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LICENSED DRIVING DETECTION USING FINGERPRINT SENSOR

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ABSTRACT

This project demonstrates a fingerprint-controlled car model, incorporating wireless communication for enhanced functionality.

The core system utilizes fingerprint recognition for access control. A fingerprint sensor captures user fingerprints, and an Arduino compares them against a pre-loaded authorized user database. For authorized users, a control signal is transmitted wirelessly using an RF transmitter.

The wireless aspect is achieved through an RF transmitter and receiver pair. The receiver Arduino interprets the received signal (or lack thereof for unauthorized users) and controls the car's movement accordingly. An L298N motor driver manages the motor's operation based on the control signal from the Arduino. This project showcases the potential of fingerprint recognition for security purposes and explores incorporating wireless communication for remote control possibilities in a practical application.

I. INTRODUCTION

This project presents a fingerprint-controlled car model with an added layer of wireless communication. The core functionality relies on fingerprint recognition for access control. A fingerprint sensor captures fingerprints from users.

An Arduino then compares them against a database of authorized users stored in its memory. Authorized fingerprint matches trigger the transmission of a control signal wirelessly via an RF transmitter. The wireless aspect utilizes an RF transmitter and receiver pair. The receiver Arduino interprets the received control signal (or the lack thereof for unauthorized users) and controls the car's movement accordingly. An L298N motor driver manages the motor's operation based on the control signal from the Arduino.

This project demonstrates the potential of fingerprint recognition for security purposes and explores incorporating wireless communication for remote control possibilities in a practical application.

1.1 Literature Survey

A literature survey is essential to understand existing research related to fingerprint-controlled systems and wireless communication in robotics projects. Here are some key areas to explore:

- **Fingerprint Recognition Techniques:** Review existing research on various fingerprint recognition techniques, such as image processing algorithms and sensor technologies, to understand their capabilities and limitations.
- **Wireless Communication in Robotics:** Explore how wireless communication protocols like RF (Radio Frequency) are used to control robots or robotic systems remotely. This could involve research on projects utilizing RF modules for remote control or data transmission.
- **Fingerprint-Controlled Systems:** Investigate existing projects or applications that utilize fingerprint recognition for access control or security purposes. Analyze their design, components, and functionalities to gain insights for your project.

1.2 Formulation of the Problem and Objectives

Problem

Traditional car models controlled by wired connections limit user mobility and interaction. Additionally, basic on/off control mechanisms might not provide the desired level of security.

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Objectives

- Design and build a car model controlled by fingerprint recognition for enhanced security.
- Integrate wireless communication using RF technology to enable remote control or verification of authorized users.
- Implement a system that combines fingerprint recognition and wireless communication for a more interactive and versatile user experience.

II. SOFTWARE DESCRIPTION

The Arduino IDE serves as the primary platform for writing, compiling, and uploading code to the microcontroller, offering a user-friendly environment for development. The Fingerprint Sensor Library provides essential functions for interfacing with the fingerprint sensor, enabling secure biometric authentication by reading and matching fingerprints. The RF Communication Library facilitates the wireless transmission and reception of signals between the RF transmitter and receiver, ensuring effective remote control. Lastly, the L298N Motor Driver Library is used to control the motors through the L298N motor driver, enabling precise movement of the vehicle in various directions. These libraries collectively ensure smooth integration of the hardware components with the software, providing reliable system operation.

III. HARDWARE DESCRIPTION

The hardware components in your project are crucial for bringing the system to life. The Fingerprint Sensor R307 enables biometric authentication, allowing the system to recognize authorized users by scanning their fingerprints. The Arduino Uno serves as the central microcontroller, processing inputs and controlling the system's functions. RF Transmitter and Receiver modules facilitate wireless communication, allowing remote control of the car model. The L298N Motor Driver controls the DC motors that drive the car, managing the direction and speed of movement. Jumper wires are used to connect various components, ensuring smooth data and power transmission. The Power supply powers the entire system, providing the necessary voltage for operation. All these components are mounted on a car model chassis, which acts as the vehicle's structure, bringing the project's physical design together and enabling movement based on user authentication and control inputs.

IV. BLOCK DIAGRAM AND WORKING

4.1 Block Diagram

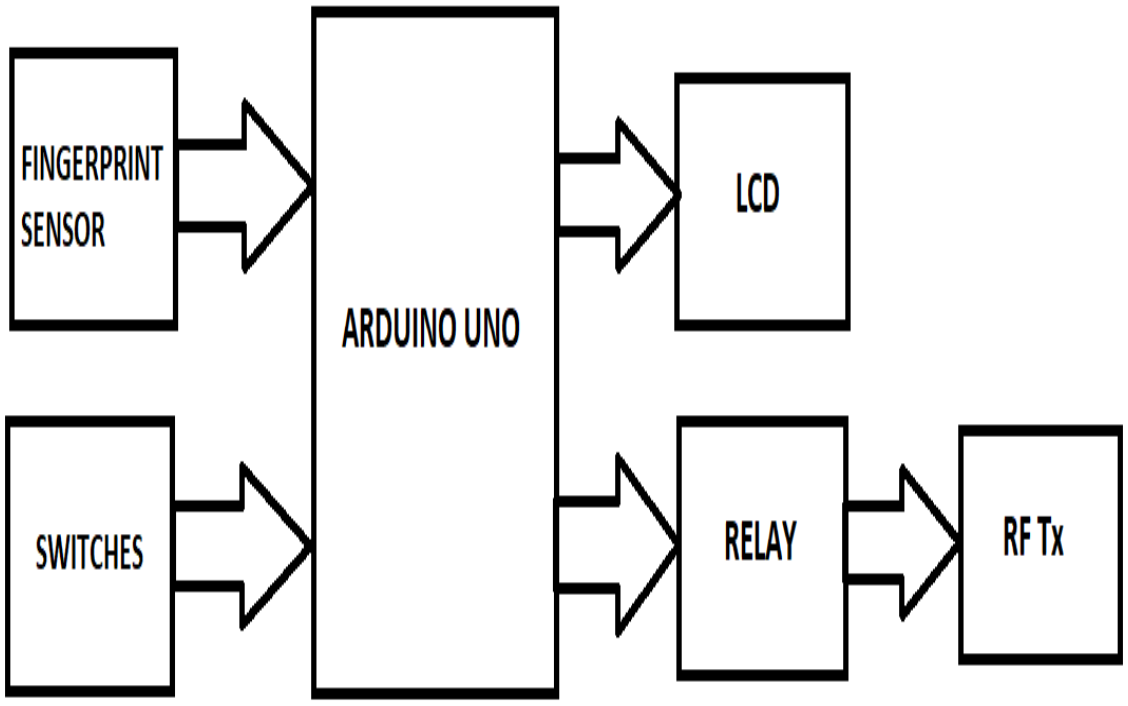

Figure 4.1 Block Diagram

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4.2 Working and Circuit Diagram

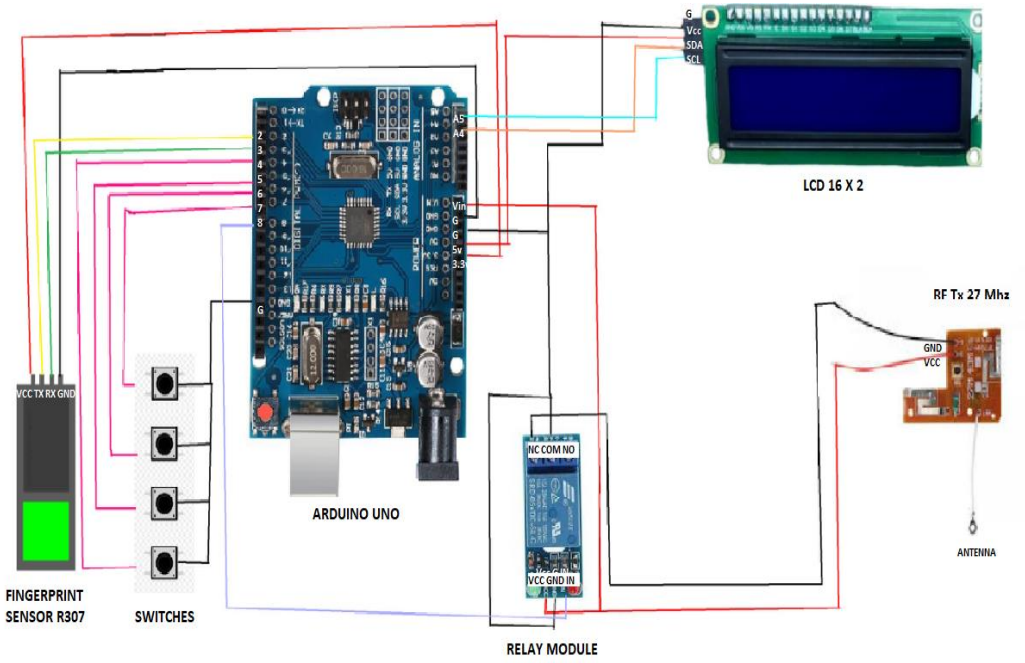

Figure 4.2 Circuit Diagram

The system integrates several components to create a fingerprint-based authentication and control mechanism, with the Arduino serving as the central controller. It receives input from a fingerprint sensor, which captures fingerprint data and sends authentication results to the Arduino. User interaction is facilitated through buttons, allowing users to trigger actions or adjust settings. The Arduino processes this data and communicates with an LCD to display authentication status and error messages, providing real-time feedback. To manage high-current devices, such as starting a car, the Arduino sends control signals to a relay module, which acts as a switch. Additionally, an RF transmitter sends data wirelessly to an RF receiver, enabling remote communication between devices. The RF receiver captures these signals and forwards the data back to the Arduino for further action. Together, these components create a secure and user-friendly interface, allowing for efficient authentication and control of connected devices. The system is ideal for applications requiring both security and remote operation, enhancing convenience while maintaining a robust security framework.

V. RESULTS AND DISCUSSSIONS

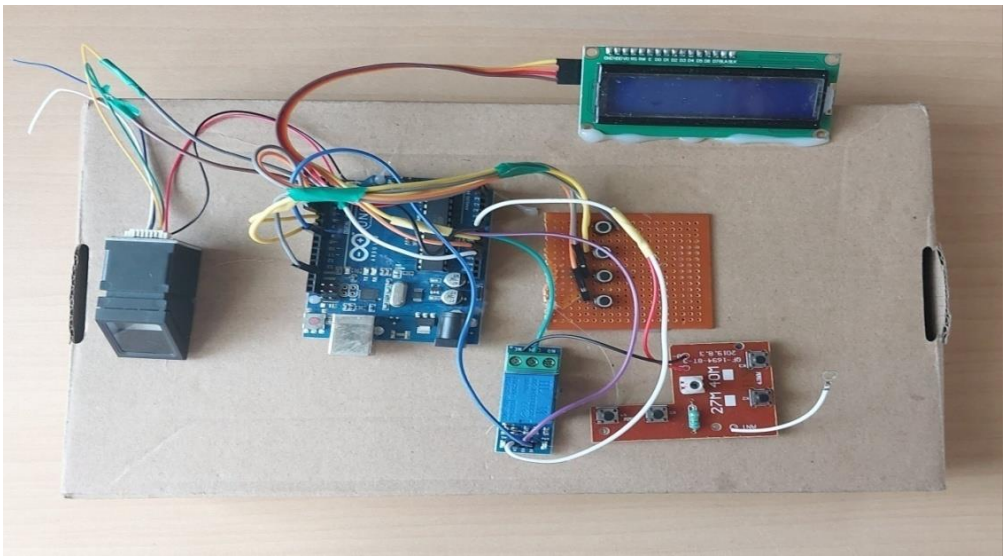

Figure 5.1 Set Up of Transmitter Circuit

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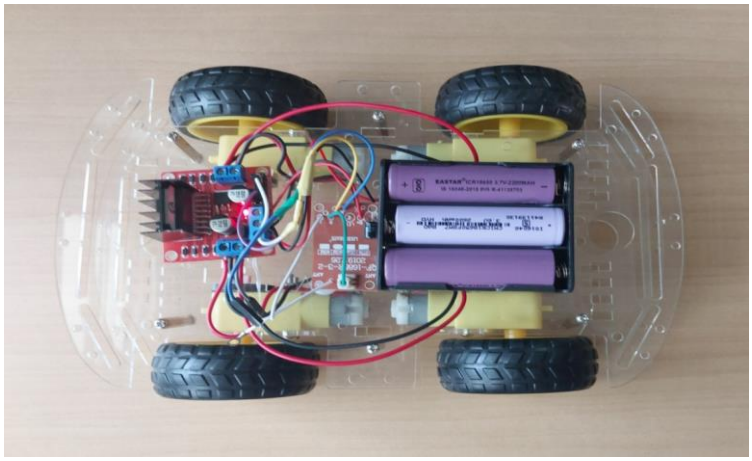

Figure 5.2 Set Up for Receiver Circuit

The fingerprint authentication system begins with the user scanning their finger on the R307 sensor, which captures and processes the fingerprint data, sending it to the Arduino for verification. If the fingerprint matches a stored template, the system activates; otherwise, "Unauthorized" appears on the LCD, keeping the vehicle inactive. Upon successful authentication, the Arduino triggers the relay module to power the L298N motor driver, enabling vehicle control. The LCD prompts the user with "Place Finger," signaling readiness for the next command.

For remote control, RF communication plays a vital role, with the RF transmitter sending signals to the RF receiver, which communicates with the Arduino to execute commands, enhancing functionality. Fingerprint registration is initiated by a designated push button, allowing users to scan their finger for storage in the system, with the LCD confirming successful registration. Continuous feedback is provided through the LCD, displaying authentication results and registration confirmations. Additionally, push buttons may feature LEDs or sound indicators to signal the system's active status and other notifications. This comprehensive feedback mechanism ensures users are well-informed about the system's state and actions, enhancing overall usability and security.

5.1 Fingerprint Registration with Push Buttons

The system features four buttons for selecting and registering locations, with up to 25 locations available. One button is dedicated to registering a location, while two others allow the user to increment or decrement the selected location. When accessing the vehicle, the system prompts the owner to input the registered location number before proceeding with fingerprint authentication. The user must first select their location using the buttons and then place their finger on the sensor for detection. If the entered location and fingerprint match the pre-registered data, the vehicle is activated. This two-step process enhances security by ensuring that both the location and fingerprint are verified before granting access. If either input is incorrect, the vehicle remains inactive, preventing unauthorized use.

Figure 5.3 To Enrol The Fingerprint In The Desired Location

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5.2 Detection and Comparison of Fingerprint with Preloaded Library

When a finger is placed on the fingerprint sensor, the sensor captures an image of the fingerprint and converts it into a set of unique data points called minutiae. These minutiae are then compared with the fingerprint templates stored in the sensor's library. If the current fingerprint template matches one of the pre-stored templates, it indicates that the fingerprint has been successfully recognized. Upon successful detection, the system moves on to the next step, such as verifying additional information or granting access to the vehicle. This matching process ensures that only authorized individuals with a registered fingerprint can proceed, adding an extra layer of security to the system. If no match is found, the system prevents further actions, safeguarding against unauthorized access.

```
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){
   lcd.clear();
   lcd.print("Finger Not Found");
   lcd.setCursor(0,1);
   lcd.print("Try Later ");
   for(int x=0; x<10; x++){
   digitalWrite(buzzer, HIGH);
   delay(300);
   digitalWrite(buzzer, LOW);
   delay(100);
```

Figure 5.4 Code For Comparison Of Fingerprints

5.3 Access Approved or Access Denied

When the fingerprint matches one of the registered fingerprints, the system grants access to the owner to operate the vehicle. Once access is granted, the vehicle starts moving forward, indicating that the relay module has sent a signal to the DC motor to initiate motion. The relay acts as a switch, controlling the motor's activation based on the fingerprint match. Additionally, the vehicle can be operated in different directions using an RF transmitter and receiver system. The RF transmitter sends control signals wirelessly to the RF receiver installed in the vehicle, allowing the owner to steer the vehicle as needed. This combination of fingerprint authentication and RF control ensures that only authorized individuals can operate the vehicle securely and conveniently.

If the fingerprint does not match any of the registered fingerprints, access is denied, and the message "Finger Not Found, Try Later" is displayed on the LCD screen to inform the user. This message alerts the owner that the vehicle will not move because the fingerprint authentication failed. In this case, the relay module will not send a signal to the DC motor, preventing it from activating. As a result, the vehicle remains stationary and will not respond to any control inputs. This system ensures that only authorized users with a valid fingerprint can operate the vehicle, providing an additional layer of security.

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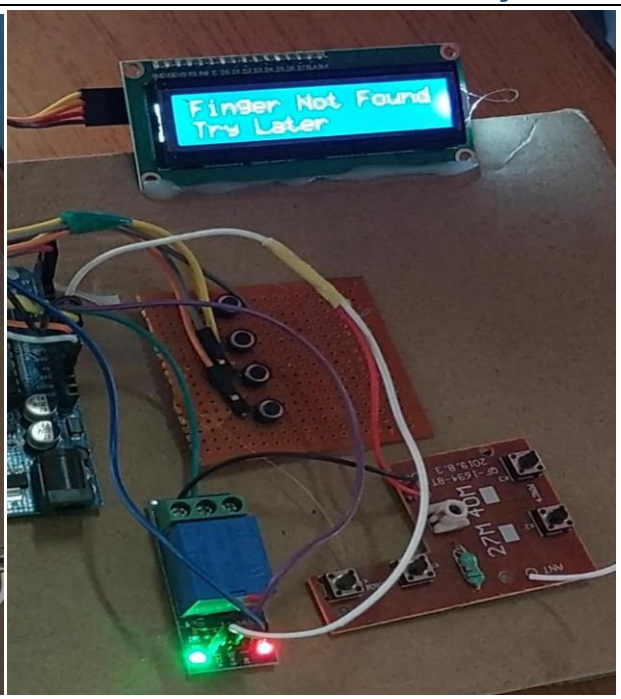

Figure 5.5 Access is granted and Vehicle can be operated Figure 5.6 Access is not granted and the vehicle does not move

VI. CONCLUSION

The licensed underage driving project successfully integrates multiple components to ensure secure and controlled vehicle operation. Utilizes an Arduino Uno, the system employs an R307 fingerprint sensor for user authentication. The 16x2 LCD provides real-time status updates and guides users through the fingerprint registration process. A relay module controls the car's motor, while RF communication allows for wireless control. The L298N motor driver, managed by push buttons, ensures precise vehicle movements. This project highlights the potential for enhanced safety and control in underage driving scenarios through biometric authentication and user-friendly controls.

VII. REFERENCES

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