

# Design and Implementation of Vehicle Tracking System Using Can Protocol

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**Abstract:** -- Avoiding Vehicle Theft is making buzz in present automobile industry. Design and development of a theft control system for an automobile, can be achieved by making use of ARM LPC2148, GSM and GPS. The developed system makes use of an GSM 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 SMS feature of GSM and GPS is used to get the location information and this information is used by the owner of the vehicle for future processing. The owner sends the message to the GSM 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 accept 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.

**Keywords:** Controller Area Network Bus ; Engine Control Unit; Vehicle Network ; Mobile Phone ; GPS ; GSM ; Theft Control Unit.

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## 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 [1].

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 clients 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. After switch of the engine, motor cannot restart without permission of password. This system installed for the four wheelers, 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.

In [2], the hardware and software of the GPS and GSM network were developed. The proposed GPS/GSM based System has the two parts, first is a mobile unit and another is controlling station. The system processes, interfaces, connections, data transmission and reception of data among the mobile unit and control stations are working successfully. These results are compatible with GPS technologies.

In [3], a vehicle tracking system is an electronic device, installed in a vehicle to enable the owner or a third party to track the vehicle's place. This paper proposed to design a vehicle tracking system that

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works using GPS and GSM technology. This system built based on embedded system, used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). This design will continuously watch a moving Vehicle and report the status of the Vehicle on demand. In [4], Face Detection System used to detect the face of the driver, and compare with the predefined face. The car owner is sleeping during the night time and someone theft the car. Then Face Detection System obtains images by one tiny web camera, which is hidden easily in somewhere in the car. Face Detection System compared the obtained images with the stored images. If the images don't match, then the information sends to the owner through MMS. The owners get the images of the thief in mobile phone and trace the place through GPS. The place of the car and its speed displayed to the owner through SMS. The owner can recognize the thief images as well as the place of the car and can easily find out the hijackers image. This system applied in our day-to-day life.

In [5], this system provided vehicle cabin safety, security based on embedded system by modifying the existing modules. This method monitors the level of the toxic gases such as CO, LPG and alcohol within the vehicle provided alert information as alarm during the dangerous situations. The SMS sends to the authorized person through the GSM. In this method, the IR Sensor used to detect the static obstacle in front of the vehicle and the vehicle stopped if any obstacle detected. This is avoiding accidents due to collision of vehicles with any static obstacles. In [6], Kai-Tai Song and Chih-Chieh Yang have a designed and built on a real-time visual tracking system for vehicle safety applications. In this paper built a novel feature-based vehicle-tracking algorithm, automatically detect and track several moving objects, like cars and motorcycles, ahead of the tracking vehicle. Joint with the concept of focus of expansion (FOE) and view analysis, the built system can segment features of moving objects from moving background and offer a collision word of warning on real-time. The proposed algorithm using a CMOS image sensor and NMOS embedded processor architecture. The constructed stand-alone visual tracking system validated in real road tests. The results provided information of collision

warning in urban artery with speed about 60 km/hour both at night and day times.

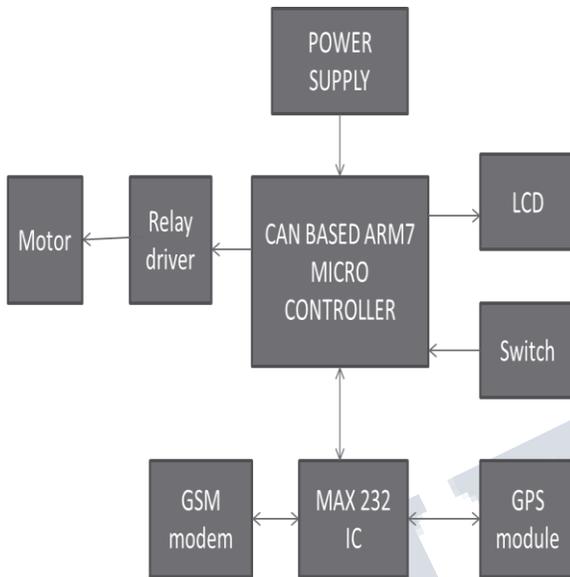
In [7], the remote monitoring system based on SMS and GSM was implemented. Based on the total design of the system, the hardware and software designed. In this paper, the GSM network is a medium for transmitting the remote signal. This includes two parts that are the monitoring center and the remote monitoring station. The monitoring centers consist of a computer and communication module of GSM. The software-monitoring center and the remote monitoring station implemented by using VB. The result of this demonstration shows that the system can watch and control the remote communication between the monitoring center and the remote monitoring station. In [8] this paper, the proposed tracking system based on cloud computing infrastructure. The sensors are used to monitor the fuel level, driver conditions, and speed of the vehicle. All the data transferred to cloud server using GSM enabled device. All the vehicles equipped with GPS antenna to locate the place. To avoid the drunk and drive, the alcohol sensor installed to monitor the driver status. The proposed technology significantly avoids the accident in highways.

## **II. CAN BASED LOCKING AND UNLOCKING OF THEFT VEHICALS SYSTEM**

In this proposed work, 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. In active mode any interruption occurred in ignition of the vehicle then GSM sends SMS to the vehicle owner about the thefting. The controller issues the message about the place of the vehicle to the owner or authorized person using GPS and GSM. When send SMS to the controller, issues the control signals to the engine motor. Engine motor speeds are gradually decreases and come to the off place. To restart the engine, authorized person needs to send the unlock message. In this method, tracking of vehicle place easy and locked automatically, thereby thief cannot get away from the vehicle.

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The Block diagram of Vehicle tracking and locking system based on GSM and GPS technology is shown in below figure. This consists of the ARM7 LPC2148 microcontroller, GSM, GPS, Power Supply and LCD.

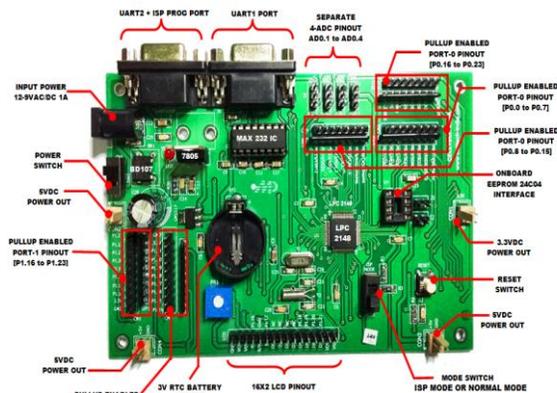


**Fig 1. Block Diagram of Proposed System**

**A. Anti-Theft System Components**

**1) ARM7 LPC2148**

The main key in the proposed system is the CAN based ARM7 LPC2148 Development Board. ARM Seven Development Board is a powerful platform which comes with a micro controller on-chip memory. These boards are ideal for developing embedded applications like high speed wireless communication, real time data monitoring and control, interactive control panels and USB based data logging. Manufactured from double sided PTC and PCB material, these boards provide extra strength to the connector joints for increased reliability. ARM Seven Development Board can support the operating supply voltage ranging from 7V to 14V and comes with a built-in reverse polarity protection.



**Fig. 2. ARM7 Microcontroller**

**2) GPS Module**

GPS Technology The Global Positioning System (GPS) is a satellitebased navigation system consists of a network of 24 satellites located into orbit. The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. GPS works in any weather circumstances at anywhere in the world. Normally no subscription fees or system charges to utilize GPS. A GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track movement. With four or more satellites in sight, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the vehicle position has been determined, the GPS unit can determine other information like, speed, distance to destination, time and other. GPS receiver is used for this research work to detect the vehicle location and provide information to responsible person through GSM technology.



**Fig. 3. GPS Module**

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### 3) GSM SIM800L

The GSM modem is a specialized type of modem which accepts a SIM card operates on a subscriber's mobile number over a network, just like a cellular phone. It is a cell phone without display. Modem sim300 is a tri-band GSM/GPRS engine that works on EGSM900MHz, DCS1800MHz and PCS1900MHz frequencies. GSM Modem is RS232-logic level compatible, i.e., it takes -3v to -15v as logic high and +3v to +15 as logic low. MAX232 is used to convert TTL into RS232 logic level converter used between the microcontroller and the GSM board. The signal at pin 11 of the microcontroller is sent to the GSM modem through pin 11 of max232. This signal is received at pin2 (RX) of the GSM modem. The GSM modem transmits the signal from pin3 (TX) to the microcontroller through MAX232, which is received at pin 10 of IC.



**Fig. 4. GSM Module**

#### Features of GSM:

- Single supply voltage 3.2v-4.5v
- Typical power consumption in SLEEP Mode: 2.5mA.
- SIM300 tri-band

#### B. Debugging and Testing Process

A microcontroller-based system is a complex activity that involves hardware and software interfacing with the external world. Doing well design of a microcontroller-based system requires skills to use the variety of debugging and testing tools available. The debugging and testing of microcontroller-based systems divided into two groups: software-only tools and software-hardware tools. Software-only tools come as monitors and simulators, which are independent of the hardware under development. Software-hardware tools

are usually hardware dependent, more expensive and range from in-circuit emulators and in-circuit simulators to in-circuit debuggers. In general, the higher the level of integration with the target hardware, the greater the benefit of a tool, resulting in a shorter development time, but the greater the cost as well. The factors to consider when choosing a debugging tool are cost, ease of use and the features offered during the debugging process.

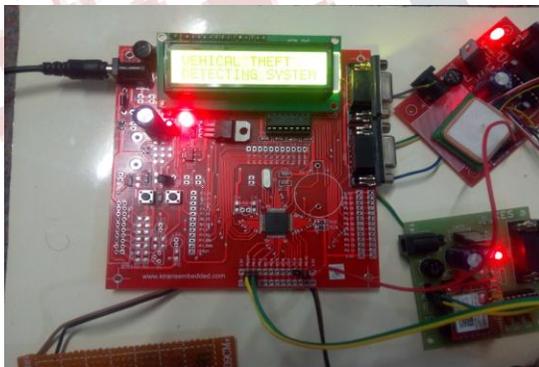
A software simulator is a computer program running on an independent hardware and it simulates the CPU, the instruction set and the I/O of the target microcontroller. Simulators offer the lowest-cost development tools for microcontroller-based systems and most companies offer their simulator programs free of charge. The user program operated in a simulated environment where the user can insert breakpoints within the code to stop the code and then analyze the internal registers and memory, display and change the values of program variables and so on. Incorrect logic or errors in computations can analyze by stepping through the code in simulation. Simulators run at speeds 100 to 1000 times slower than the actual micro controller hardware and, thus, long time delays should avoid when simulating a program.

Micro controller based systems usually have interfaces to various external devices such as motors, I/O ports, timers, A/D converters, displays, push buttons, sensors and signal generators, which are usually difficult to simulate. Some advanced simulators, such as the Proteus from Labcenter Electronics allow the simulation of various peripheral devices such as motors, LCDs, 7-segment displays and keyboards, and users can create new peripheral devices. Inputs to the simulator can come from files that may store complex digital I/O signals and waveforms. Outputs can be as form of digital data or waveforms, usually stored in a file, or displayed on a screen. Some simulators accept only the assembly language of the target microcontroller. Most of the microcontroller software has written a high-level language such as C, Pascal or Basic, and it has become necessary to simulate a program has written in a highlevel language.

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### III. OPERATION AND EXPERIMENTAL RESULTS

Results are obtained after carrying out the experimentation by using the following hardware components. The component includes Android Based Phone, ARM Controller, Relay Circuit, GSM Module, and LCD Display. Fig. 6 shows ARM Controller, Relay circuit, GSM Module and LCD Display are interfaced on a single board and embedded on single board which is embedded to a vehicle as a control unit. The relay is connected to the Vehicle Engine Unit of the Automobile. Hardware Kit embedded to the vehicle When “OFF” message sent by the owner of the vehicle to the mobile embedded in the control unit, the controller displays the message in the LCD and invokes the relay that is connected to the vehicle engine which will stop fuel flow thus locking the vehicle engine by sending message through the CAN Bus in the CAN readable format. Similarly when “ON” message sent by the owner of the vehicle to the mobile embedded in the control unit, the controller displays the message in the LCD and invokes the relay that is connected to the vehicle engine which will in turn allows the fuel flow by unlocking the vehicle engine by sending message through CAN Bus



*Fig 5. Hardware setup of Proposed System*

### IV. CONCLUSION

In this paper, we have proposed a novel method of vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. This system puts into the sleeping mode

vehicle handled by the owner or authorized persons; otherwise goes to active mode. The mode of operations changed by persons or remotely. The developed system is less expensive vehicle tracking control system that could be implemented on any vehicle since the system is developed by using mobile and GSM technology which is operated by sending and receiving messages. The vehicle engine ignition system can be controlled by reading the message received. The Proposed system can be deployed on any automobile, less expensive and ignition of an engine can be controlled being at the remote place, encompasses some advantages of the system. Therefore, the Mobile based Vehicle Theft control Unit (TCU) provides an easier and featured tracking system. Also helps the owner of the vehicle to have an easy remote control of the theft vehicle.

### V. FUTURE ENHANCEMENT

The system can be enhanced by using on chip Ethernet and image processing modules. By interfacing web camera we capture the images of the thief and by using internet we share this information to the shared medium.

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