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ANTI-THEFT PROTECTION OF VEHICLE BY USING FINGERPRINTS VERIFICATION AND MESSAGE ALERT

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Abstract
The number of offenses involving vehicle theft has increased significantly along with the number of vehicles on the road. Vehicle theft continues to rank among the most frequently reported crimes worldwide despite a number of strict regulations being in place and security measures being used by automakers. Because motor cars are expensive, there is plenty of incentive for small-time thieves to try thefts, and a simple exterior redecoration makes it nearly hard to track the stolen vehicles.
A lot of technologies have been proposed throughout the years, but they haven't really taken off because of their expensiveness and intricate mechanics. In this document, a straightforward and affordable solution to the issue is laid out. This system offers adequate protection against auto theft and may be put together and utilized even by private automobile owners.

Keywords— Anti-theft, Vehicle tracking, Immobilization

Introduction
In the past 20 years, the number of motor vehicles has rapidly increased thanks to remarkable advancements in the automotive industry. Currently, there are about 100 million vehicles in India, but by 2020, that number is anticipated to reach 450 million. The United States, which has the greatest automobile population in the world, has more motor vehicles than there are licensed drivers.
The number of crimes involving vehicle theft has increased as a result of the enormous increase in the number of automobiles on the road. A vehicle is stolen every 36 minutes in Delhi, the nation's capital, which works up to almost 40 thefts each day.
Vehicle theft has not yet been significantly reduced, despite enhanced security measures and raised awareness among owners of vehicles. Only a very small portion of thefts are successfully recovered since a simple exterior upgrade renders the stolen cars impossible to track. Owners are currently being forced to spend an increasing amount of money on auto insurance and other policies due expensive motor vehicles.
This document presents a straightforward and cost-effective theft prevention system that, with the help of vehicle monitoring and immobilization features, may be installed even by individual automobile owners.

Technical Background
The technical foundation of this work comes from research on GPS tracking techniques and GSM-based alert and security methods. The development of a car security system by Sehgal et al [1] and a motorcycle security system by Nasir et al [2] both used GSM-based alert systems. Moloo et al [3] and Manoharan [4] both employed GPS tracking techniques.

Proposed System
The concept behind this plan is to include two features that will aid the owner of the car in constantly monitoring it.
The most crucial task is to give the owner a simple text message monitoring system that is both user-friendly and effective for tracking the car. The owner can text the GSM modem in the car whenever

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he feels the need to do so, and the modem will respond with a text message containing the coordinates of the vehicle's current location in a matter of seconds. An Arduino microcontroller is interfaced with a GSM modem and a GPS module as part of the vehicle's tracking system. In the event that the Arduino gets the user's 'TRACK' message over the GSM modem, it makes use of the GPS module to determine its present location and communicates the coordinates to the user
Via an additional SMS message to the GSM modem.

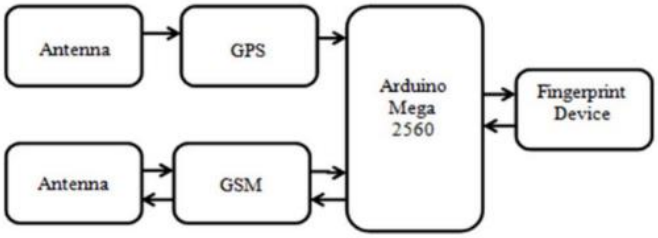

Figure 1. Block diagram of vehicle tracking system with fingerprint verification.

In case he detects a vehicle theft, the second function enables the owner to remotely immobilize (and also reverse the immobilization) the vehicle using text messages. Additionally, it can be done when the owner believes there may be a risk of theft or whenever he parks his car in a parking lot.
For this purpose, as soon as the Arduino receives a message saying "Immobilize," it turns on a relay, which disables the fuel injection circuitry and immobilizes the car.
A 'Reverse' message from the owner can undo the immobility, completing the fuel injection circuitry and restoring the vehicle's ability to move.
When implemented properly, these features, which were designed with various scenarios and requirements in mind, can offer nearly flawless security against theft.

Flowchart

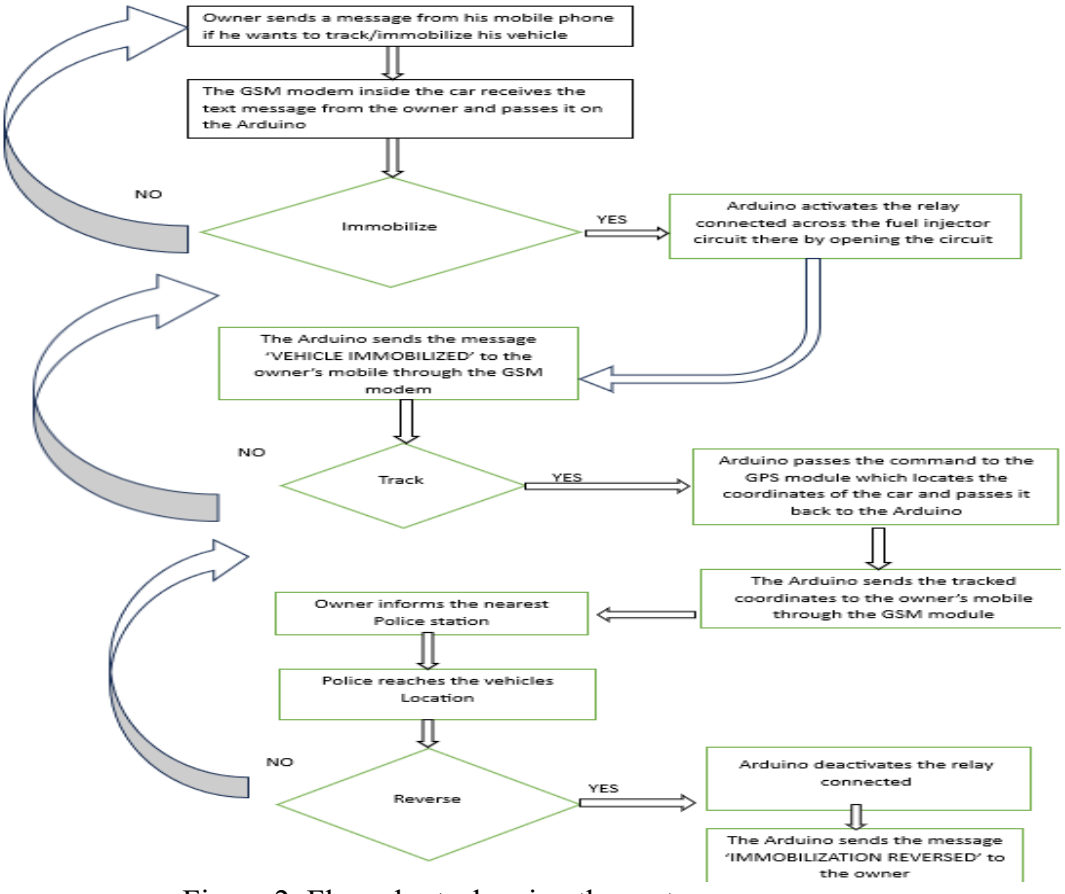

Figure 2: Flow chart showing the system process.

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The above flow chart describes the overview of the project.
Owner sends a message from his mobile phone if he wants to track /immobilize his vehicle (when his/her vehicle is said to theft). When the message send towards the device The GSM modem inside the car receives the text message from the owner and passes it on the Arduino. If it is said to be immobilize then Arduino activates the relay connected across the fuel injector circuit there by opening the circuit. (here the function of relay is that stops the flow of the fuel towards the engine when it is immobilized).if no then cycle goes on toward 1st stage as shown in the flow chart.
The Arduino sends the message "VEHICLE IMMOBILIZED" to the owner's mobile through the GSM modern. By this easily we can track the vehicle if no, the cycle repeats until it tracks as shown in the flow chart. when the vehicle has been tracked then Arduino passes the command to the GPS module which locates the coordinates of the car and passes it back to the Arduino.
After receiving the message the Arduino sends the tracked coordinates to the owners module through the GSM module. The owner informs to the nearest police station recording his complaint and receive the vehicle from police otherwise the cycle goes on has shown on the flow chart. If he receive his vehicle then Arduino deactivates the relay connected and finally the Arduino sends the message IMMOBILIZATION REVERSED to the owner by this relay again make a connection to flow the fuel towards the engine.

DESIGN AND IMPLEMENTATION

The next part report has been organized thus:
A. Hardware implementation
B. Software implementation
C. Results and observations
. Hardware implementation: The system can be broadly divided into three parts:
1) The GSM modem
2) The GPS module
3) The Immobilization Circuitry
Whenever necessary, communication with the car is conducted using the GSM modem. GSM networks are now virtually universally available because to advances in GSM technology.
It has been decided to use the GSM network as the communication medium due to its widespread use. Here, a GSM TTL SIM900A modem based on the SIM900A module has been used, one of the modem alternatives available. It offers quick and reliable performance and supports frequencies between 900 and 1800 MHz.
The Arduino microcontroller, which controls interior vehicle activities, is interfaced with the GSM modem.
The interface of the modem is depicted in the sketch in Figure 2.

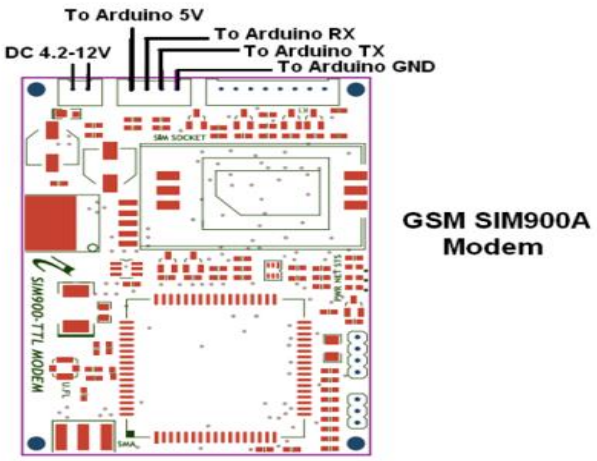

Figure 3: interfacing of GSM

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The GPS component

The most crucial vehicle tracking functionality is provided by the GPS module. When the Arduino requests the vehicle's current coordinates, the GPS module, which is also interfaced with the Arduino, responds with them.

The interface between the GPS module and the Arduino microcontroller is shown in the following sketch. Since the GSM modem already uses the built-in serial port on pins 0 and 1, it was necessary to establish emulated ports on pins 2 and 3 using a software serial library.

The sketch in Figure 3 shows the interfacing of the GPS module.

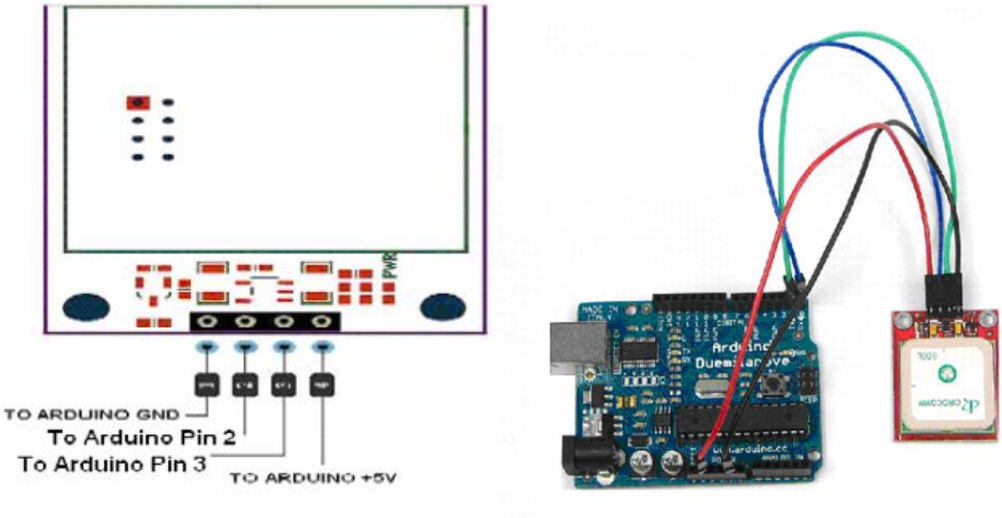

Figure 4: Interfacing GPS module

Circuitry for immobilization

The immobilization circuitry comprises of a normally closed (NC) 5V SPDT relay installed on the fuel injector line and managed by the Arduino via one of its digital pins. The digital pin attached to the relay goes HIGH when the Arduino receives the order "IMMOBILIZE" from the owner via the GSM modem, which cuts the electrical signals to the fuel injector and immobilizes the car.

A 'REVERSE' order from the owner can undo the immobility by bringing the digital pin low once more and completing the fuel injector circuit.

The relay is connected to the Arduino and the fuel injector line in Figure 4's subsequent sketch.

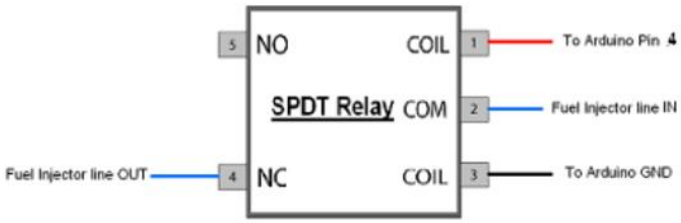

Figure 5: Immobilization circuitry

Software implementation: The code that must be entered into the Arduino microcontroller is covered in the software section. The code's structure is as follows, and it executes in an infinite loop:

1. READ THE GSM MODEM MESSAGE
2. If MESSAGE equals "TRACK"

• SEND LOCATION COORDINATES TO OWNER'S MOBILE PHONE • READ LOCATION FROM GPS MODULE

3. OPEN FUEL INJECTOR CIRCUIT BY ACTIVATING RELAY IF MESSAGE = "IMMOBILIZE"

• SEND A MESSAGE SAYING "IMMOBILIZATION SUCCESSFUL" TO THE OWNER'S CELL PHONE

4. If the message reads "REVERSE," shut off the fuel injector circuit by deactivating the relay and send the message "Immobilization Reversed" to the owner's cell phone.

5. SEND "INVALID MESSAGE, TRY AGAIN" MESSAGE TO OWNER'S CELL PHONE FOR ANY OTHER MESSAGE

6. END

C. Findings and observations: This system performed admirably throughout testing on various different autos.

Under clear skies, it took the GPS module an average of 45 to 90 seconds to determine the location. The entire tracking process, from the time the 'TRACK' message was sent until the message containing the tracked locations was received, took, on average, 150 seconds.

It was found that the tracking might proceed more quickly with a longer antenna. Tracking the car takes longer in cloudy or rainy conditions.

Without a hitch, the immobilization and reversing functions operated. The tasks required an average of 60 seconds to complete, and it took 90 to 120 seconds for the owner's mobile device to get a message confirming their accomplishment.

The GSM network's connectivity and speed had a significant impact on the operating time. Despite the fact that connectivity is now almost widespread, the network's strength varies and is weaker.

rural regions. The speed of message delivery is strongly correlated with network speed, and it has been observed that during times of network congestion, message delivery might take up to five minutes.

TABLE I. FUNCTION EXECUTION AND CONFIRMATION TIMELINE

Function	Average time of execution	Average time for return message
Track	90 seconds	150 seconds
Immobilize	60 seconds	120 seconds
Reverse	60 seconds	120 seconds

A clause that restricts the system to only responding to messages from his number can be included to ensure that only the car owner uses the security features. As an alternative, the owner may be the only one with access to the car security system's phone number, which would work as a security code and enable him to use these features from any cell phone.

The module is powered directly from the vehicle's battery to guarantee a steady source of power. When the device is not in use, very little power is consumed. The 20mA to 30mA range is the current intake. As a result, the system can operate for a very long time on a car battery. The automobile battery is the ideal power source for our module because almost all vehicles already have a charging system in place that charges the battery while the car is moving.

Result

The Figure5 below shows the working of the three functions as seen from the owner's mobile phone.

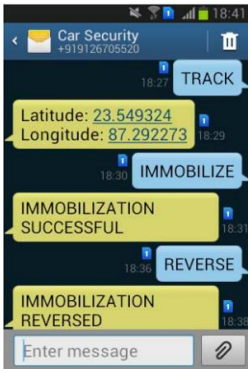

Figure 6: Screenshot of owner's mobile showing working

An Android app that can extract the coordinates from a text message and plot them on Google maps was created to supplement the tracking capability. It would provide a more user-friendly interface for the owner to understand where his automobile is now located.

Conclusion

The created technology offers sufficient security against theft. Effective usage of the immobilization feature essentially eliminates the potential of theft by adding an additional layer of security. The tracking feature is a great tool for finding the stolen car in the event of theft. The likelihood of a car recovery is very high when utilized in conjunction with the immobilization feature and a prompt police force.

The system does have certain drawbacks, though. The main drawback occurs if the stolen car is kept in a concrete garage or shade, which makes it impossible for the GPS module to track it. Given that stolen automobiles are frequently kept hidden for a while before being brought out again, it could pose a serious problem. However, there is a good probability of catching the theft before it can hide if it is swiftly discovered and tracked.

The theft can also be prevented if the Anti-theft module is discovered and destroyed before it is activated. The majority of this can be prevented by putting the module in a concealed location, of which there will be several if the vehicle is vast.

An antenna can be used to expose the GPS module to the outside environment as needed.

With the addition of more sensors, this module can be further enhanced or advanced by the inclusion of other functions, such as one that notifies the owner if the Anti-theft module is being attempted to be destroyed. Additionally, a feature can be included that allows the owner to set an alarm to remotely monitor the ignition process and alert him if an ignition occurs (which could signify a theft).

The key goal has been to maintain this system's simplicity and economy without sacrificing its dependability. This technique, if widely used, will significantly lessen the risk of vehicle theft and spare owners of those vehicles thousands in insurance costs and other losses.

Acknowledgement

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