

UNIQUE IDENTIFICATION, INFORMATION & SURVEILLANCE SYSTEM FOR VEHICLES

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Abstract

Number of vehicles is an ever-increasing commodity in present era, this growth asks for some drastic revolution in surveillance and information system regarding the safety and security as a prime concern. So, we are generalizing on the evolution of such a system which will be capable of providing an integrated platform in the areas of Unique Identification, User Authentication, Surveillance (tracking) & Accident recognition. So, "Unique Identification, Information & Surveillance System for Vehicles" is a system which will utilize the benefits of existing technologies including (GSM) Global System for Mobile communication, (GPS) Global Positioning System, (RFID) Radio Frequency Identification for ultimately fulfilling the foreseen vision. The proceeding content will reveal a general outlook to achieve the foresaid objectives.

Key Words: - GPS, GSM, RFID, SIM, Identification, Authentication, Surveillance

I. EVOLUTION OF IDEA

If you lose a pen, what will you do? Of course you will buy a new pen but can you do the same if it happens to your car?

Government is spending a lot of money on the projects which involves large numbers of vehicles like trucks and even they are provided with free diesel and petrol depending upon the distance they are covering while completing their responsibilities, but do Government really know whether this vehicles are really completing their responsibilities or not? Do Government really know whether they are lying or not?

There are thousands of complaints in police station about lost or stolen vehicles, But is it practically possible to get back all those vehicles to their owners with our conventional system?

If serious accident happens and there is no one around for help, do you think those people will survive? We are losing around 86% people who met an accident just because we are not able to provide them immediate medical help, are we?

We always blame police department for not being on time but just think from another point of view, do they get appropriate information on time?

What if I lose my only key of my car? What option do I have except breaking my car lock?

What if someone uses a fake numberplate while doing an illegal thing and unfortunately that numberplate matches with my numberplate? What can I do in such situations?

Vehicles play a very important role in everyone's life. Our national security totally dependent upon these vehicles, because there is no such crime which does not involve any unauthorized access of any vehicle.

Till when we will be silent in front of all such questions? So here we are providing answers to each and every question related to safety and security of vehicles. Our system is utilising the benefits of existing technologies to fulfil our motive.

II. INTRODUCTION

Aim of this paper is to discuss such a system which will be able to provide excellent way to keep a track of each and every vehicle irrespective of boundary limits and also the features provided by system regarding safety and security. The entire system implementation can be divided into following Modules.

- Surveillance
- Unique Identification
- User Authentication
- Accident Recognition

While discussing each module we will be following a simple pattern starting from the drawbacks of traditional system and how this system can tackle those drawbacks with an ease. We will also emphasize on the features which can prove the system performance to maximum level possible.

III. SURVEILLANCE

Surveillance has always been the necessity in many industrial and other fields. It can be of a great advantage to improve the efficiency of an organization. Thus we want to develop a GPS based low cost passive surveillance system which has various applications. The system consist of a vehicle unit which is equipped with a GPS receiver which plots the position and a GSM module which handles the communication link between the car unit and the base unit which must be under civic bodies like police authorities. The information can be viewed on electronic maps via the Internet or specialized software. Thus the car location can be tracked by the owner of the car or by police activities. Current tracking systems have their roots in the shipping industry. A corporation with large fleets of vehicles requires some sort of system to determine where each vehicle was at any given time and where it would be in future, which will be helpful in enhancing the efficiency as well as the accuracy of the company in taking decisions and providing great service to their customers. Thus surveillance system can be of great help in such Corporations for effective fleet management.

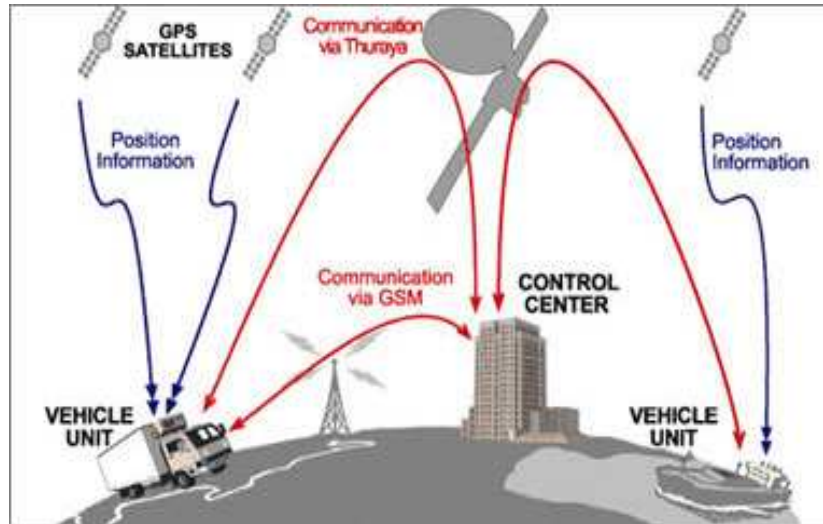


Fig. 1. Example of Surveillance System

IV. UNIQUE IDENTIFICATION

Nowadays we use a physical number plate for identifying all the vehicles which is a traditional method. But there are various cases in which criminals have been using fake or multiple number plates.

Actually seeing we know that the number plate is not at all connected to the internal engine of the car hence removing the number plate or threatening it becomes very easy, which is the task of removing two screws only.

Hence to get reed of these problems we want to make an unique identification system which will be electronic, which can be integrated to engine, which can be programmed in such a way that any kind of threatening to the system can to reported to the authority such as police or the car owner.

By using SIM (Subscriber Identity Module)cards can be easily used for providing the unique identification in an electronic way. Every SIM card is unique in its own sense hence there is no need of further explanation for the numerous advantages which will reduce Identification Vulnerabilities. This Identification can be used for the global safety and security as a prime concern.



Fig. 2. SIM(Subscriber Identity Module) card

V. USER AUTHENTICATION

We have been using mechanical locks from years for our houses, our cars. But mechanical locks has their own disadvantages one of which is that even if you are the real master of that lock it won't let you access until you have the Key.

And sometime due to some work or our human behavior we do mistakes and misplace the keys. And which results into loss. Even some times some wrong people access your key for some time and replicate it and use it against you.

So we thought of replacing these keys with and Electronic Identification system i.e. RFID (Radio Frequency Identification). So the owner of the car can have multiple RFID tags which he can use for accessing the car. Owner can maintain a database in which he can easily add or remove authorisation of various tags. Hence car owner, his family members and close friends can easily access the car without worrying about the keys, depending upon his wish.

Whenever anybody access the car and ignites the engine a Text Message will be sent to the car owner with the ID which is used to access the car.

Any authentication system is required to have few characteristics one of which is that it must be accurate, as well as user should be comfortable to use it.

And RFID is an excellent system which maintains an utmost balance in between accuracy and comfort.

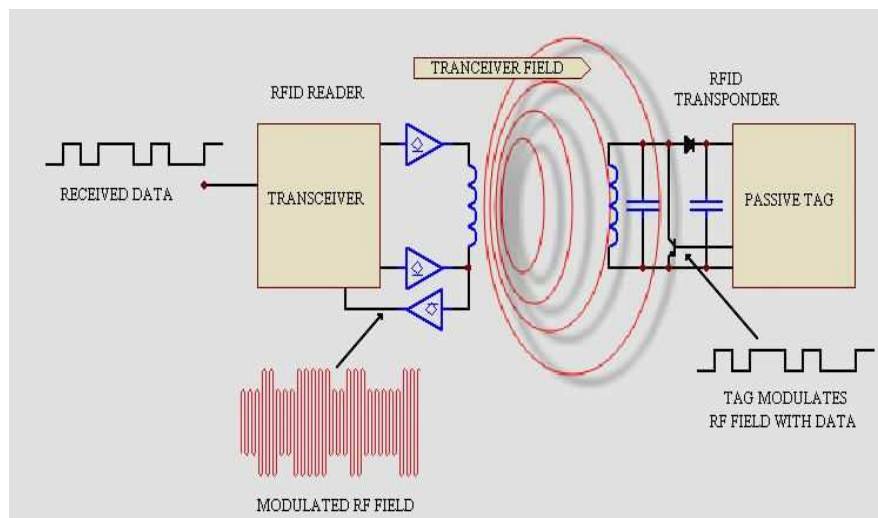


Fig. 3. Using RFID Tag

VI. ACCIDENT RECOGNITION

Most of times in accidents, it has been observed that possibility of rescuing the person who met an accident is 86%. Lives of those 86% of people are dependent upon how early they get medical help.

So we want our system to inform civic bodies nearer to accident spot about the accident by means of A Message. So police, Ambulance, Fire Brigade will get instant Message informing about the accident with exact location in no time.

Due to the exact information about location and intensity of an accident an ambulance can easily determine a shorter route to reach at the exact location in minimum amount of time. Police force and fire brigade team can make a proper guess of what kind of help is required at that particular accident site depending upon the intensity of the accident.

So such kind of electronic information system will work independently and hence not only the persons who met an accident but also the policemen and other civic bodies will get help from this system to handle their responsibilities.

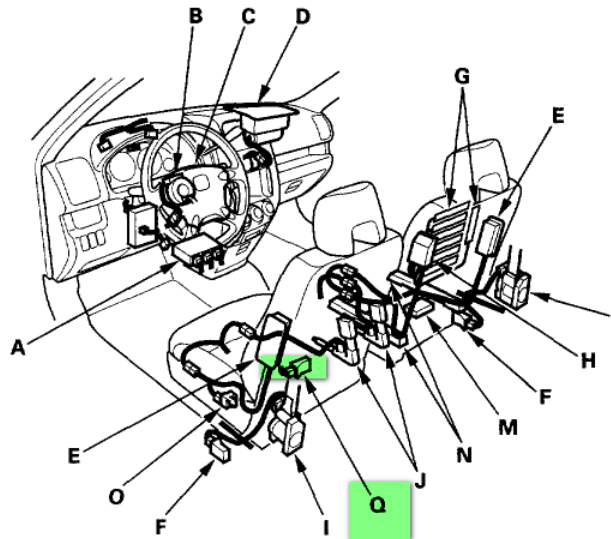


Fig. 4. Points of maximum Stress In case of accident

For triggering the system about the accident we have to rely on sensors. But while selecting a sensor we must be very sure that it won't give any false alarms or any missed alarms, this is totally depends upon the threshold level decided by the programmer. An array of such stress sensors can be situated in car and depending upon their outputs it can be easily determined when actually a car had faced an accident and what the intensity off that accident is.

The GPS receiver will take down the co-ordinates which will be transmitted to the nearest civic bodies in the form of a Text Message. Such civic bodies include Police, Fire Brigade and Ambulance. Hence everyone will get exact amount of help at the instant of accident without any delay.

VII. SYSTEM ELEMENTS

For implementing all the features stated above we need to have a constant interaction between following hardware

- GPS Receiver

- GSM Module
- RFID Reader
- Stress sensors
- Microcontroller

The performance of the system is totally dependent upon the performance of these hardware modules, and their interaction with Microcontroller.

These hardware modules and their responsibilities can be explained as below

A. GPS Receiver

GPS receiver plays an important role in this entire system. It is responsible for providing the exact co-ordinates all over the entire earth by contacting the Geo-synchronous satellites orbiting around the earth for the purpose of Global positioning system.

For providing the exact co-ordinates GPS need to receive signal from at least 4 satellites. Accuracy of GPS receiver is entirely dependent upon the accuracy of the internal clock of GPS receiver. Exact synchronisation of GPS clock and clock of satellite can provide ultimate accuracy of 0.8 meter for both horizontal and vertical measurements.

B. GSM Module

Most popular low cost GSM modules available in market consist of SIM 300 and SIM 900. Responsibility of GSM module to handle the entire communication in the form of messaging. The communication between Microcontrollers with GSM is done by using AT commands.

It can be easily programmed to send a pre defined Message in the occurrence of particular event .For surveillance systems it is programmed to send the position of the car after every half an hour; it can also send the coordinates (position) of the car on the reception of a request message from owner of the car. After every successful ignition of the car engine it will send the ID number which is accessing the vehicle along with the position details.

It has a very crucial responsibility of jamming the engine of the car in the case when it will receive a Pre-Defined message from the Owner. Setting such pre defined messages is totally dependent upon the owner, he can personalize it in any way he want.

C. RFID reader

RFID reader is a kind of RF transponder .For detecting the tag it transmits a RF signal which gets modulated by RFID tag and then it receives the modulated signal. And depending upon the modulated signal it recognizes what is the tag number.

RFID Tag has a capability of modulating the RF signal as per their Identification numbers. following are the different tags available for use.

TABLE I: VARIOUS RFID TAGS

Type of Tag	Frequency	Reading Distance(m)
RFID Passive	138KHz-13.5MHz	0.04-3
RFID Active	13.85MHz	3-10
RFID Passive Programmable	138KHz-13.5MHz	0.04-3
RFID Active Programmable	138KHz-13.5MHz	3-10
Data Tag	13.85MHz-985MHz	3-10
RF Location Tag	303MHz-5.8MHz	1-100

D. Stress Sensors

Stress sensors are the having the responsibility of detecting the accident without any false recognition. The Impact of accidents are very high hence the stress sensors used must have the capability to withstand extreme stress.

E. Microcontroller

Microcontroller does have a high amount of responsibility in this system. Ultimately taking the co-ordinates from GPS, transmitting them, analysing the stress sensors values and deciding whether the accident is happened or not are the prime tasks handled by Microcontroller.

VIII. ALGORITHMS

A. Getting CO-ordinates from GPS

An example string has been given and explained below:
\$GPGGA,100156.000,2650.9416,N,07547.8441,E,1,08,1.0,442.8,M,-42.5,M,,0000*71

1. A string always start from '\$' sign
2. GPGGA :Global Positioning System Fix Data
3. ',' Comma indicates the separation between two values
4. 100156.000 : GMT time as (hr):01(min):56(sec):000(ms)
5. 2650.9416,N: Latitude 26(degree) 50(minutes) 9416(sec)North
6. 07547.8441, E: Longitude 075(degree) 47(min) 8441(sec) East
7. 1 : Fix Quantity 0= invalid data, 1= valid data, 2=DGPS fix
8. 08 : Number of satellites currently viewed.
9. 1.0: HDOP
10. 442.8,M : Altitude (Height above sea level in meter)
11. -42.5, M: Geoids height
12. __, DGPS data

13. 0000: DGPS data

14. *71: checksum

Algorithm

Step 1 Start.

Step 2 Receive one character from GPS

Step 3 Check whether the first character is '\$' if yes then go to next step or else go to step 2.

Step 4 Receive one character from GPS Check whether the first character is 'G' if yes then go to next step or else go to step 2

Step 5 Receive one character from GPS Check whether the first character is 'P' if yes then go to next step or else go to step 2

Step 6 Receive one character from GPS Check whether the first character is 'G' if yes then go to next step or else go to step 2

Step 7 Receive one character from GPS Check whether the first character is 'G' if yes then go to next step or else go to step 2

Step 8 Receive one character from GPS Check whether the first character is 'A' if yes then go to next step or else go to step 2

Step 9 Receive one character from GPS Check whether the first character is ',' if yes then go to next step or else go to step 2

Step 10 Keep on receiving characters from GPS until you receive next ',' and then go to next step

Step 11 Receive next characters and save them as latitude until you get next ','

Step 12 Receive next character and save it as latitude direction.

Step 13 Repeat Step 11 and 12 for longitude and longitude direction

Step 14 Send Latitude, Latitude Direction ,longitude , longitude direction

Step 15 Stop

B.GSM Module functioning

We programmed our GSM module to work in two different modes

- Normal Mode
- Emergency mode

In normal mode GSM provides two different options first options enables the system in RESPONSE method in which the GSM will only send the co-ordinates if it receives a predefined message from Owner . And in other option the system will be following TIMER method in which the system will send the co-ordinates after a definite time interval set by the owner of the car.

In Emergency mode GSM provides a very important feature which is known as EMERGENCY SHUTDOWN. After getting a message "EMERGENCY SHUTDOWN" from the owner GSM will

automatically shut the car's Engine down. Which can be used for the safety purpose and also provide ultimate control of owner over his car.

Algorithm for Normal mode

- Step 1 Start
- Step 2 Wait for receiving "CALL READY" from GSM
- Step 3 Check the network whether the network strength is sufficient for proper functioning or not
- Step 4 Go on following next steps again and again until the network is proper
- Step 5 Ask the user to check whether he want to go for RESPONSE or TIMER method
- Step 6 If he chooses RESPONSE then follow steps from 7 to 10 again and again
- Step 7 Take co-ordinates from GPS receiver
- Step 8 Wait until GSM module receives a message
- Step 9 Read the message
- Step 10 Compare the message and if it is "COMMAND REPORT" then send the Co-ordinates or else go to step no8
- Step 11 IF he chooses TIMER then follow steps from 12 to 14 again and again
- Step 12 Take co-ordinates from GPS receiver
- Step 13 Wait for some predefined time
- Step 14 Send the Co-ordinates and Go back to step 12
- Step 15 Stop

Algorithm for Normal mode

- Step 1 Start
- Step 2 Wait until GSM module receives a message
- Step 3 Check whether the message is from the owner of the car or not if not then go back to step no 2
- Step 4 Read the message
- Step 5 Compare the message and if it is "EMERGENCY SHUTDOWN" then Shut the engine of the car down and report he owner through the message about the position of the car. If not then go back to step 2
- Step 6 Stop

C. RFID Authentication

Owner of the car will be provided with the abilities to modify the RFID database of those persons who can access the car.

But every time when a person who wish to start the engine of the car he has to provide one of those RFID tags which are entered into the database by the owner.

After every successful ignition of engine owner of the car will be reported by the means of a message containing the Identification number who is accessing the car.

Algorithm

- Step 1 Start
- Step 2 Wait until a tag is available to read
- Step 3 Read the Unique ID of that tag
- Step 4 Compare the tag details with the database and if it matches then go to step no 6 or else follow the next step
- Step 5 Report the threat to owner with position of the car and go to step no 8
- Step 6 Ignite the engine of the car
- Step 7 Report owner with the ID who is accessing the car
- Step 8 STOP

D. Accident recognition

Accuracy of accident recognition totally depends upon the threshold set by a programmer. Too high threshold can lead to some missed indications of accidents and too low threshold can lead to false indication of accidents which can increase the unnecessary burden on those civic bodies which are going to get this false indications. Hence it is very critical parameters for accident recognition. Such kind of electronic information system will make the system self dependent system.

Algorithm

- Step 1 Start
- Step 2 Keep on following next steps again and again until the car's engine is on.
- Step 3 Keep on checking the local civic bodies depending upon the database maintained
- Step 4 Keep a track of the stress sensor values situated on the car
- Step 5 If value of sensor crosses threshold level send an indication of accident with exact location to all the civic bodies and owner of the car
- Step 6 Stop

IX.APPLICATIONS

1) National Security

This system can be very useful to have a ultimate control and surveillance of all the vehicles including important persons whose security is the prime concern for the nation.

2) Municipalities

Municipalities can use Tracking System for efficiently managing the utility Services, like Garbage Disposal or Water Supply. Fitting the Vehicle Tracking System can help the municipalities in increasing the number of trips by spotting the idle time of Garbage Collector or Water Tanker. It can also helps the municipalities in improving the fuel consumption of the vehicles since Diesel issued can be linked to the distance travelled.

3) Tourism department

Tourism department can monitor the vehicle performance and vehicle position by fitting the System on the vehicles of the Tourism Department. 2 ways communication provided along the system shall help the Driver as well as Controller in emergency management.

4) **State Transport Organizations:** Tracking System is invaluable to Transport Organizations in the following

1. Online tracking to know the position of the vehicle
2. Vehicle Monitoring to know the unscheduled stops and speed violations
3. Improve the Mileage of Vehicle
4. Route Allocation & Planning
5. Emergency Handling
6. Reduce idle time.

5) **Commercial fleet operator**

Commercial Fleet Operators like Tour Operators or Truck Operators can use the system for online tracking, vehicle monitoring & planning. Vehicle tracking system becomes indispensable to those who are carrying valuable items in remote places.

6) **Bank or high security vehicles**

With the ATMs gaining popularity, more & more vehicles are being used for transporting cash. These vehicles when fitted with this system, makes the cash handling more secure.

7) **Police , Fire Brigade & Ambulances**

These all civic bodies can perform their operations and responsibilities up to their maximum limits if they get integrated with such system.

X. CONCLUSION

We have successfully designed and implemented Unique Identification, Information and surveillance system for vehicles with remarkable results. We are interested in enhancing this system in every way possible for the fulfilments of the ever-growing greed of human beings. This system will surely prove its existence, preciseness and accuracy in upcoming future.

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- Page no: 821