# GPS Based Speed Limit and Toll Collection

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**ABSTRACT:** This project is done with the intention to design a device which can address the problems faced by the common man while using roadways as a transport medium. It is used to track a vehicle using a GPS module and a Wi-Fi module is used to transmit information to the database. The GPS co-ordinates and the speed is continuously sent from the car via the Wi-Fi module to the monitoring system which will enable us to know if the driver has crossed the speed limit and whether he should be fined for the same. Simultaneously, this system can automatically deduct the toll amount when the person enters a new area without having to wait in queue which will save time, money and fuel. Moreover, post-crash, this system can help in assisting to catch hold of the law-breaker. Also, in case of theft, an alarm will be raised and this device can help us to track the stolen vehicle.

**KEYWORDS:** GPS, Wi-Fi, Transmit Information, Monitoring System, Toll Amount, Track Vehicle.

## I.INTRODUCTION

In today's world, transportation is a basic necessity of the common man. However, as more and more people use the road as a means of transport, the chances of accidents increase due to not following the road safety norms and driving at unusual speeds. According to Wikipedia[1], "The frequency of traffic collisions in India is amongst the highest in the world. A National Crime Records Bureau (NCRB) report revealed that every year, more than 135,000 traffic collision-related deaths occur in India". Thus, to solve this problem we need to improve our security methods and keep an eye on the road transport system, which is why this type of system needs to be developed.

The major problems which can be addressed by this project are as follows:
- Speed limit indication in pre-defined areas
- Toll-indication in pre-defined areas and amount deduction
- Retrieval of stolen vehicle in case of theft
- Tracking of vehicle
- Immediate help post accident
- Immediate fining due to crossing of speed-limit

The evolution of satellite communication technology helps us to identify the vehicle location. This technology can be used for vehicle tracking as the majority of the car users around the world have this facility.

## II. LITERATURE SURVEY

Tracking of vehicle has been researched many times before and solutions have been developed from time to time like lock and key, heavy duty anti-theft tyre, RFID tags, etc. Speed – control limit will help in curbing number of road-accidents due to over speeding.

The following papers were used in our literature survey:

- GPS-GSM Based Tracking system by Abid Khan and Ravi Mishra [2] which used GPS to track the vehicle and GSM was used to transmit message about the object's location to the remote user. This project finds its application in real-time traffic surveillance i.e. location of the vehicle and real-time tracking using SMS. Here, ARM LPC 2138 was used as a microcontroller along with GPS and GSM installed in the vehicle. The main concept used here was to know the location information, track driver's activity and instantaneous communication.

- Automated Toll Collection System Using RFID[3] by PranotiSalunke, PoonamMalle, KirtiDatir and JayshreeDukale was studied which used an RFID tag as unique identification number assigned by the RTO which will help in deducting the toll. Here, identification is done with the help of a radio frequency. The vehicle will hold the RFID tag. The user's information is stored using the unique identification number along with the available amount and whenever the user crosses the toll i.e. the specified GPS co-ordinates, an amount is deducted without the user being made to wait in a queue. The RFID tag contains a chip to store the unique number and an antenna to transmit information. RFID Reader is like a scanning device which reads the tags and communicates to the database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag. Since the tag cannot be cloned, no one can cheat and it is very efficient in saving time and money.

- PankajVerma and Mr. J.S. Bhatia designed a GPS-GSM based tacking system using Google Maps including a web application [4].It  had two units, one for transmitting and another one for monitoring. GPS was used for location and message transmission time.GSM was used for transmitting and receiving the data.LCD was used to show the location values and 9V battery was used to power up the circuit.ATMEGA16 was used as a controller and MAX232 was  used for GPS and GSM to communicate serially.

### III.BLOCK DIAGRAM

The block diagram for the given system is as shown below:
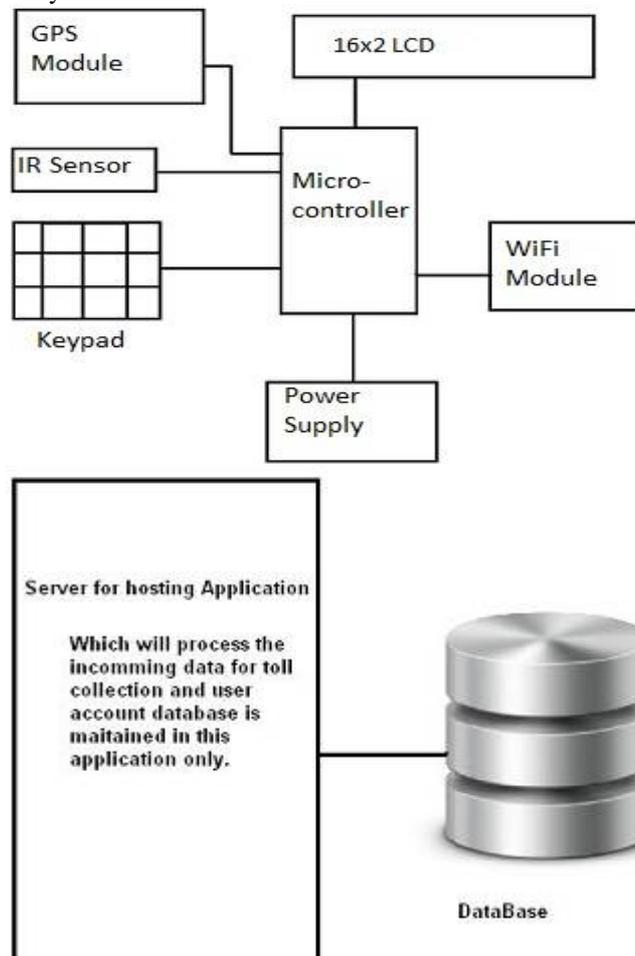
## IV. METHODOLOGY AND DISCUSSION

The project is divided in the following parts:
1. Speed Calculation.
2. Capturing GPS Coordinates: These can be taken from the GPS module.
3. Indication on accident occurence.
4. Sending value to Server: Logging Speed Data on database.
5. Deduction of Toll from balance: Automatic Toll Collection based on GPS co-ordinates.
6. Deduction of Fine from balance: Automatic Fine Collection based for over-speeding.

The following is the working of the project:

In this project we are going to continuously monitor the location of the car and its speed using GPS module. For accident prone areas or areas near school, these co-ordinates will be given a safe speed. In case the driver goes above that safe speed, three warnings will be given. Even after the warnings, if the driver doesn't decrease the car's speed, automatically a fine will be charged for over speeding and a message will be display on the LCD.

The data which is sent to the database consists of the speed, latitude and longitude (co-ordinates) and accident parameter.
Whenever a collision occurs, a switch (sensor) will get activated which will make the accident parameter from '0' to '1' in the data which is to be sent to the database.  Then, a message will be sent to the registered contacts thereby giving the accident location (from the GPS co-ordinates).

Toll Payment: Toll collection will be based on the GPS coordinates of the Toll booth identified by that area.  As mentioned above, the speed values and GPS coordinates are logged into the database. The GPS coordinates will be used for toll collection when the sent values are within the range of predefined toll area. Then the toll amount will automatically get deducted from the user's account. The toll area is predefined, by a set of 4 coordinates in sequential order. These 8 coordinates (x and y) are stored in the database. When the car enters the toll area, the GPS module will track these coordinates and compare them to the predefined coordinates in the database. If the co-ordinates of the car is inside the predefined polygon, then it means that toll has to be cut from the user's account.

In addition to this, we have a security feature i.e. when someone enters the car, they have to enter the password to start the car, if a wrong password is entered for more than three times, and an alarm is raised.

Speed calculation is based on the IR sensor. An IR sensor includes a transmitter LED and a receiver LED. The transmitter will send IR rays and if any obstacle is present, the IR rays get reflected and those would be sensed by the receiver. An exception is that the IR rays gets absorbed by the black coloured obstacle. We are proposing that the IR sensor is fitted near the wheel of the vehicle; and there will be reflective markings (white strip) on the wheel that will be used to reflect the IR rays. So when one revolution is completed, we will get one pulse. In a similar manner, we can calculate the total RPM in 5 seconds and based on the wheel perimeter, speed will be calculated. Speed values which are calculated will get sent to the database over the Wi-Fi along with the GPS coordinates.

Web application: On web application we are giving some features to user such as account recharge so that the user can maintain a sufficient amount of balance in his/her account. User will be given an username and password for logging into that account.
A GUI is made for the user which has data log of the car.

| ID | UID | Reason | Amount | Time |
|----|-----|--------|--------|------|
| 1 | 1 | Toll deduction | 50 | 04/03/2016 16:54:54 |
| 2 | 1 | Over Speed | 50 | 04/03/2016 16:57:35 |

## . FLOW CHART & ALGORITHM
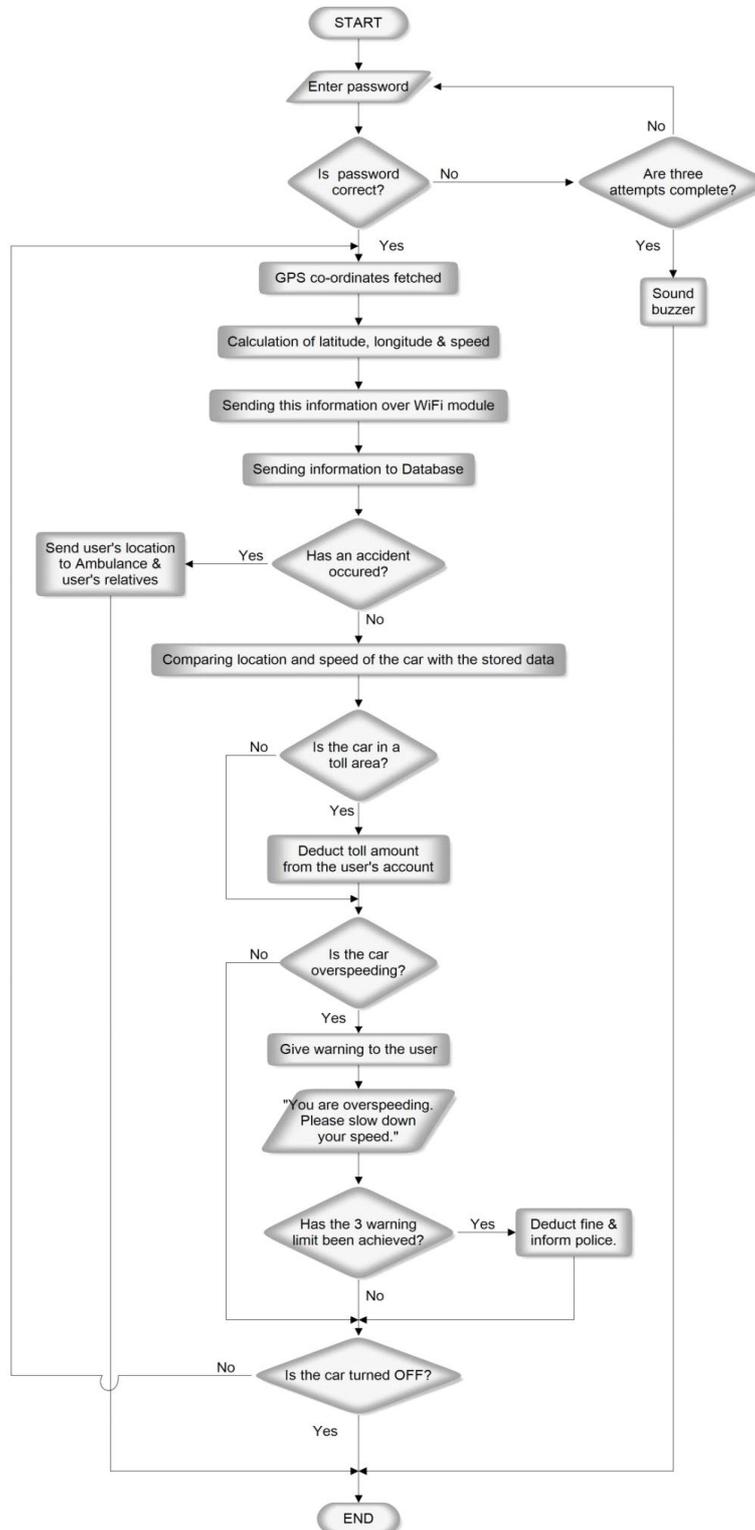
**Project Flow**:

START
1. Enter the password.
2. Check if the password is correct or not.
Yes= Goto 3
No=Goto 4
3. Fetch the GPS coordinates from the GPS module.
4. Are the three attempts complete?
Yes=Goto 5
No=Goto 1
5. Buzzer rings, Goto END.
6. After the GPS coordinates are fetched, the lattitude,longitude, speed are logged.
7. The above data is sent to the database over the Wi-Fi module.
8. To check if an accident has occurred.
   Yes= First send user's location to user's relative, the accident parameter is changed from '0' to '1' in the php file. Goto END
No=Goto 9
9. Compare the location and the speed of the car to the prestored data in the database.
10. Check if the car is a toll area.
Yes= Deduct the toll amount from the user's account. Goto 11.
No=Goto 11.
11. Check if the car is overspeeding.
Yes= Send a warning to the user. Goto 12.
No=Goto 14
12. Message is sent: You are over speeding. Please slow down your speed.
13. Check whether the 3 warning limit has been achieved.
Yes= Deduct fine. Goto 14.
No= Goto 14.
14. Check if the car is turned OFF?
Yes= Goto END
No=Goto 2
END

## VI.CONCLUSION

I. This project is basically about the real time monitoring of the car which includes its speed, location and accident parameter in which, a data log is maintained for the same. Also, speed can be limited by the user in the predefined areas in which one is not allowed to over speed. This in turn will help to reduce the number of accidents. And, medical assistance can also be received in case of accidents. Moreover, in case of theft, the car can be tracked.

II. It has a future scope of car to car communication, automated valet parking.

### REFERENCES

1. Article on Wikipedia: https://en.wikipedia.org/wiki/Traffic_collisions_in_India
2. Abid Khan and Ravi Mishra "GPS-GSM Based Tracking System" International Journal of Engineering Trends and Technology – Volume 3, Issue 2 – 2012 , pages 161-164
3. PranotiSalunke, PoonamMalle, KirtiDatir and JayshreeDukale "Automated Toll Collection System Using RFID" IOSR Journal Of Computer Engineering (IOSR-JCE),Volume 9 Issue 2 (Jan-Feb 2013) pages 61-66
4. PankajVerma and Mr. J.S. Bhatia "Design and Development of GPS-GSM Based Tracking System with Google Map Based Monitoring" International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol. 3 No. 3 June 2013 pages 33-40
5. http://www.sabreadv.com/products/wireless/gps-module- portfolio/sim28ml/
6. http://www.explorelabs.com/wifi-module- esp8266
7. Datasheet of ATmega328P http://www.atmel.com/Images/doc8161.pdf