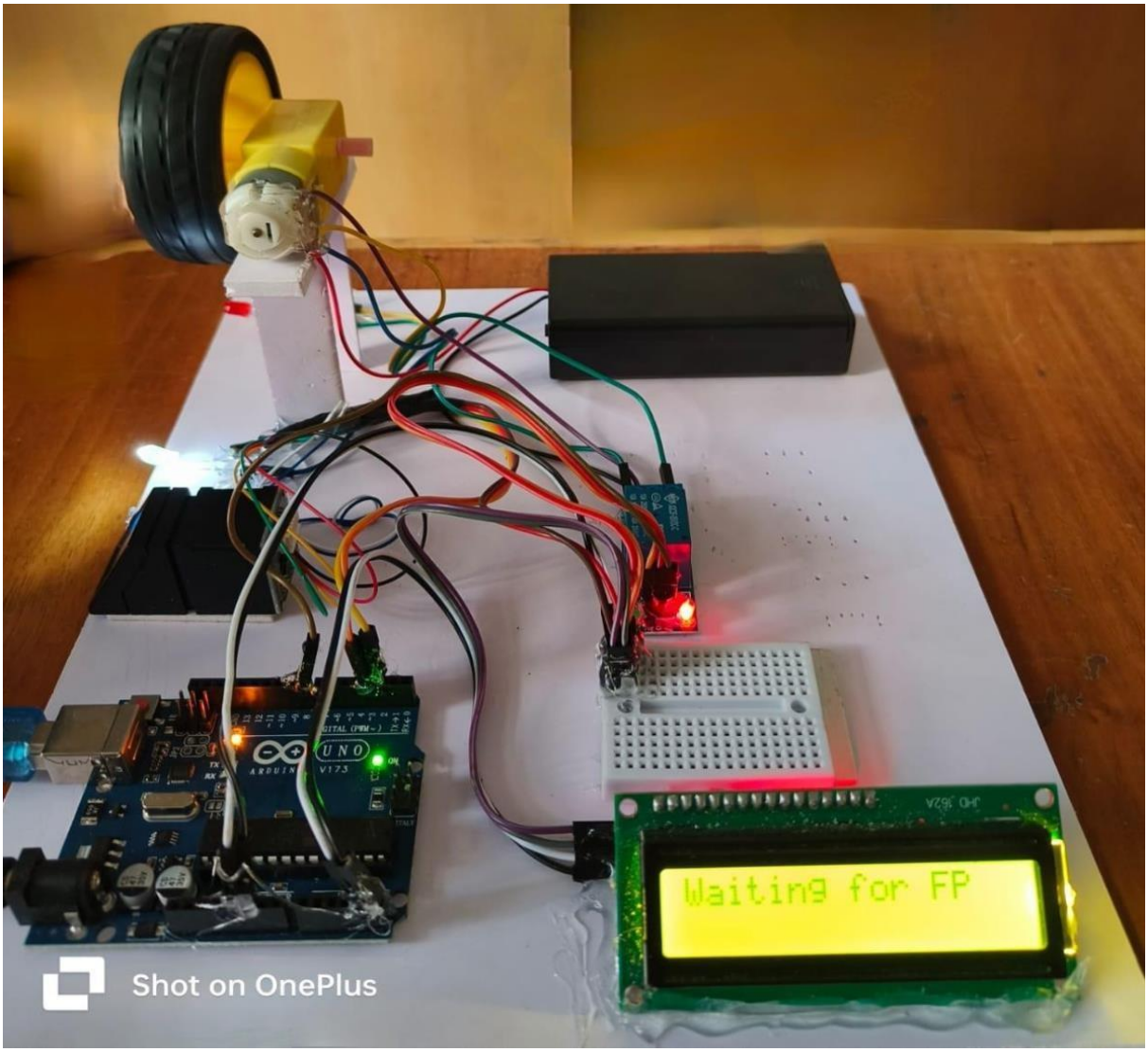

Figure 5.1: Harware model of the project

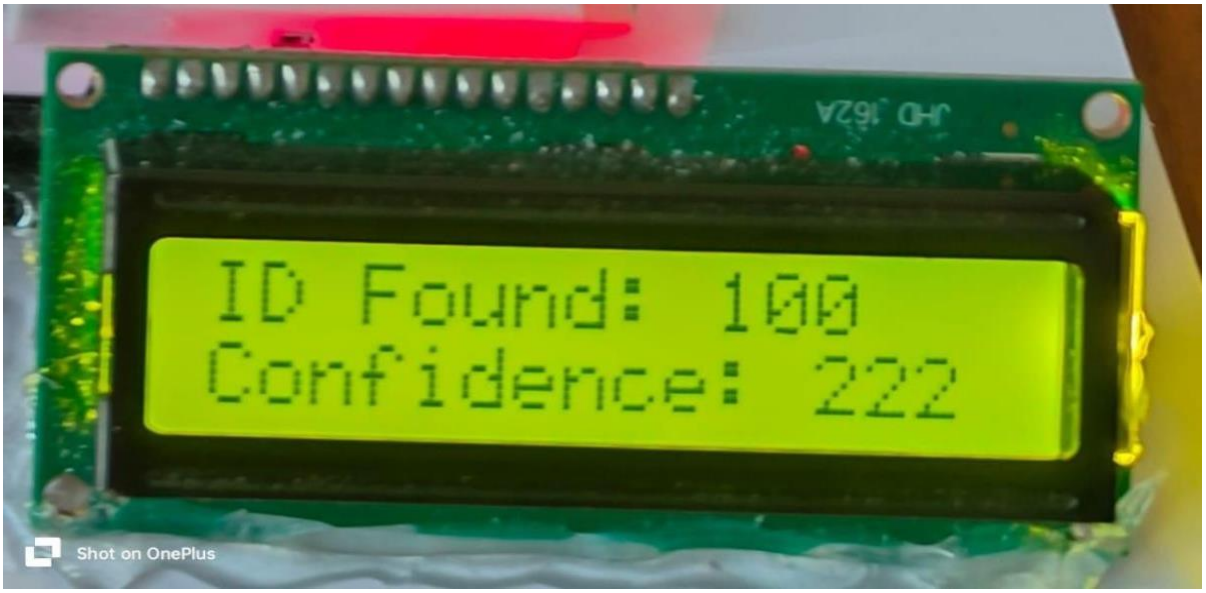

Figure 5.2: LCD Displaying ID number

CHAPTER 7

ADVANTAGES, DISADVANTAGES & APPLICATIONS

5.1 ADVANTAGES:

1. **Elimination of key duplications**: In a traditional vehicle ignition system, physical keys can be copied or duplicated, potentially allowing unauthorized access to the vehicle. By using a fingerprint-activated starting system, this issue is eliminated.
2. **Personalization**: A fingerprint-activated system offers the possibility of personalization for each user. The system can recognize different fingerprints and adjust settings according to the individual's preferences, such as seat positioning, mirror adjustments, music preferences, or climate control.
3. **User-Friendly**: The fingerprint activation system is user-friendly because it eliminates the need for physical keys, fobs, or remembering complex codes. Simply scanning a fingerprint is a quick and intuitive process.
4. **Convenience**: Fingerprint-based starting systems offer high convenience, as users no longer need to carry keys or fobs.
5. **Quick Access**: Fingerprint scanning is a fast process, allowing for quick access to the vehicle. The system usually takes just a few seconds to verify the fingerprint and initiate the engine start.
6. **Durability**: The fingerprint system is more durable than traditional keys or key fobs, which can wear out or be easily damaged.
7. **Backup system**: The backup could include a secondary authentication method like a PIN code, an emergency key, or a remote fob.

5.2 DISADVANTAGES:

1. **Reliability Issues**: The system's ability to consistently and accurately read fingerprints can be affected by various factors, such as dirt, moisture, or changes in the user's fingerprint over time
2. **Initial Cost**: The initial cost of installing a fingerprint-activated vehicle starting system can be higher than traditional key-based ignition systems
3. **Maintenance Requirements**: Fingerprint-activated systems require regular maintenance to ensure they continue to function optimally.
4. **Environmental Sensitivity**: Fingerprint-activated systems can be sensitive to environmental conditions, such as extreme temperatures, humidity, rain, or dust. For instance, in cold or hot weather, moisture on fingers or the fingerprint sensor could cause issues with accuracy or prevent the system from functioning.

CHAPTER 8

APPLICATIONS

1) **Research and Development**: Research and development (R&D) in this context focuses on the investigation of various fingerprint recognition technologies and their integration with vehicle ignition systems

- **Technology Feasibility**

  Research fingerprint sensor options (optical, capacitive, ultrasonic).

  Assess compatibility with vehicle systems.

- **Prototyping**

  Develop a small-scale model for testing.

  Test integration with a car ignition system

2) **Integration with Smart Home Systems**: Linking the system to home security features so that unauthorized attempts to start the vehicle are logged and can trigger alerts, enhancing security at home.

- **Home-to-Car Automation** Trigger the vehicle to start climate control based on the user's departure time. Synchronize with smart lighting or garage doors for convenience when leaving or arriving.
- **Centralized App Management** Use the same smart home app to manage vehicle access, monitor vehicle health, or receive alerts

3) **Personal Vehicles**: Each fingerprint can be associated with a personalized profile for settings such as seat position, mirrors, infotainment system preferences, and even driving modes.

- **Use Case**: Register fingerprints of family members or trusted individuals.

  Eliminate the need for physical keys or fobs, reducing the risk of theft.

  Customize settings for each user (e.g., seat position, climate control, or infotainment preferences based on their fingerprint).

4) **Ride-Sharing Services**: Drivers can use their fingerprints to access the vehicle, ensuring that only authorized individuals are driving the car. Passengers can also authenticate themselves before entering the vehicle for added security.

- **Driver Authentication** Only registered drivers can operate the vehicle, reducing unauthorized use or misuse.
- **Passenger Verification** Optional integration for passengers to verify their identity before entering premium or exclusive rides

CHAPTER 9

CONCLUSION AND FUTURE WORK

CONCLUSION

Fingerprint activated vehicle starters offer numerous benefits, including enhanced security, improved convenience, and a personalized user experience. These systems provide a secure and reliable method for vehicle access and starting, reducing the risk of theft and unauthorized use. Moreover, they offer a more convenient and streamlined user experience by eliminating the need for physical keys. As technology continues to advance, we can expect to see further innovations in this area, making vehicle ownership even more secure and convenient for users. Fingerprint activated vehicle starters represent a significant advancement in automotive security, offering a robust and user-friendly alternative to traditional key-based systems. By leveraging biometric technology, these systems enhance vehicle security by minimizing the risk of theft and unauthorized access.

FUTURE WORK

The future of fingerprint-activated vehicle starting systems lies in advancing both security and user experience. One key area is enhanced security features, where multi-factor authentication could combine fingerprint recognition with other biometrics, such as facial or iris scanning. Moreover, encrypted storage of fingerprint data and anti-spoofing technologies would mitigate the risk of unauthorized access by detecting fake fingerprints or replicas.

Another significant focus is integration with connected car technology. By leveraging IoT and cloud systems, manufacturers could enable remote management of fingerprint data, such as adding or removing users via smartphone apps. This would also support vehicle-sharing models by allowing multiple authorized users with personalized settings, like seat adjustments or climate preferences, based on their stored fingerprints.

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BUDGET DETAILS

Sl no.	Budget	Amount.
1.	Materials / Consumables (Arduino Uno, LCD Display, Fingerprint sensor, BO motor, Relay, 9V battery, LEDs, Breadboard, Jumper wires)	5,000
2.	Labour	1000
3.	Travel	1000
4.	Miscellaneous	1200
	TOTAL	8200