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A NEW AUTOMATION SYSTEM FOR VEHICLE SECURITY THAT USES FINGERPRINT AND DRIVER'S LICENSE

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Abstract:
In order to greatly improve the defence against car theft, this study presents a novel vehicle security system that combines fingerprint biometrics with driver's licence authentication. The heart of the system is an Arduino controller that works in perfect harmony with a fingerprint sensor and an RFID reader. The driver's licence must have an embedded RFID tag in order to be used with the RFID reader, which is the first line of protection. Additionally, the fingerprint sensor—which verifies the driver's identity by scanning their fingerprint—supports the second layer of security. The system does not allow access to the car until both security levels have been correctly validated. By limiting access to the vehicle to only authorised individuals who possess both the driver's licence and the registered fingerprint, this innovative method to vehicle security effectively lowers the danger of theft and unauthorised usage while providing strong protection. At the centre of the system is the Arduino controller, which coordinates the data exchange between the fingerprint sensor and the RFID reader. A driver must first show their driver's license—which has an RFID tag—when they get close to the car. The licence is scanned by the RFID reader, verifying its authenticity. The motorist is then asked to press their finger against the fingerprint sensor in order to complete the authentication process. Access to the car is only provided after the fingerprint and driver's licence have been successfully verified. This cutting-edge vehicle security system is a great asset to the automotive sector since it not only improves protection but also provides effective and user-friendly access control.

Keywords: RFID reader, Arduino, fingerprint sensor, and car security

Introduction

A smart car security system that incorporates cutting-edge technology like IoT, sensors, and maybe biometrics is presented in this study [1]. The system seeks to improve vehicle security by detecting and thwarting theft or unauthorised access through the use of various technologies. Strong security measures are provided by the information on system architecture, sensor integration, and communication protocols. This research [2] presented a smart licence technology-based vehicle safety and security system. The technology attempts to lower the risk of theft and increase vehicle security by integrating digital licences for access control and authentication. It covered how smart licence technology is being used, how it integrates with car systems, and how both authorities and car owners may benefit from it. The technology of fingerprint recognition is covered in this study [3], with a particular emphasis on a standardised fingerprint model for precise and effective identification. There is a discussion of the fundamentals of fingerprint recognition, the creation of standardised models, and the uses of fingerprint recognition in various industries, including law enforcement, access control, and security. This research [4] investigates smartphone-specific smart authentication techniques with the goal of improving user ease and security. It discusses cutting-edge authentication methods intended to protect mobile devices from unwanted access, like biometrics, pattern recognition, and behavioural analysis. The usefulness and efficacy of these clever authentication techniques in practical settings are

assessed in this research. This work [5] discusses several modalities including fingerprint, iris, and facial identification while giving an overview of newly developing biometric technology. It examines the developments in biometric technology, how they are used in security systems, and the difficulties that arise when putting them into practice. The purpose of the survey is to give light on the state-of-the-art in biometrics at the moment as well as possible avenues for further investigation and advancement. A gesture-based wheelchair control system is presented in this study [6] with the goal of enhancing the mobility and independence of people with physical disabilities. It might go over how gesture recognition technology is evolving and how wheelchair control systems work with it. The study assesses gesture-based control's efficacy and usefulness in practical contexts, emphasising how it may improve the lives of people with disabilities. A low-cost autonomous car driven by image processing and a neural network built on a PIC microcontroller is described in this research [7]. It talks about how the control system of the car was designed and put into operation, including how image processing and neural network methods were combined. The performance and effectiveness of the autonomous car system are also assessed in the article under various conditions, emphasising its potential for affordable autonomous navigation.The history, guiding concepts, algorithms, and applications of (AFIS) are all covered in detail in this work [8]. It probably goes over how AFIS is used in forensic investigations, law enforcement, and biometric authentication, emphasising how well it works to identify people by their fingerprints. The difficulties and technical developments in AFIS development and implementation are also covered in the article. In order to improve car security and safety, the author of this paper [9] suggests an Arduino microcontroller-based safety system for automobiles. It goes over how to integrate different Arduino-controlled sensors and actuators to monitor and regulate various elements of vehicle functioning. The design of the system, the locations of the sensors, and the communication protocols that guarantee dependable and efficient functioning are also covered in length in this study.This research [10] investigates face recognition and Internet of Things-based car security systems. It probably talks about how increased security features for cars can be achieved by integrating facial recognition technology with IoT platforms. A Controller Area Network (CAN)-based anti-theft car locking system is presented in this research [11], with the goal of thwarting theft and unauthorised access. It probably explains how to create and put into practice a secure locking mechanism that is managed by the CAN communication protocol. The system's features, which improve car security and discourage theft, include tamper detection, alarm systems, and remote locking and unlocking. An electronic police ambush system based on vehicle and driver safety authentication is proposed in this work [12]. Through the assurance of the legitimacy and safety of cars and drivers on the road, it seeks to enhance law enforcement operations. The system uses technology including vehicle monitoring, biometric authentication, and real-time contact with law enforcement to identify and deal with questionable activity.

2. Proposed system

Using an RFID-enabled driver's licence for first-level verification and the driver's fingerprint for second-level verification, the current study develops a system that adds an advanced vehicle security system. The output is only supposed to activate the car's engine in the event that dual authentication is successful.

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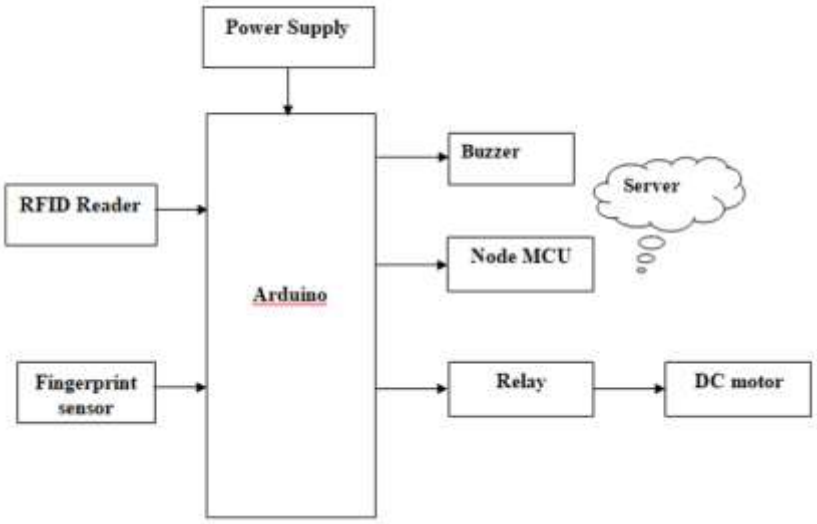

Figure.1.Block Diagram of the project

TOOLS USED
A. Arduino UNO

Figure.2.Arduino UNO

Arduino can be a great tool for a voice-controlled LPG gas cylinder trolley for non-critical functions due to safety concerns. It excels at
Voice control: Recognize basic commands (move, stop, turn) through voice recognition modules.
Sensor integration: Use ultrasonic sensors to avoid minor bumps during movement.
B. NODE MCU

Figure.3. Node MCU

The ESP8266 Node MCU CP2102 board has ESP8266 which is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.
C. MQ2 Sensor

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Figure.4. MQ2 Sensor

The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

D. LCD

Figure.5.LCD

LCD (Liquid Crystal Display) is the innovation utilized in scratch pad shows and other littler PCs. Like innovation for light-producing diode (LED) and gas-plasma, LCDs permit presentations to be a lot more slender than innovation for cathode beam tube (CRT). LCDs expend considerably less power than LED shows and gas shows since they work as opposed to emanating it on the guideline of blocking light.

E.Buzzer

Figure 6. Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play.

F. HX711 Load Cell Amplifier

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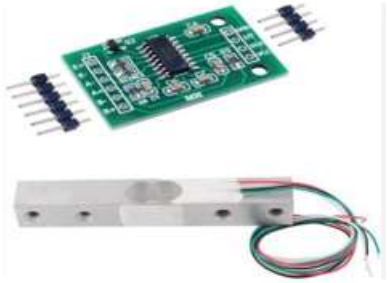


Figure.7. HX711 Load Cell Amplifier

The Load Cell Amplifier is a small breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the amplifier to your microcontroller you will be able to read the changes in the resistance of the load cell, and with some calibration, you'll be able to get very accurate weight measurements.

G.HC-05 Bluetooth module

Figure.8. HC-05 Bluetooth module

The HC-05 Bluetooth module bridges the gap between wired and wireless communication for microcontrollers (like Arduino) and other devices. It acts like a wireless serial port, allowing data exchange over short distances. This makes it useful for applications like sending sensor data wirelessly, controlling robots or drones with a smartphone app, and connecting devices to the cloud for internet of things (IoT).

H.Fire Sensor

Figure.9.Fire Sensor

Fire sensors are watchful heroes in our homes and buildings. They constantly sniff out trouble by

detecting signs of fire, like smoke or sudden heat spikes. When they sense danger, they trigger a loud alarm to wake you up and give you precious time to escape. This early warning can save lives and prevent fires from spreading.

I.LED

Figure.10.LED

LEDs, or light-emitting diodes, are super versatile little lights you see everywhere. They're way more efficient than traditional bulbs, lasting much longer and using less energy. They come in a rainbow of colors and can be really bright, making them perfect for all sorts of uses: from lighting up your phone screen and traffic signals to illuminating buildings and even helping plants grow.

J.Motor Driver

Figure 11.Motor Driver

The L293D motor driver is like a translator between your microcontroller (like Arduino) and your DC motors. It takes low-power control signals from your microcontroller and turns them into high-power signals to drive two DC motors forward, backward, or even control their speed (a little bit). This makes it a popular choice for building robots, trolleys, and other projects that need to control small to medium-sized DC motors easily and affordably.

3.Results and Discussion

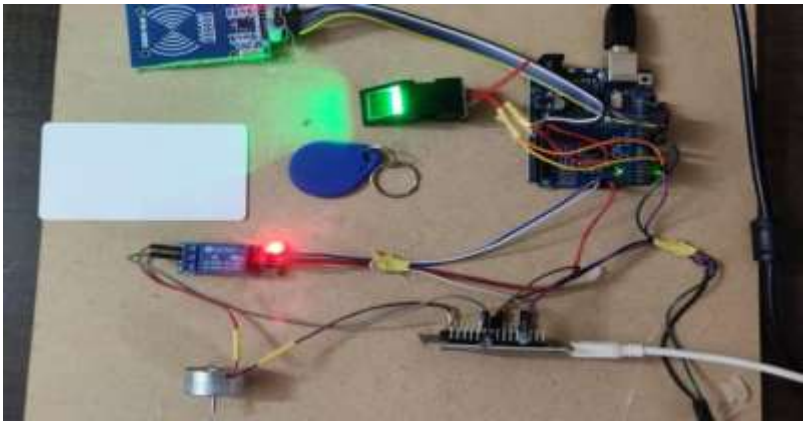
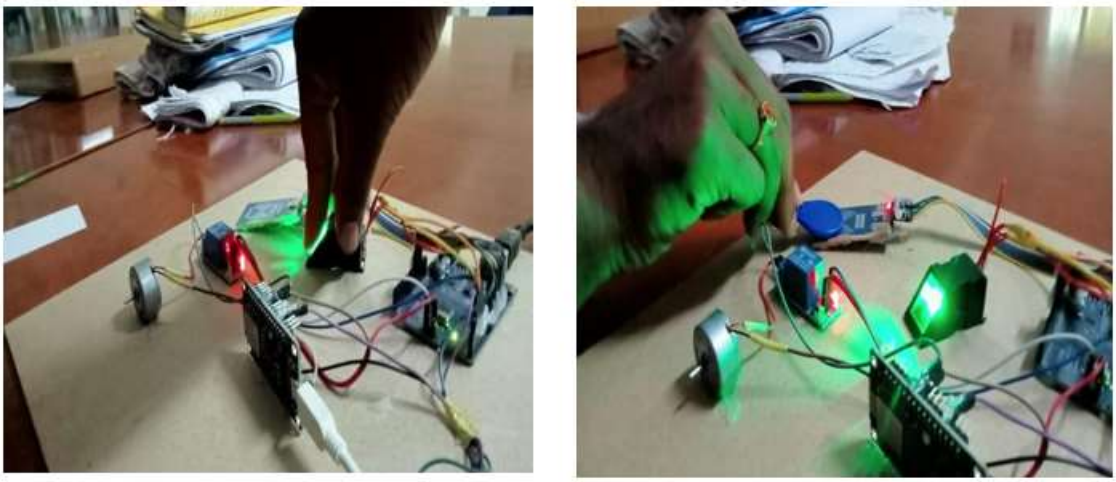


Figure.12. Developed system in working mode

The image displays the Internet of Things integration of various components, such as an Arduino Uno, an RFID reader, a fingerprint module, a Node MCU, a relay, and a DC motor. This comprehensive solution, which combines dual-factor authentication with real-time monitoring, further improves

security by acting as a strong deterrent against vehicle theft and unauthorised use while giving vehicle owners more convenience and control.



(a) (b)

Figure.13. (a) Fingerprint not valid (b)Driver's License invalid

Here, the fingerprint shown in the image 13 (a) is a Invalid fingerprint and the driver's license card shown in the figure 13 (b) is a invalid license card.

(c) (d)

Figure.13. (c) Relay Not Activated, Vehicle Not Started (d) Serial Monitor Output

Fingerprint : Not Matched, Driver's License : Not Matched, Vehicle Status : Door Not Opened

Here both levels of authentication are failed, so the vehicle engine is not started and gives a beep sound.

2024-01-20T07:12:44+00:00	54 FINGER_MATCHED
2024-01-20T07:14:40+00:00	55
2024-01-20T07:15:12+00:00	56 CARD_MATCHED
2024-01-20T07:15:50+00:00	57
2024-01-20T07:16:23+00:00	58 FINGER_MATCHED
2024-01-20T07:16:56+00:00	59 FINGER_MATCHED
2024-01-20T07:17:37+00:00	60
2024-01-20T07:18:10+00:00	61 #FINGER_MATCHED
2024-01-20T07:18:43+00:00	62
2024-01-20T07:19:16+00:00	63 CARD_NOT_MATCHED
2024-01-20T07:20:23+00:00	64
2024-01-20T07:20:56+00:00	65 #CARD_NOT_MATCHED
2024-01-20T07:31:14+00:00	66
2024-01-20T07:31:47+00:00	67 CARD_MATCHED
2024-01-20T07:32:20+00:00	68
2024-01-20T07:32:53+00:00	69 CARD_NOT_MATCHED
2024-01-20T07:33:25+00:00	70
2024-01-20T08:45:55+00:00	71 FINGER_MATCHED

Figure.14. Real-Time Data Visualization & two level authentication

The efficacy of dual-factor authentication (fingerprint and RFID) is demonstrated in image 14. It shows both successful and unsuccessful attempts graphically, with "card matched" and "fingerprint matched" entries clearly labelled alongside their "not matched" counterparts.

Furthermore, this project drives data to ThingSpeak, a powerful real-time data visualisation and analysis tool, via NodeMCU. By facilitating wireless connection between cars and a central computer, this integration improves our system and makes monitoring and management easier. With ThingSpeak, users can view real time car data that offers insightful information about vehicle's functionality and operation. This ensures the highest levels of safety and operational effectiveness while giving owners and authorities remote monitoring and management capabilities.

4.Conclusion

In conclusion, a major advancement in automobile security innovation has been made with the creation and deployment of a driver's licence and fingerprint automation-based car security system. The system provides an attractive answer to the problems of vehicle theft and unauthorised access thanks to its strong authentication procedures and adaptable applications. It is anticipated that future biometric technology research and development will result in even more complex and advanced security systems, highlighting the need of ongoing innovation in protecting cars and their occupants.

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