



# **An Intelligent Tracking System Based on GSM and GPS Using Smartphones**

Vigneshwaran.K<sup>1</sup>, Sumithra.S<sup>2</sup>, Janani.R<sup>3</sup>

PG Student (M.E-Communication Systems), Pavendar Bharathidasan College of Engineering and Technology,  
Tiruchirappalli, Tamilnadu, India<sup>1&3</sup>

Associate Professor, Department of ECE, Pavendar Bharathidasan College of Engineering and Technology,  
Tiruchirappalli, Tamilnadu, India<sup>2</sup>

**ABSTRACT:** In automobile field, the security and theft prevention are one of the main areas in current scenario. The security goals are achieved by the GSM, GPS technology. But it is commonly used the four wheeler and not in the two wheeler. Using these technologies, we can only track and monitor the vehicle. Previously, GPS is used to get the vehicle current position of the two wheelers and that data will be send to the user mobile phone through the GSM. In this system, we implement for theft prevention in two wheeler using GSM, GPS and Android technology. We can track, monitor and stop the stolen two wheelers too by this system. The two wheeler position is obtained by the GPS module, which is send to the microcontroller, which then sends the message to the user smart phone through the GSM module. In this implementation we use Atmel microcontroller, air solenoid and water solenoid valves are interfaced with GSM modem and GPS module which will be fixed in the two wheeler. User can stop the two wheeler when the vehicle under theft by android application.

**KEYWORDS:** Tracking, Global Positioning System (GPS), Global System for Mobile Communication (GSM), Microcontroller, vehicles

## **I. INTRODUCTION**

Vehicle tracking system is a miniature model of Global Positioning System(GPS). GPS is used to find out the position or location of the vehicle around the world. This implementation introduces an Android based tracking and theft prevention system.

The peltier unit is attached at the exhauster along with the Thermal Electric Generator (TEG). Through this unit the heat energy is converted into power using the peltier effect. The generated power will be stored in battery used in two wheelers.GPS will be fixed in the vehicle to monitor current position of the vehicle. With the help of the GPS value, we can calculate the distance with respect to time. The direction and the distance are fed into the microcontroller and that will be transmitted to GSM through digital modulation techniques.

At the receiver end the signal will be detected and demodulated with digital demodulation technique. Then the signal will be given to Android mobile. Android mobile is used to control the air solenoid, water solenoid and power cable in vehicle engine system.The GPS, GSM is interface with microcontroller to track and give the message to the owner of the two wheeler. Android application is used to control mechanical element such as air solenoid and water solenoid. This android application is specifically designed for this implementation.The software for the microcontroller interfacing with GSM, GPS is written in Embedded C, that code run through the AVR studio.

The main problem of the current system is only monitor the theft vehicle and complaint to the police department .then they take legal action against complaint. It takes long time to gets their vehicle back. This system mainly approach in four wheeler.Even if it is GPS enabled vehicle, we can only track and monitor the vehicle .we cannot stop the stolen vehicle.The objective is to track the stolen two wheeler and to stop it using AIR SOLENOID and WATER SOLENOID.The main advantage of the application is that security will increase in the two wheelers and theft will directly be prevented by the consumer using low cost technology.



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Automobile theft has increased in the world and also in India. According to the NCRB data, 8,171 motor vehicles were stolen in Delhi in 2012. It is a serious problem in automobile field. This issue is a motivation to design this system.

## II. RELATED WORKS

Several security and tracking systems are designed to assist corporations with large number of vehicles and several usage purposes. They can't permit the owner to communicate with the vehicle online, even if the owner is certain that his vehicle was stolen. The proposed security system in this paper is designed to track and monitor vehicles that are used by certain party for particular purposes, also to stop the vehicle if stolen and to track it online for retrieval, this system is an integration of several modern embedded and communication technologies. To provide location and time information anywhere on Earth, the Global Positioning System (GPS) is commonly used as a space-based global navigation satellite system. The location information provided by GPS systems can be visualized using Google Earth. In wireless data transporting, GSM and SMS technology is a common feature with all mobile network service providers. Utilization of SMS technology has become popular because it is an inexpensive, convenient and accessible way of transferring and receiving data with high reliability. If the car starts running, the client receives a confirmation SMS that it is running now. If this is illegal operation or any intruders try to run the car, the owner can send SMS to switch off the car. Afterwards, the system will check the mobile number for received message, to confirm that the phone number could access the security system.

### A. Anti-theft tracking system:

The system has two main units. The first is security unit which is embedded in the vehicle. This unit consists of a GSM modem, GPS receiver, control relay, current sensor and Microcontroller. The current sensor will send an analog signal to the microcontroller when the car is running. The microcontroller will send SMS directly to the owner for confirmation. NC control relay contacts are connected with the hot line that powers the fuel pump and ECM.

The microcontroller can send a signal to the relay to cut off the power, when received SMS contains code from owner mobile to stop it. The GPS Receiver retrieves the location information from satellites in the form of latitude and longitude readings in real-time. The Microcontroller processes the GPS information and transmits it to the user using GSM modem by SMS for every 10 minutes.

The Microcontroller also reads engine parameters from vehicle data port (OBD-II) and sends them to the second module in the same SMS. The modem receives SMS text that includes GPS coordinates, engine parameters, and vehicle engine status. This text is processed using a Visual Basic program to obtain the numeric parameters, which are saved as a Microsoft Office Excel file. To transfer this information to Google Earth, the Excel file is converted to KML (Keyhole Markup Language) format. Google Earth interprets KML file and shows vehicle's location on the map. The system's efficiency is dependable on the sufficiency of the used communication network.

### B. Vehicles retrieval:

When the car is in motion, the client receives a confirmation SMS indicating the status. If this is illegal or any intruder tries to run the car, the owner can send SMS to switch off the car. The system will also check the mobile number of the message sender, to confirm that the phone number is legal or illegal to access the system and if the phone number is legal the system will turn off the car.

## III. PROPOSED SYSTEM DESIGN

The aim proposed is to implement miniature model by using a single chip microcontroller in the vehicle. GPS will be fixed in the vehicle to monitor and to find out location of the vehicle. With the help of the GPS value, the distance can be calculated with respect to time. The direction and the distance are fed into the microcontroller and that will be transmitted to GSM through digital modulation techniques. At the receiver end the signal will be detected and demodulated with digital demodulation technique. Then the signal will be given to Android mobile. Android mobile is used to control the AIR solenoid, water solenoid and power cable in vehicle engine system. The two-wheeler engine is an internal combustion engine. The peltier unit is attached at the exhauster along the Thermal Electric Generator (TEG). Through this unit the heat energy is converted into power using the peltier effect. The generated power will be stored in battery used in two wheelers. In this system GPS, GSM is interfaced with atmega162 v

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Vol. 4, Issue 5, May 2015

microcontroller. A 16x4 LCD display is used to show some message to the user. First the thermal electrical generator is attached with battery. Small amount of power is generated from the silencer of the bike. The power supply is given to the system.

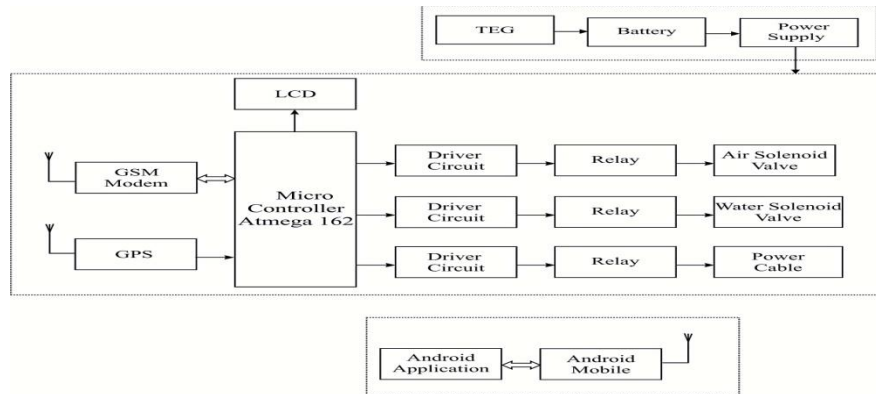


Fig 1:Block diagram for the proposed system

## A. Global System for Mobile Communication (GSM):

In our work, GSM basically keeps the owner of the mobile asset as well as the server updated. The module sends SMSs to the owner of the vehicle using a pre-defined time interval which is neither too periodic nor too overdue. Besides, the GSM module also responds to any SMS sent by the owner of the vehicle after authenticating it. The owner of the asset can ask the GSM module about the location, speed, water level, movement status, engine level, geographical limit, or all at once. In short, the owner can find the status of the vehicle with just an SMS. The owner has also been given the control to turn the vehicles engine off just by sending an SMS. The coordinates of every vehicle are also sent continuously to a standalone server running 24/7.

For the mobile phone users, they can simply send a SMS to the system installed inside their vehicles. Upon reception of the SMS, the tracking system will send a query message, packed with the objects latitude and longitude, to the server asking for the location name. The server after performing the implemented method, and with the help of Google Maps, will send back an SMS to the tracking system about the location name being asked. The tracking system, in the interim, will also be capable of entertaining multiple queries by assigning IDs to each query. If the user has a smart phone, the tracking system will send a SMS to the owner smart phone, and upon reception of that SMS, the coordinates will be plotted on an Android based self-developed application without the need of internet data.

## B. GSM Modem SIM900-D:

We have used GSM modem from SIMcom 21. The device and its pin configuration are shown in fig 2. Some of the significant characteristics of SIM900-D are given below:

- Frequency = (850, 900, 1800, 1900) MH
- Current = 40 mA, Voltage = 3.2-4.8 V
- SMS Sending/Receiving, Voice Calls, GPRS supported, and Baud rate = {4800, 9600 and so on...}

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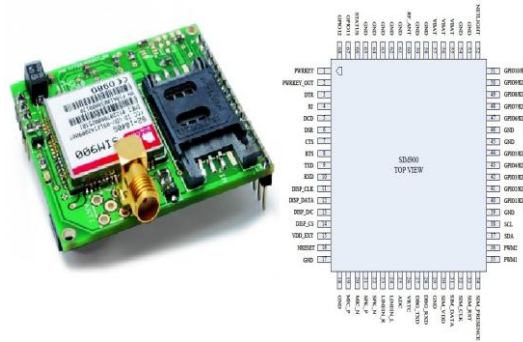


Fig 2:(a) GSM Modem SIM900-D (b) SIM900-D Pin Configuration

### C. Global Positioning System (GPS):

GPS has become an efficient tool in the field of scientific use, commerce engineering, surveillance of objects and tracking. GPS uses Trilateration process to compute the position of an object. In our system, GPS is the key component in getting the assets' coordinates for tracking.

### D. Microcontroller:

A microcontroller is a computing device which usually consists of built-in peripherals. It included CPU, USART (Universal synchronous asynchronous Receiver Transmitter), timers, counters and other components.

#### Microcontroller ATmega-16:

In our work, we have used the ATmega-16 microcontroller of the Atmelfamily 22. The device and its pin configuration are shown in fig. 3. C/C++ and assembly language is used to program the microcontroller. The welcome message displayed at the start of system power on is shown in fig. 7. Some of the significant characteristics of ATmega-16 are given below:

- 8 bit Microcontroller, RISC Architecture, 32 • ~ 8 General Purpose Working Registers
- EEPROM = 512B, Internal SRAM = 1 KB, In-System Flash program memory = 16 KB
- 32 Programmable I/O Lines, Peripheral Features

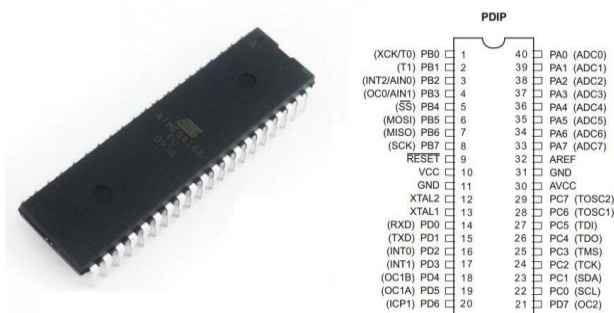


Fig 3: (a) Microcontroller ATmega-16 (b) ATmega-16 Pin Configurations

### Additional Components:

Along with the major modules and components, a number of other components are also used in our project.

Some of them are listed below:

- 16 × 2 LCD Display & 12V Battery
- LEDs, Buzzers, Indicators, Relays
- MAX 232 IC, Voltage Regulators & Other Electronic Components

### E. Thermoelectric Generator:

Thermoelectric generators are all solid-state devices that convert heat into electricity. Unlike traditional dynamic heat engines, thermoelectric generators contain no moving parts and are completely silent. For small

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applications, thermoelectric can become competitive because they are compact, simple (inexpensive) and scale able. Thermoelectric systems can be easily designed to operate with small heat sources and small temperature differences. Such small generators could be mass produced for use in automotive waste heat recovery or home co-generation of heat and electricity. When high quality combustible fuel is available, internal combustion engines are cost effective and reasonably efficient in the 100 W to 100 kW range but tend to be noisy. For applications requiring less than 100W, the scalability of thermoelectric gives them a clear advantage.

## F. Solenoid control valve:

A solenoid valve is an electro mechanical valve for use with liquid or gas controlled by running or stopping an electrical current through a solenoid, which is a coil of wire, thus changing the state of the valve. The operation of a solenoid valve is similar to that of a light switch, but typically controls the flow of air or water, whereas a light switch typically controls the flow of electricity. Solenoid valves may have two or more ports: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. Besides the plunger-type actuator which is used most frequently, pivoted-armature actuators and rocker actuators are also used.



Fig 4:Auto part solenoid valve



Fig 5: flow control valve.

## G. Flow control valve:

A flow control valve regulates the flow or pressure of a fluid. Control valves normally respond to signals generated by independent devices such as flow meters or temperature gauges. Control valves are normally fitted with actuators and positioners. Pneumatically-actuated globe valves are widely used for control purposes in many industries, although quarter-turn types such as (modified) ball and butterfly valves are also used.

The flow control and transfer category covers a wide spectrum of products designed to facilitate, control, maintain, meter, or read the flow of material through hoses, pipes or tubing. Valves are apparatus designed to maintain, restrict, or meter the flow of materials through pipes, hoses, tubing or entire systems. They generally function by allowing flow while in their open position, and restricting flow when closed. The valve family is broken down into product areas based on the mechanism that is used to restrict flow.

## H. Relay Driver Circuit:

Relays are components which allow a low-power circuit to switch a relatively high current on and off, or to control signals that must be electrically isolated from the controlling circuit itself. a relay operate, you have to pass a suitable pull-in and holding' current (DC) through its energizing coil. And generally relay coils are designed to operate from a particular supply voltage often 12V or 5V, in the case of many of the small relays used for electronics work. In each case the coil has a resistance which will draw the right pull-in and holding currents when its connected to that supply voltage. So the basic idea is to choose a relay with a coil designed to operate from the supply voltage you're using for your control circuit (and with contacts capable of switching the currents you want to control), and then provide a suitable ' relay driver' circuit so that your low-power circuitry can control the current through the relay's coil. Typically this will be somewhere between 25mA and 70mA.



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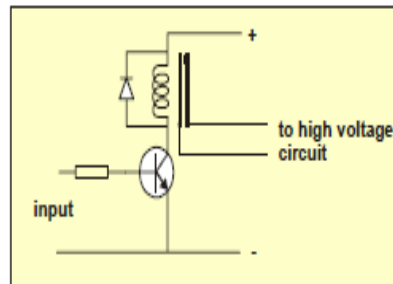


Fig 6: Relay circuit diagram

## I. Android Application:

The Android mobile application is the second client of our system. This application makes our proposed system much more efficient than the already developed systems. With this application, the smart phone users can see the track of their assets on a android application without the need of internet data.

## IV. RESULT AND ANALYSIS

We have successfully implemented our system that showed effective results. We tested our system a number of times and then we deployed it in real time to check a vehicles record. The tracking system was installed inside a car and the car travelled 3 cities. The tracking system was continuously asked for the statuses at intervals and it responded every time successfully.

For the purpose of analysis, we visited a number of tracking companies and compared our features with theirs. Our system beats the already developed tracking systems on the basis of overall cost, control, services, portability, reliability, authentication and 24/7 facilities. Consequently, our system design turns out to be the most efficient, robust and powerful tracking system design with a number of features to offer along with the already mentioned.

## V. CONCLUSION

In this paper the software coding is developed for tracking and theft prevention system in Embedded C programming language and was executed through the AVR studio. The GSM Modem transmits the data between two different terminals in serial. Also the satellites currently tracked by the GPS receiver are shown in Hyper-Terminal. This paper presents a GPS and GSM based vehicle tracking system that provides the owner of a mobile asset with full security and track of the asset. The system allows users to track the position, speed, water level, engine level and different parameters. The owner of the vehicle just has to send an SMS and the tracking system installed inside the vehicle will respond within a minute. The system is equipped with a backup battery in case of a smart thief. Our proposed system design works continuously and offers services 24/7. We have also developed a web portal for the users to track their vehicle on internet, and an android application for smart phone users, with which they can easily track their vehicles on Google Maps without the need of internet. The results show that our system outperforms the traditional existing tracking systems in terms of cost, services, reliability and control.

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