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Fingerprint Based Smart Vehicle

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Abstract: ***The demand for security is rising everywhere as a result of the advancement of technology and the new discoveries being made by scientists. Security is the main worry, and in our busy, competitive environment, many cannot find ways to properly secure their private belongings. Currently, everyone needs to use a vehicle on a regular basis. In addition, it's crucial to safeguard the car from theft. The main objective of this project is to use fingerprint technology to secure the car against any unauthorised entry. Because a person can be uniquely identified by analysing one or more distinguishing biological traits, fingerprints prove to be one of the best traits offering good mismatch ratio and high accuracy in terms of security. It is one of those things that are particular to each person, and using a fingerprint on a car can solve the security issue.***
Keywords: Fingerprint, Security, unauthorised

I. INTRODUCTION

Due to the increase in vehicle thefts, vehicle security is a crucial concern nowadays. It is really challenging to obtain a stolen car back. Vehicle parts go missing frequently, and many lost automobiles are never located. Additionally, the expense increases, leading people to look for a system that will increase security and prevent thefts of vehicles. Although most modern cars come with built-in car alarms, it is still a good idea to stay on top of new developments and advancements.[7] It's crucial to update the vehicle's alarm system because many old security measures can be easily ignored by experienced vehicle thieves.
It's important to keep our cars safe from thieves because they are expensive assets. By implementing biometrics to start the vehicles and grant authorised access, the installation of a vehicle security system serves the primary objective of protecting our vehicles and their belongings.[6]

II. METHODOLOGY

For the implementation of a fingerprint-based security system to prevent unauthorized access to a car. The proposed system uses Arduino UNO, Bluetooth Module (HC-05), Motor Driver, 12V DC Motor, 9V Adaptor, Fingerprint Sensor, and LCD. The methodology includes the following steps:

1) Setting up the Arduino UNO board with the necessary software and libraries to control the DC Motors, Bluetooth module, and Fingerprint Sensor.
2) Connecting the Bluetooth module to the Arduino UNO board to establish a wireless communication channel with a smartphone app.
3) Connecting the Motor Driver and DC Motors to the Arduino UNO board to control the movement of the car.
4) Connecting the Fingerprint Sensor and LCD to the Arduino UNO board to enrols and authenticate fingerprints.
5) Programming the Arduino UNO board to control the DC Motors, Fingerprint Sensor, Bluetooth module, and LCD based on user input from the smartphone app and fingerprint authentication.
6) Testing and evaluating the system's performance in terms of security and functionality.

The system successfully enrols and authenticates fingerprints and allows only authorized users to control the car using the smartphone app. The system displays messages on the LCD based on user input and fingerprint authentication.[8] The research paper concludes that the proposed system provides a highly reliable, low-cost theft control system for a car. It recommends future research to include the development of voice recognition hardware and the inclusion of artificial intelligence for interactive purposes.

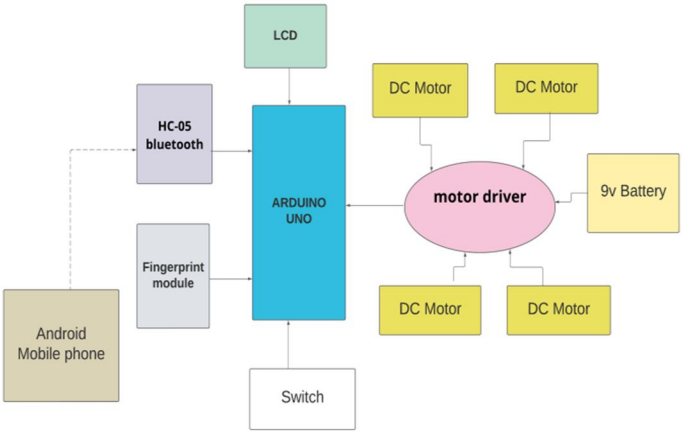

Fig 2.1 Block diagram

III. HARDWARE COMPONENTS

R307 Fingerprint sensors are used to store fingerprints and validate them with previously saved fingerprints. The accuracy of the currently accessible fingerprint recognition systems is sufficient for small- to medium-scale identification systems with a few hundred users as well as verification systems. A person's many fingerprints provide additional information to enable mass recognition involving millions of identities.[1]

An LCD screen is used to show data related to fingerprint enrolment and authentication. A LCD (Liquid Crystal Display) screen is a type of electronic display module that has several uses. A 16x2 LCD display is a very fundamental module with two 16-pin controllers that is widely utilised in a variety of devices and circuits. These modules are favoured over other multi-segment LEDs and seven segments because they are less expensive, easier to programme, and have no restrictions on displaying unique characters or even creative animations (unlike seven segments). An LCD screen shows the system's status. [3]

In this project, an Arduino Uno AT-Mega 328 is used to operate a variety of modules, such as sensors, motors, power supplies for the ignition system, displays, and more. It has these characteristics: A crystal oscillator, a USB port, and 16 of the 54 pins (digital output/input) can be used for analogue input. It has these characteristics: Six analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins, six of which can be used as PWM outputs, a USB connector, a power jack, an ICSP header, and a reset button are all included.[4] An Android application programme called Bluetooth Terminal allows Android PDAs to easily interface with Bluetooth devices using a terminal. Thus, the Bluetooth Terminal application programme enables the Android PDA to send (or receive) messages to (and from) the linked Bluetooth devices in either hexadecimal (hex) or string format. The HC-05 module is connected to a microcontroller at the receiving end, and it is configured to save the received message and show it on the LCD screen. A really cool module that can provide two-way (full-duplex) wireless functionality is the HC-05. Data is wirelessly transmitted from the transmitter to receiver using the Bluetooth module. Four pins exist within the HC-05 Bluetooth module: The transfer of data is done using the transmitting pin, or TX pin. The data-receiving pin, or RX pin, is where the receiver's data is sent.

VCC pin – power supply pin. GND pin – power supply pin.

The ideal motor driver for driving DC Motors and Stepper Motors is the Motor Driver Module. With direction and speed control, it can turn on and off 4 DC motors. [10]

Four 12V DC Motors are used to power the robot automobile in this instance. Four wheels make up a robot automobile, hence one motor is utilised for each.[10] The Arduino integrated development environment (IDE), a cross-platform programme, is provided by the Arduino project. A free integrated toolset for programming an Arduino processor is called the Arduino Integrated Development Environment (IDE). Embedded C is used to complete the coding. Arduino IDE software comes with a code-writing text editor, a message box, a text console, a toolbar with buttons for frequently used operations, and a variety of menus. It establishes a connection with the Arduino hardware and communicates with it to upload programmes. The void setup() function defines the pins. The codes to carry out various actions on devices (ON/OFF) are written in the void loop().The server manages and keeps an eye on these. [2]

Kodular is a free online toolkit for creating mobile applications. It primarily offers an online drag-and-drop platform for developing Android apps.

Fig 3.1 App for controlling the vehicle

A. Algorithm

Step-1: Start
Step-2: Enroll the fingerprint
Step-3: Using Fingerprint sensor authenticate the fingerprint
Step-4: If the fingerprint matches then controlling the vehicle using bluetooth is possible.
Step-5: Initialize the Bluetooth Application
Step-6: Control the vehicle with the mobile application.
Step-7: Else the vehicle cannot be controlled.
Step-8: Return to start

B. Flow Chart

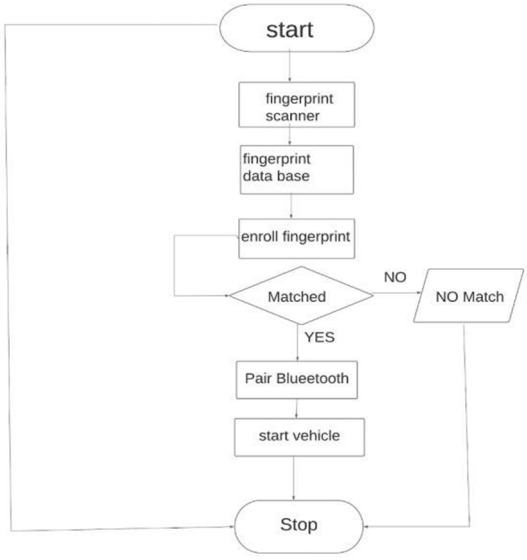

Fig 3.2 Flow chart

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C. Working Algorithm

Before beginning the project, study on the various modules and the particular microcontroller version to be utilised was carried out. The circuit diagram's connections were made to each pin of the module. According to the various system components, the code was developed in the IDE programme and then downloaded to the microcontroller.[5]

The fingerprints are stored on the microcontroller, which is linked to the fingerprint sensor. The first step is fingerprint enrolment, which is presented on an LCD.[9] If the fingerprint matches the one that is already stored, the Bluetooth module on an Android phone is used to control the vehicle. When a command is given, the vehicle responds appropriately and can move in the direction specified. Using the Arduino IDE software, the code is uploaded to the Arduino and tested further.

IV. RESULTS AND DISCUSSIONS

The R307 fingerprint sensor in the fingerprint-based smart car is used to enrol and validate the user's fingerprint. While enrolling and authenticating a fingerprint, the LCD displays the following messages:

Fig 4.1 Enrolling the fingerprint

Fig 4.2 Scan your finger

Fig 4.3 Access granted

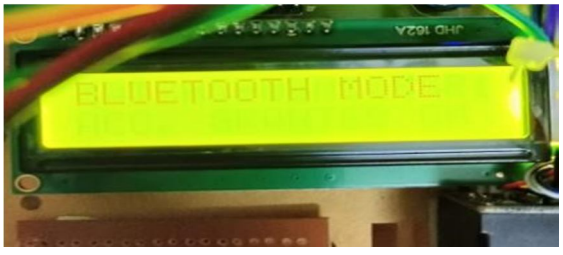

Fig 4.4 Initialize Bluetooth module

If the fingerprints match, a mobile application is used to control the vehicle. There are five buttons in the app, including buttons for forward, backward, left, right, and stop. The user's commands determine how the vehicle moves. For instance, if the user clicks on the Forward button, the vehicle moves forward; if the user clicks on the Backward button, the vehicle moves backward; if the user clicks on the Left button, the vehicle moves left; if the user clicks on the Right button, the vehicle moves right; and if the user clicks on the Stop button, the vehicle stops.

Fig 4.5 Bluetooth mode Operations

If the fingerprint doesn't match then the access is denied which can be seen in LCD as match not found.

Fig 4.6 Match not found

There isn't a prototype for this particular use case—protecting the car with a fingerprint and controlling it with an app—in the huge field of robotics. Through this project, biometrics are used to secure automobiles.

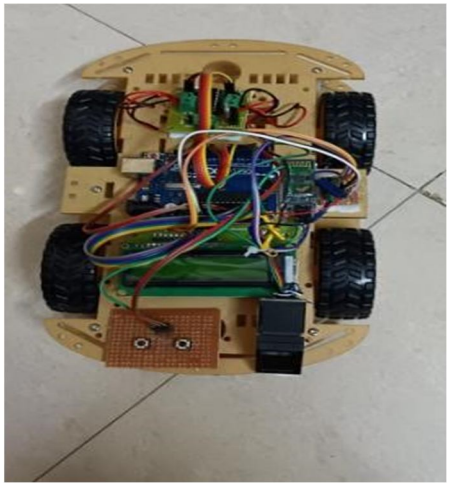

Fig 4.7 Final prototype of Fingerprint based smart vehicle

V. CONCLUSION

In all kinds of applications, security is a crucial requirement. The objective of this project is to increase the standard for vehicle security. Considering the fact it can be used quickly and securely, the fingerprint is a potential biometric pattern for identifying a person. The method of developing and building up a highly reliable, low-cost theft control system for an automobile. By allowing the usage of only authorised people, fingerprint technology enhances the security of a vehicle. The achievement of our automatic security system is thus made possible by installing this system on vehicles, which results in a low cost and readily accessible form. Systems for biometric personal identification offer greater security and convenience than traditional approaches.

VI. APPLICATIONS

1) Vehicles will be equipped with this initiative to increase security and avoid theft.
2) It is inexpensive, can be used for many types of vehicles, and requires only minor adjustments, so the cost of the Vehicle is not significantly increased.
3) This project can be used to the door lock mechanism.

VII. FUTURE SCOPE

The development of a system that can recognise voice commands directly and not through an Android app will allow for further advancement in the future. This will eliminate the need for any additional voice recognition hardware. The created device communicates with users using pre-recorded human voice sounds, however artificial intelligence can be included for interactive purposes so that the robot can engage with users more effectively by analysing the testing environment and their behaviour. In addition to cars, this can be used in various types of vehicles. There are additional biometrics that can be employed.

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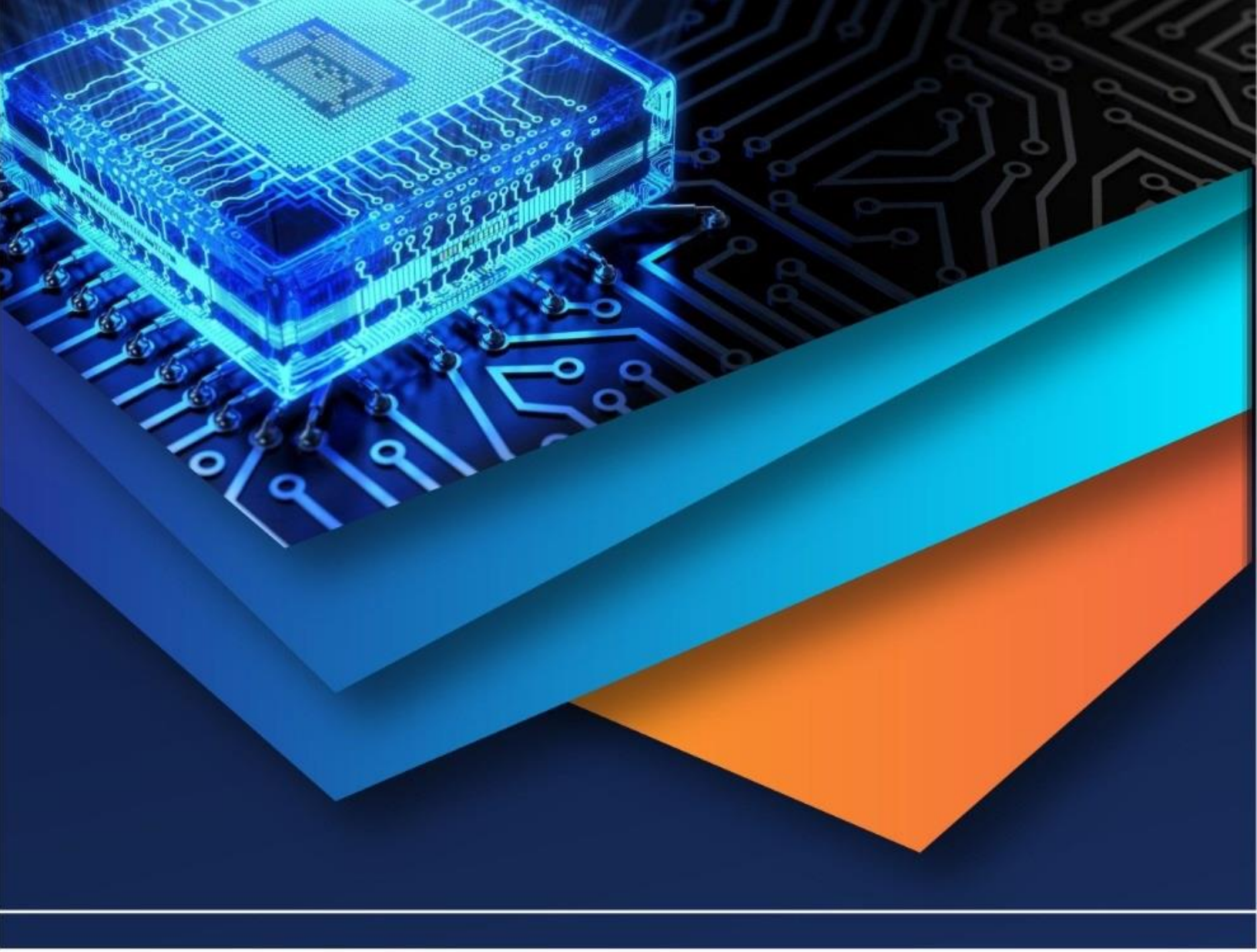

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