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Vehicle Security Management System using GPS, GSM and Fingerprint Module

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Abstract: The system is built around an Arduino microcontroller, which serves as the system's brain, controlling different components and acting as the user's interface. The GSM module is used to communicate and receive commands, while the GPS module helps to track the location of the vehicle. By using fingerprint sensors, a new concept has been presented to improve the security system for automobiles. This design includes a keypad for adding a passcode as an alternative to a fingerprint sensor for a car. In case of theft, the GSM and GPS module has also been utilised to track the location of the car. As a result, the user of this system can follow the owner's vehicle on Google Maps and get its current location information on his smartphone

Index Terms: Arduino, GPS(Global Positioning System), GSM(Global System for mobile communication)

I. INTRODUCTION

Since the number of vehicle thefts is rising daily, it has become more and more challenging to provide a vehicle with excellent protection while keeping the main focus on the theft tool. Today, fingerprint sensors will be included for security even in more affordable devices. Despite the fact that vehicle theft is on the rise, no vehicles in the market have a fingerprint security system as of yet. The findings show the theft of a motor vehicle is still India's least solved crime. Only 19.6% resolved. The goal of the car security system that uses GPS, GSM, fingerprint, and passcode verification is to improve vehicle security and reduce the danger of theft and unauthorised entry. The system aims to accomplish this by utilising a combination of technologies that can track the location of the vehicle, remotely disable the engine, authenticate the driver via fingerprint or passcode verification, and send alerts to the owner's mobile phone if the vehicle is stolen with. The system's ultimate purpose is to provide a high level of security for the vehicle and its occupants while also giving the owner with peace of mind. The system aims to minimise the risk of damage or loss to the vehicle, prevent theft and unauthorised access, and improve chances of recovery in the event that the car is stolen. In conclusion, the goal of the GPS, GSM, fingerprint, and passcode verification car security system is to offer a complete security solution for automobiles that combines many technologies to improve security and lower the risk of theft and unauthorised access.

II. LITERATURE REVIEW

The project titled "Smart Anti-Theft Device for Vehicle Security" is a model for an anti-theft device for four wheelers presented by S. Akash, R. Alex Prabhu, T. Kirubakaran, S. Shyam Kumar. The project aims to develop a real-time tracking and user-controlled anti-theft tool. With the use of GPS and GSM technology, this is accomplished. The idea adds an additional degree of security by using fingerprint recognition as a biometric to enable entry to the vehicle. A sensor that recognises the vehicle being dragged has also been added to the project in order to stop all possible vehicle theft methods.[1] The proposed fingerprint, GPS/GSM-based vehicle security system is the cutting-edge and dependable method of security mechanism in the study by Kiran CS. The mechanism that this project develops offers comprehensive protection against theft. By adding an extra degree of security to the vehicle, the fingerprint sensor effectively eliminates the need for a key to turn the bike's ignition and eliminates the risk of theft. The valve opens, fuel begins to flow, and the bike is started when the registered fingerprint is placed on the fingerprint sensor. The suggested model is quite affordable and very user-friendly. Additionally, the real-time location of the car can be determined using the GSM/GPS modem.[3] The project paper titled 'Vehicle Anti-Theft System' presented by Abhinav Chugh, Aditya Gupta and Abhinandan Chaturvedi is a prototype for a high-security password-controlled vehicle ignition system with a feature to alert the user when the car is about to start. alerts you if you enter the inaccurate password as well. In the event of any mistakes, such as vehicle theft, it also aids in tracking the vehicle. The use of a vehicle tracking system increased output generally. You can handle more work within a given time frame with better scheduling or route planning. Vehicle tracking enhances safety and security, communication tools, performance monitoring, and productivity for both personal and professional use.[5]

III. SYSTEM ARCHITECTURE

The system consists of fingerprint and keypad module which is used as a means of authentication to allow access to the vehicle. The scanner is connected to microcontroller that verifies the fingerprint against stored data before allowing access to the vehicle.

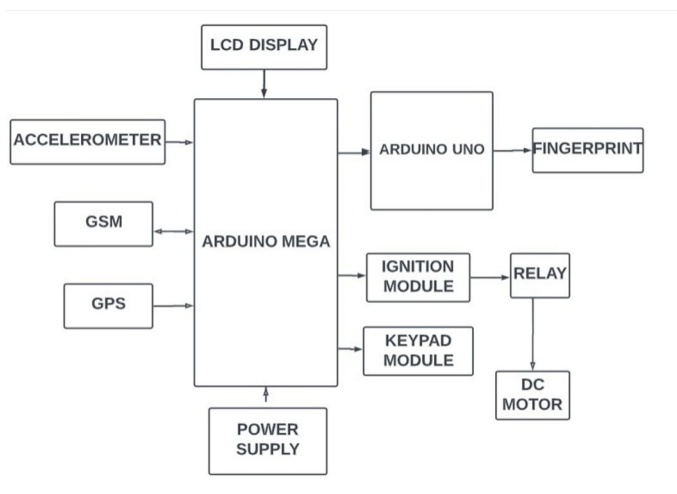


Fig. 1. Block diagram of the system

As a microcontroller, the Arduino Mega is used in this block, where all controlling operations are performed. It handles each input and output that the microcontroller receives. Therefore, it functions as the system's brain. We used a NEO 6m GPS module to determine the system's location, and we have access to the moving system's real-time location. Our system receives input from latitude and longitude. A chip or circuit known as a GSM module or GPRS module is used to establish communication between a mobile device or computer and a GSM or GPRS system. Its features include reading, writing, deleting, and sending SMS messages. This system has an ignition key that is used to start or stop the system. We worked with the R-307s module to verify fingerprints. Accuracy, improved performance, and robustness based on unique fingerprint biometric technology are the major features of this device. Both fingerprint readers and scanners are highly safe and suited for safety rather than a secret word, because it is difficult to remember the password and is also simple to scan. To start the engine, we entered the password using the keypad. The user's key press is read and processed using a keypad as an input device. The 4x4 keypad has 3 columns and 4 rows. Between the rows and columns are switches. Relay is one kind of electro-mechanical component that functions as a switch and LCD display is used for displaying status of the system.

IV. WORKING OF THE SYSTEM

The GPS module is connected to the microcontroller, which can then transmit the vehicle's location to the owner's phone or computer via the GSM module. When the owner wants to access the vehicle they have to first turn on the ignition key which is connected to the relay that controls power supply of the engine. After that the user has two options for authentication either they can enter the password through keypad or can use fingerprint module to turn on the engine. As the engine starts the GPS module sends the location data to

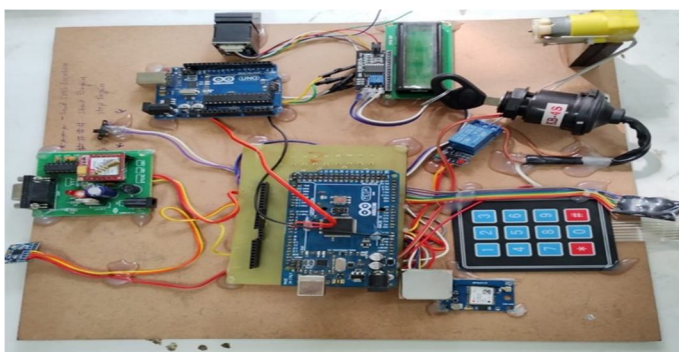


Fig. 2. Hardware implementation of vehicle security system

the microcontroller, which then sends it to the owner’s phone through gsm module. The owner can view the start and stop location of their vehicle on their phone. If the vehicle is stolen, the owner can remotely turn off the engine using the GSM module. At any particular instant the owner can get access the location of the vehicle through GSM module. When the owner is finished using the vehicle, they can turn off the engine and remove the ignition key. The relay cuts off power to the engine.

V. RESULT

A system has to be tested under various conditions to ensure its correctness. The testing conditions for this project include several authorized and unauthorized attempts to access the system. These include: begin

- 1) Authorized access i.e., registered fingerprint to access the system.
- 2) Unauthorized access i.e., unregistered fingerprint to access the system.
- 3) Correct pin i.e., entered password is correct
- 4) Incorrect pin i.e., entered password is incorrect

The following table shows result of all possible inputs

Scenario	Input to the system	Output
Authorized access	Finger registered	Finger matched (System gets activated and location sent to user via SMS)
Unauthorized access	Finger unregistered	Finger not matched (System does not activate)
Correct pin	Entered correct password	Password matched (System gets activated and location sent to user via SMS)
Incorrect pin	Entered incorrect password	Password not matched (System does not activate)

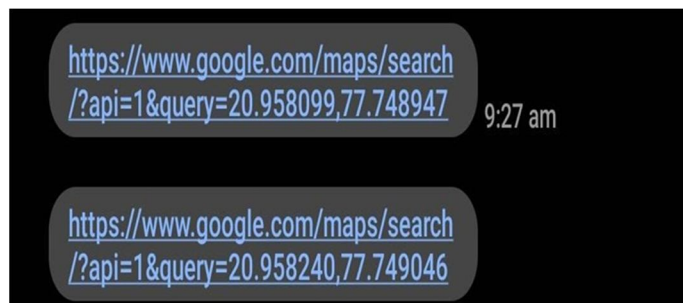


Fig. 3. SMS alert

VI. ACKNOWLEDGMENT

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VII. CONCLUSION

The "Vehicle Security Management System" project is a prototype for a vehicle anti-theft equipment. The project aims to develop a real-time tracking, user-controlled anti-theft gadget. GPS and GSM technology are used to do this. The idea includes biometrics, such as fingerprint recognition and a keypad module to allow access to the vehicles, adding an additional layer of protection. The technology allows for simple remote control and monitoring via a computer or mobile device and offers real-time information about the location, status, and security of the vehicle.

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