



EMBEDDED BASED VEHICLE THEFT DETECTION

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Abstract— In recent years vehicle theft has become a major issue. The number of vehicles theft increasing day by day. The safety and security of the vehicle is essential. Alarm also connected to the vehicle to indicate the theft but does not appear feasible, since the wires can be disconnected before the vehicle is the stolen. Vehicle theft cannot be prevented but after the theft vehicle can be traced by using traditional method that includes tracking using GPS. The project aims in building vehicle theft detection and tracking system that helps us to identify the location of the vehicle. Additional procedure is included to cut-off the ignition system, so that the engine cannot be started. The project also includes notification system that sends message, whenever the ignition is turned on

Index Terms— Security, Solenoid valve, Theft Detection, Tracking

I. INTRODUCTION

In the last few decades, India has progressed at such an enormous rate that many companies have strongly established themselves here. These companies bring a huge amount of workforce with them. Arranging transportation to such a huge mass is a cumbersome task involving many intricacies. Generally, this transport is arranged through the local transport vendors on a yearly contract basis, recently happen mishaps such as burglary, rape cases etc. The development of satellite communication technology is easy to identify the vehicle locations. Vehicle tracking systems have brought this technology to the day-to-day life of the common person. Today GPS used in cars, ambulances, fleets and police vehicles are common sights on the roads of developed countries. All the existing technology support tracking the vehicle place and status. The GPS/GSM Based System is one of the most important systems, which integrate both GSM and GPS technologies. It is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world. This system designed for users in land construction and transport business, provides real-time information such as location, speed and expected arrival time of the user is moving vehicles in a concise and easy-to-read format. This system may also useful for communication process among the two points. Currently GPS vehicle tracking ensures their safety as travelling. This vehicle tracking system found in vehicles as a theft prevention and rescue device. Vehicle owner or Police follow the signal emitted by the tracking system to locate a robbed vehicle in parallel the stolen vehicle engine speed going to decreased and pushed to off. Google maps are used to view vehicle's location. After switch of the

engine, motor cannot restart without permission of password. Vehicle tracking usually used in navy operators for navy management functions, routing, send off, on board information and security. The applications include monitoring driving performance of a parent with a teen driver. Vehicle tracking systems accepted in consumer vehicles as a theft prevention and retrieval device. If the theft identified, the system sends the SMS to the vehicle owner. After that vehicle owner sends the SMS to the controller, issue the necessary signals to stop the motor.

A) PROBLEM STATEMENT

Most of our daily activities take place outside our home. Because of this, transportation affects every aspect of our lives especially in doing our daily routines such as going to work, school, mall, bank, gym, etc., and even back to our home. Motorcycle is one of the least expensive and a convenient mode of transportation for all people. Unfortunately, it is easy to steal, and difficult to track the vehicle, even appeal will take long time to sort it out. To avoid these long procedures, this project can be implemented to track the vehicle faster.

B) OBJECTIVE

This is an efficient system for automobiles. In this system uses modern techniques of GPS (Global Positioning System) and GSM (Global System for Mobile Communication) to get perfect output as these two systems are the modern and most developed products in this field. This is a 2 in 1 system, initially it prohibits any unauthorized use of vehicle by locking its ignition system which could not be accessed without owner's consent.

In case of theft, this system would provide effective tracking of vehicle through which owner can track the vehicle easily as it instantly prompts user about theft after very next second of theft Also, after theft it starts providing location, co-ordinates to user immediately after theft and continues to send these co-ordinates after prescribed time intervals through which owner can easily track the vehicle and get it back by getting help from law enforcing agencies. In addition to all these features owner can also track the vehicle through SMS if vehicle is in authorized access. Using this feature owner could monitor the vehicle if it is in use of some friend or family members. Also, parents can keep an eye on their children using this feature of our proposed project.

II. LITERATURE REVIEW

The developed system in [1], for avoiding vehicle theft makes use of a mobile phone that is embedded in the vehicle with an interfacing to Engine Control Module (ECM) through Control Area Network (CAN) Bus, which is in turn, communicated to the ECM. The vehicle being stolen can be stopped by using GPS feature of mobile phone and this information is used by the owner of the vehicle for future processing. The owner sends the message to the mobile which is embedded in the vehicle which has stolen which in turn controls the vehicles engine by locking the working of the engine immediately. The developed system accepts the message and broadcasted to the Vehicle Network through CAN Bus. The engine can be unlocked only by the owner of the vehicle by sending the message again. The goal behind the design is to develop security for vehicles and Embedded system to communicate with engine of the vehicle.

In [2], The user can access the quantity of fuel in the tank through this GSM and GPS technology. The keypad is unlocked using the secret password. A signal is sent for fuel verification. If fuel is beyond the range of the sensor the buzzer will go "on" for two minutes and simultaneously a text message is sent to the owner. The intruder can't stop the buzzer and if the buzzer is not stopped within two minutes, then it will be treated as a theft of fuel and vehicle and a message is sent to the police station and to previously stored numbers with coordinates of that location.

In [3], a novel method of vehicle tracking and locking system used to track the theft vehicle by using GPS and GSM technology. This system puts into sleeping mode while the vehicle handled by the owner or authorized person otherwise goes to active mode, the mode of operation changed by in person or remotely. If any interruption occurred in any side of the door, microcontroller is interrupted and SMS is sent to the microcontroller. The controller issues the message about the place of the vehicle to the car owner or authorized person. When send SMS to the controller, issues the control signals to the engine motor. Engine motor speeds are gradually decreasing and come to the off place. After that all the doors locked. To open the door or restart the engine, authorized person needs to enter the passwords. In this method, tracking of vehicle place easy and doors locked automatically, thereby thief cannot get away from the car.

While going for work after riding the vehicle, the antitheft system must be kept in the active mode with the help of a switch present in the system [4]. If anyone by chance starts the vehicle which is already in active mode, the voltage in the circuit becomes high which gives the signal to the microcontroller. This microcontroller again sends signal to the GSM, GPS and GPRS system to send SMS to the owner, and also its location like Longitude, Latitude and speed of the vehicle through GPS to GSM and GSM sends the SMS to the owner. If the owner finds any threat to the vehicle, then the owner with the help of SMS, he will cut off the ignition by switch off the spark plug with the help of relay and fuel supply to the engine with the help of the solenoid valve.

In [5], detection of vehicle starts, tracking the vehicle's location using GPS is being implemented and also remotely locking the engine which is implemented using an android application that will be present with user's phone. In the system the GPS track's location of vehicle. Here both the ignition key as well as the start button in the app must be used to start/stop the vehicle. SMS alert is sent to user upon vehicle start and also in case of rash driving conditions. Then owner using the lock option in android app to lock the vehicle permanently. This will help the user from preventing the theft of the vehicle. The android app mainly used to start/stop the vehicle, engine locking function and also to monitor the movement of the vehicle at any given time with its latitude and longitude.

In [6], lot of mobile applications installed in user's smartphone, especially student who download some mobile application for education purpose and manage their task using the mobile application. Nowadays, Internet connection in student smartphone is necessary since they need full internet access to know the current issue and use the facility for discussion through the mobile application. Real-Time Campus University Bus Tracking Mobile Application's project is believed to help student in managing their trip to class. Beside students are able to use the Real-Time Campus University Bus Tracking Mobile Application as an opportunity to make a complaint to be heard by management.

In [7] author described that, by using Image Processing or recognition techniques system can avoid vehicle theft and protect the usage of unauthenticated users. Secured and safety environment system for automobile user and key points for the investigators can easily find out the hijacker's image. System can predict the theft by using this system in our day-to-day life. Also; the GSM modem provides information to the user on his request. This is reliable and efficient system for providing security to the vehicle through GSM and GPS.

In [8], system is designed to develop a system that can help people to track the location of the bus. This feature can make UiTM student easier to take the UiTM bus as their transportation in daily life. The information will be shown to the user's smartphone which is the smartphone is the requirement for every people nowadays. Furthermore, this system help student to manage their time without in hurry. Student can estimate how much the time taken for done their work while taking for the bus. Besides, this friendly user system can produce the information of bus destination which can prevent from user taking the wrong bus route. In the notification, user can know where the destination of the bus so it helps user to decide whether user want to take the bus or not.

III. PROPOSED METHODOLOGY

Nowadays GPS devices are becoming smarter day by day. Modern devices lock their connection with satellites very strongly even in dense areas as well as remote areas. On an average GPS device of Garmin are more accurate within a

threshold of 15 meters, on the other hand latest versions of Garmin GPS receivers are smarter and accurate up to 3 to 5 meters’ distance on average. System consists of step-down transformer, bridge rectifier, capacitors and voltage regulator ICs. 230V AC is converted to 12V DC using transformer and bridge rectifier. This 12VDC is further reduced to 5V DC using voltage regulator IC. Here the buzzer is used to give the beep sound when the vehicle theft is detected. Here the buzzer used is piezoelectric type and of 5 Volts. Solenoid valve is an electromechanical device. The valve is operated by electric current passed through the solenoid. Through this valve the outflow of the fluid can be allowed or restricted. Solenoid valve uses less power, accurate in working, gives longer life and compact design. While we go for work after riding the vehicle, the antitheft system must be kept in the active mode with the help of a switch present in the system. If anyone by chance starts the vehicle which is already in active mode, the voltage in the circuit becomes high which gives the signal to the microcontroller. This microcontroller again sends signal to the GSM, GPS and GPRS system to send SMS to the owner, and also its location like Longitude, Latitude and speed of the vehicle. If the owner finds any threat to the vehicle, then the owner with the help of SMS, he will cut off the ignition by switch off the spark plug with the help of relay and fuel supply to the engine with the help of the solenoid valve. Fig 1 shows the block diagram of proposed system.

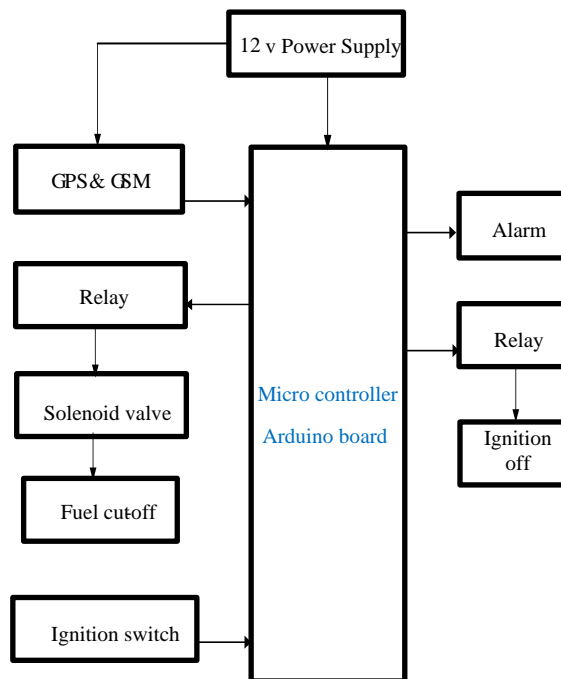
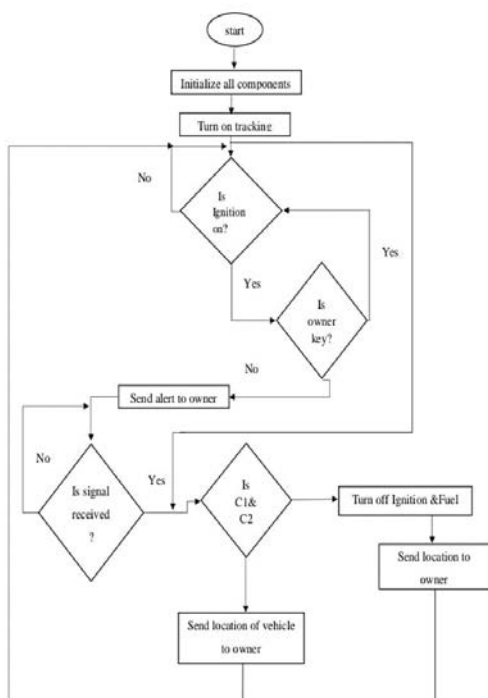


Fig 1: Block diagram of embedded based vehicle theft detection

Fig 2: Flow Chart



When Bike is turn ON the device will activate and it will check whether vehicle is authorized or unauthorized access mode. If vehicle is in unauthorized mode GSM will be used to send an alert SMS to the owner for every 15 seconds and also send current vehicle location to the owner for every 30 seconds. From this the owner will get conformation that vehicle is with unauthorized person. The owner can control through mobile by sending commands to the device. The device can take control to by locking ignition system and by blocking fuel through solenoid valve will be closed. Fig 2 shows the flowchart of proposed methodology.

The user can able to send SMS from the register mobile number or device, If the user needs to turn ON the vehicle, then “BIKE ON” message is sent it will ON, for vehicle location user needs to send “GET Location, to turn OFF the vehicle then “BIKE OFF” message is sent. In addition, owner can also track the vehicle through SMS if vehicle is in authorized access. Using this feature owner could monitor the vehicle if it is in use of some friend or family members and parking place. Owner can catch the thief and collect their vehicle with help of law agencies

IV. HARDWARE AND SOFTWARE REQUIREMENTS

ESP8266 Microcontroller



Fig 3: ESP8266 Microcontroller

The ESP8266 is a low-cost Wi-Fi microchip, with built-in TCP/IP networking software, and microcontroller capability, produced by Espressif Systems in Shanghai, China. The chip was popularized in the English-speaking maker community in August 2014 via the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

However, at first, there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation. The ESP8285 is a similar chip with a built-in 1 MiB flash memory, allowing the design of single-chip devices capable of connecting via Wi-Fi.

FEATURES

- Processor: L106 32-bit RISC microprocessor core based on the Ten silica Diamond Standard 106Micro running at 80 or 160 MHz

Memory:

- 32 KiB instruction RAM
- 32 KiB instruction cache RAM
- 80 KiB user-data RAM
- 16 KiB ETS system-data RAM

External QSPI flash:

- up to 16 MiB is supported (512 KiB to 4 MiB typically included)
- IEEE 802.11 b/g/n Wi-Fi
- Integrated TR switch, balun, LNA, power amplifier and matching network
- WEP or WPA/WPA2 authentication, or open networks
- 17 GPIO pins
- Serial Peripheral Interface Bus (SPI)
- I²C (software implementation)

- PS interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC

PINOUT

The pinout is as follows for the common ESP-01 module:

- GND, Ground (0 V)
- GPIO 2, General-purpose input/output No. 2
- RX, Receive data in, also GPIO3
- VCC, Voltage (+3.3 V; can handle up to 3.6 V)
- RST, Reset
- TX, Transmit data out, also GPIO

Digital I/O

Just like with a regular Arduino, you can set the function of a pin using pin Mode (pin, mode); where pin is the GPIO number, and mode can be either INPUT, which is the default, OUTPUT, or INPUT_PULLUP to enable the built-in pull-up resistors for GPIO 0-15. To enable the pull-down resistor for GPIO16, you have to use INPUT_PULLDOWN_16.

SOLENOID VALVE WITH ARDUINO

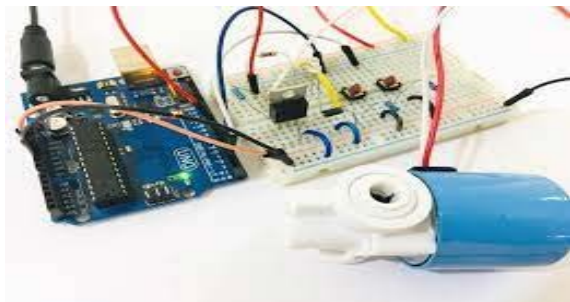


Fig 4: Testing of Solenoid Valve

A solenoid valve is an electromechanical device that uses a magnetic field to control the flow of fluids or gases. It consists of a coil of wire that creates a magnetic field when an electric current is passed through it. This magnetic field then attracts a plunger or armature, which moves inside the valve body to open or close a flow path.

In the case of fuel cut off, an Arduino microcontroller can be used to control a solenoid valve that is connected to the fuel line of an engine. When the Arduino receives a signal indicating that the engine needs to be shut down, it sends a signal to the solenoid valve to close the flow path in the fuel line, thereby cutting off the fuel supply to the engine.

To achieve this, the solenoid valve is connected to a power source and the Arduino through a relay module, which acts as an interface between the high current solenoid valve and the low current Arduino. The Arduino sends a signal to the relay module, which in turn activates the solenoid valve by passing a high current through the coil of wire.

When the solenoid valve is activated, the magnetic field generated by the coil pulls the plunger or armature towards the valve body, which blocks the flow path of the fuel line. As a result, the engine is unable to receive fuel, and it shuts down.

Overall, using a solenoid valve controlled by an Arduino microcontroller is an effective and reliable way to cut off the fuel supply to an engine when needed. This can be useful in situations where safety or security is a concern, such as in emergency shutdowns or anti-theft systems."

V. IMPLEMENTATION

A) STEPS FOLLOWED IN IMPLEMENTATION OF PROJECT

1. Install a solenoid valve in the fuel line of the vehicle. Connect the solenoid valve to a microcontroller
2. Connect a relay module to the microcontroller. This relay module will be used to cut off the power supply to the vehicle.
3. Install a GPS module in the vehicle. Connect the GPS module to the microcontroller
4. Write the code for the microcontroller. The code should continuously monitor the GPS location of the vehicle
5. If the vehicle moves out of a predefined area, the microcontroller should trigger the solenoid valve to cut off the fuel supply to the engine.
6. At the same time, the microcontroller should trigger the relay module to cut off the power supply to the vehicle.
7. The system should send an alert to the owner's phone or an authorized security personnel's phone, indicating that the vehicle has been stolen and its GPS location.
8. The owner or security personnel can then use the GPS location to track and recover the vehicle.

B) DESCRIPTION OF PROJECT

Vehicle theft detection using a solenoid valve to cut off fuel supply, a relay module to cut off power supply, and GPS for tracking of the vehicle is a security system that is designed to prevent vehicle theft and aid in the recovery of stolen vehicles. The system is composed of several components that work together to provide comprehensive security coverage.

The solenoid valve is installed in the fuel line of the vehicle, and it can be activated remotely using a wireless signal. When the solenoid valve is activated, it shuts off the fuel supply to the engine, which makes it impossible for the thief to drive the vehicle.

The relay module is also installed in the vehicle, and it is used to cut off the power supply to the engine. When the relay module is activated, it disables the ignition system, preventing the engine from starting. This feature ensures that even if the thief bypasses the fuel supply cut-off, they still won't be able to start the vehicle.

The GPS tracking system is used to monitor the location of the vehicle at all times. The GPS device is installed discreetly in the vehicle, and it transmits the location data to a central monitoring system. If the vehicle is stolen, the owner can

report the theft and the monitoring system can track the location of the vehicle, allowing law enforcement to recover the stolen vehicle quickly.

Overall, this security system is a highly effective way to prevent vehicle theft and increase the chances of recovering stolen vehicles. By combining a fuel cut-off system, a power supply cut-off system, and GPS tracking, this system provides comprehensive protection against vehicle theft. Fig 5 shows the Top View of the Project.

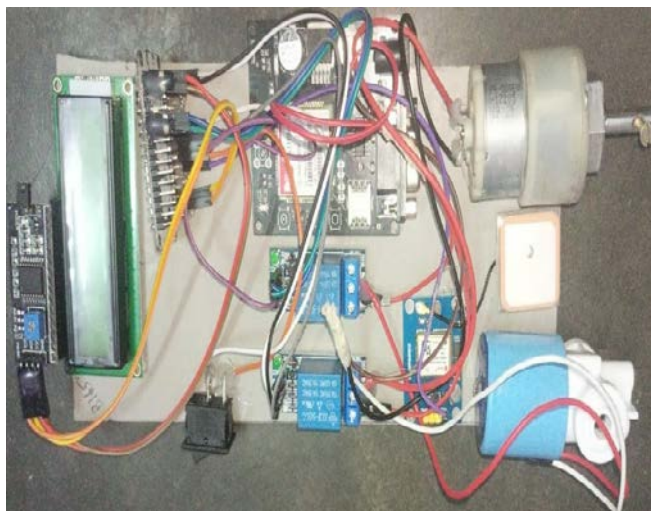


Fig 5: Top View of the Project

VI. CONCLUSION

The use of a solenoid valve to cut off fuel supply, a relay module to cut off power supply, and GPS for vehicle tracking can effectively detect and prevent vehicle theft. The solenoid valve and relay module work together to immobilize the vehicle by cutting off its power and fuel supply, making it difficult for the thief to operate the vehicle. The GPS tracking system allows the vehicle owner to track the location of the vehicle in case of theft and provides valuable information to law enforcement agencies for recovery. Overall, this system provides a comprehensive approach to vehicle theft prevention and recovery.

a) FUTURE SCOPE

The use of solenoid valves and relay modules in combination with GPS tracking technology for vehicle theft detection is a promising area with a lot of potential for future development. This type of system has the potential to be very effective in preventing vehicle theft, as it can quickly and easily disable the vehicle's fuel and power supply, as well as track the vehicle's location in real-time.

One of the main advantages of using solenoid valves and relay modules is that they can be easily integrated into the existing electrical and mechanical systems of most vehicles. This means that the system can be relatively simple and cost-effective to install, with minimal modifications required to the vehicle itself.

Another advantage of using GPS tracking technology is that it allows for real-time monitoring of the vehicle's location, which can help law enforcement officials to quickly recover stolen vehicles and apprehend thieves. Additionally,

this type of system can be used to remotely disable a stolen vehicle, making it more difficult for thieves to evade capture.

Overall, the future scope of vehicle theft detection using solenoid valves, relay modules, and GPS tracking technology is very promising. As these technologies continue to improve and become more widely available, we can expect to see more effective and sophisticated anti-theft systems being developed for vehicles.

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