VEHICLE TRACKING AND ANTI-THEFT SYSTEM USING INTERNET OF THINGS

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Abstract - This paper presents a system that effectively and efficiently provides an application of Internet of things in transportation by assisting in Fleet Management, Vehicle Security and Safety. Technology achieves success only when it meets every stratum of people. Apart from the various expensive GPS tracking devices that are available in the market, this paper introduces a vehicle tracking and anti theft system that works only using GSM-GPS and open source technologies which makes it cheapest system for Fleet Management, safety and security. The system checks for change in GPS co-ordinates of the vehicle when not being used by the owner. Once the location of vehicle changes, owner is notified via text SMS Message. The text SMS message consists of current GPS Location of vehicle and also a warning message. The owner then sends a SMS, which instructs the microcontroller to turn OFF the vehicle by switching the relay supply of the battery of the vehicle. The enviable advantage of this system is that it helps the owner in tracking the vehicle at a greater pace, and reduces the complexities compared to other systems, besides being a cheapest alternative for anti-theft system as well.

Keywords - Internet of Things, Transportation, Fleet Management, GSM-GPS tracking system, Anti-theft system.

I. INTRODUCTION

Internet of Things (IOT) is interconnection of things/objects using networks, where things or objects can interact with each other without or minimal human intervention. It enables the objects to communicate with each other and the user. IoT uses sensors and other hardware to collect the data from the system, software to interpret the data and use it for required purpose and connectivity to provide communication between various systems. Thus IoT can provide communication, control and information processing across the system. Figure 1, shows the architecture of IOT.

Fig.1. Architecture of IOT

1.1 Internet of Things & Transportation

Leveraging IoT in Transportation can provide applications in aspects of transportation systems. Dynamic interaction between vehicle, infrastructure, and the driver or user enables communication between vehicles, smart parking, toll collection systems, traffic control, logistic and fleet management, vehicle security, safety and road assistance.

Cars, trains, and buses along with the roads and the rails equipped with sensors, actuators and processing power may provide important information to the driver and/or passengers of a car to allow better navigation and safety. Collision avoidance systems and monitoring of transportation of hazardous materials are two typical example functions. Governmental authorities would also benefit from more accurate information about road traffic patterns for planning purposes.

Whereas, private transportation can find the right path with information about the jam and incidents. Enterprises, such as freight companies, would be able to perform more effective route optimization which allows energy savings. Information about the movement of the vehicles transporting goods together with information about the type and status of the goods can be integrated to provide important information about the delivery time, delivery delays, and faults.

For Fleet Management, technologies which can provide data about location and status of the vehicle in real time are required. 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 Maps/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.

Fig.2. Internet of Things in Transportation [4]
Figure 2. shows the framework of IOT enabled Transportation System which consists of: GPS receiver, GSM modem, and embedded controller. The users of this application can monitor the location graphically on Google Map/Google Earth, can stop any vehicle of the fleet if it was stolen; they can also view other relevant information of each vehicle in the fleet.

**II. SYSTEMS USED IN TRANSPORTATION**

Despite the various technologies that have been introduced in recent years to deter vehicle thefts and tracking it, the effectiveness of these systems have not reduced vehicle thefts by a good rate. Also several security and tracking systems are designed to assist corporations with large number of vehicles for fleet management. A fleet management system can minimize the cost and effort of employees to finish road assignments within a minimal time. Besides, assignments can be scheduled in advanced based on current vehicles location. Therefore, central fleet management is essential to large enterprises to meet the varying requirements of customers and to improve the productivity. However, there are still some security gaps where these technologies don’t prevent a vehicle from theft, don’t assist to recover it and don’t allow the users to know the status of their vehicles. They can’t permit the owner to communicate with the vehicle, even if the owner is certain that his vehicle is stolen.

There exist two types of devices for vehicles for tracking, theft detection and safety from theft. These are,

1. **GPS Tracking devices for vehicles**: These systems provide tracking of vehicle location in real time. In case of thefts these systems won’t be able to stop the vehicle because these systems can only provide the GPS co-ordinates of the vehicle in real time. There is no program for theft detection or a circuitry involved in the system to stop the vehicle. One of such tracking devices that is used in India is called MapMyIndia and it costs INR 15000

2. **GPS tracking along with Central Locking and Immobilizer**: These systems provide GPS tracking as well as mechanisms to stop the vehicle by using a central locking and immobilizer mechanism. These systems have the circuit to implement theft detection and to prevent the theft from happening. The most widely used GPS tracking along with Central Locking and Immobilizer are AutoCop which costs INR 16000 and 3Dtrack which costs INR 18000. These systems are the most widely used systems worldwide and are not used much in India because of the high cost.

Luxury Sports companies that manufacture cars like BMW, Mercedes, Lamborghini, Porsche etc. have pre-installed anti-theft and tracking systems. All common car companies do not have such systems. Considering all the literature survey and the Market survey the system developed should have improved efficiency, reduced power consumption, reduced cost and size, improved accuracy, user-friendly and easy to use and installable in all vehicles (with fuel injectors) over the existing or theorized systems available.

**III. ANTI THEFT SYSTEM**

The main objective of the anti theft system for vehicles is to establish a connection between vehicle and the user. The established connection enables the vehicle to notify the user in situation of theft and the user can stop the vehicle after sending a command. The system should be compact so that it can be placed at a location where a thief cannot perceive it and hence the safety of the vehicle and the reliability of the system are not compromised.

The scope of the study as follows:

- To implement system to provide vehicle tracking in real time.
- Design a mechanism to detect theft and notify user of theft.

To accurately implement the system in real time a GPS Antenna, GPS+GSM Module, a Microcontroller and a Relay circuit will be required. Figure 3 shows the framework of the system. In this system, a GPS Antenna is used to acquire real time GPS co-ordinates of the vehicle. A GPS+GSM Module (SIM808 Module) is used to carry out the extraction of GPS co-ordinates obtained from GPS antenna. GSM part of the SIM808 Module is used for sending the GPS co-ordinates and the warning message about the theft to the user via SMS Messages and for receiving commands from the user to start or stop the vehicle. Vehicle is stopped using a relay circuit which can cut the supply to fuel injector from the battery. Relay circuit used is implemented using a Hercules Motor driver IC. This IC has high input range and provides protection from over voltage/over current. Thus this driver is very safe to use for vehicle battery so that the battery does not get damaged by any voltage/current fluctuations. The microcontroller is the most important element of the system and controls the entire operation while coordinating with SIM808, GPS Antenna and the Relay circuit.

SIM808 Module extracts the GPS co-ordinates from the GPS antenna and the micro-controller converts the GPS co-ordinates extracted into a form that can be used for signal processing. If theft is detected, the microcontroller along with SIM808 sends the warning SMS Message to the user and receives the commands via reply obtained from the user. The Microcontroller converts the signal which is then
applied to the relay circuit. The SMS message and GPS co-ordinates is sent by SIM808, GPS antenna in conjunction with Microcontroller.

The system requires the following I/O functions:
- Conversion of GPS co-ordinates acquired by GPS antenna (GPS aspect of SIM808) into text format that can be displayed via a SMS message.
- Conversion of SMS Message (GSM aspect of SIM808) into electrical signals for controlling relay and sending of SMS message using Microcontroller and SIM808

### IV. ALGORITHM FOR THEFT DETECTION

For theft detection, algorithm shown in figure 4 is used. Whenever vehicle starts, system will send a SMS to the owner. If vehicle use was unauthorized, owner can then reply with a text SMS ‘Stop’ to turn the vehicle off.

#### RESULT

The progression was made to implement the system in real time on a Battery of a vehicle (Bike) while placing the system inside the vehicle such that it is not visible to the thief. Testing of the system was done and the system responded by sending a warning SMS message to the user when there was unauthorized movement of the vehicle. The user got a SMS message which had the warning message and GPS co-ordinates. The user sent a SMS message to stop the vehicle and the system responded to this message by relaying the supply to the battery and hence the vehicle stopped.

### CONCLUSION

The system developed effectively provides an application of connected devices or Internet of things in Transportation. The system includes a Combined GPS+GSM Module which can track the location of the vehicle via the GPS antenna implanted in the vehicle. Thus, this system is an integration of several modern embedded and communication technologies. This makes the system very cheap since these are simple and open source technologies. Also the system is very compact. Security standards are maintained by mobile network providers hence security of the network is very good. This makes the system suitable for the market since it is cheaper than other anti theft systems available. Also it is user friendly since a simple ‘Stop’ SMS turns the vehicle off. Along with tracking and theft prevention, this system can also provide more applications like condition monitoring, vehicle control, fleet management, traffic management, smart parking and vehicle safety by using various sensors like speed sensor, alcohol...
sensor, proximity sensor and other sensors to get the data about condition and performance of vehicle and the driver. Thus, this system is very useful and can be used in all aspects of transportation system.

REFERENCES

[14] SIM808 GPRS/GSM+GPS Shield v1.1