

# Real Time GPS Vehicle Tracking System

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**Abstract**— Currently almost of the public having an own vehicle, theft is happening on parking and sometimes driving insecurity places. The safe of vehicles is extremely essential for public vehicles. The Global Positioning System (GPS) is being used for fleet management, stolen vehicle recovery, surveillance and mapping. This paper, designing and implementation a real time GPS tracker system using Arduino. When user sends SMS on the number which is registered on the GPS-GSM shield attached to Arduino then user receives the location coordinates and data will get stored continuously on SD card at the same time. This work has significant application for vehicle security, salesman tracking and private driver. This is more secured, reliable and low cost.

**Index Terms**— GPS, GSM, Arduino, Storage card, Adafruit FONA 808 Shield.

## I. INTRODUCTION

Vehicle tracking system is technology used to determine the location of a vehicle using GPS and such this technology has become very prominent. In order to implement a vehicle tracking system which can display the location on google map, the GPS, GSM/GPRS modules controlled by Arduino MEGA must be placed inside the vehicle. The vehicle position will be updated every 10 second as the vehicle is moving. This system enables the owners who have expensive cars to observe and track the vehicle and find out vehicle movement and its past activities of vehicle. This technology popularly called real time GPS vehicle Tracking Systems which created many wonders in the security of the vehicle. The system can be fitted into the vehicle where it can not be seen by anyone. Thus it is used as a covert unit which continuously or by any interrupt to the system, sends the location data to the monitoring unit. When the vehicle is lost or stolen, the system can send the location by sending the coordinates to the specific mobile when the user makes the request, the system automatically sends a return reply to that particular mobile indicating the position of the vehicle in terms of latitude and longitude which can be viewed using Google Map. This information is available to authorized users of the system via website over the internet [1].

## II. RELATED WORKS

The system consists of modern hardware and software of the GPS and GSM network which enable to track the vehicle[2]. Any vehicle tracking system consists of mainly three parts mobile vehicle unit, based station. mobile unit is

the hardware component attached to the vehicle having either a GPS/GSM modem. The controller modem converts the data and sends the vehicle location data. Based Station consists of a wireless network to receive and forward the data to the data center. Base stations are equipped with tracking software for determining the vehicle location. This paper proposed to design a vehicle tracking system that 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 [2][3].

The Global Positioning System (GPS) is the only fully functional Global Navigation System (GNSS). The GPS uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals that enable GPS receivers to determine their location, speed, direction, and time. A GPS receiver receives the signals from at least three satellites to calculate distance and uses a triangulation technique to compute its two dimension (latitude and longitude) position or at least four satellites to compute its three dimension (latitude, longitude and altitude) position.

Therefore GPS is a key technology for giving device its position. GPS was developed by the United States Department of Defense. Its official name is NAVSTAR-GPS. It is originally used in military services but later allowed the system available free for civilian use as a common good. Since then, GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, and scientific.[5][6]

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. GSM (Global system for mobile) uses a process called circuit switching. This method of communication allows a path to be established between two devices. Once the two devices are connected, a constant stream of digital data is relayed. GSM networks consist of three major systems the Switching System (SS), The Base Station (BSS) and the Mobile station (MS). The Switching system is very operative system in which many crucial operations are conducted, SS systems holds five databases with in it which performs different functions. The SS system it performs call processing and subscriber related functions. These databases from SS systems are HLR, MSC, VLR, AUC and EIR. The MSC in cooperation with Home Location register (HLR) and Visitor location register (VLR), take care of mobile calls and routing of phone calls. Authentication centre (AUC) is small unit which handles the security end of the system and Equipment identity register

(EIR) is another important database which holds crucial information regarding mobile equipments. The base station system have very important role in mobile communication. BSS are basically outdoor units which consist of iron rods and are usually of high length. BSS are responsible for connecting subscribers (MS) to mobile networks. All the communication is made in Radio transmission. The Base station System is further divided in two systems. These two systems, they are BTS and BSC. BTS (Base Transceiver station) handles communication using radio transmission with mobile station and BSC (Base station controller) creates physical link between subscriber (MS) and BTS, then manage and controls functions of it. Mobile Station consist of a mobile unit and a smart card which is also referred as a subscriber Identity Module (SIM) card. This card fitted with the GSM Modem and gives the user more personal mobility. The equipment itself is identified by a unique number known as the International Mobile Equipment Identity (IMEI).[6][7]

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 [7].

### III. PROPOSED METHOD

In this proposed work, a method of vehicle tracking system used to track the vehicle by using GPS and GSM technology. The GPS receiver and GSM modem with an Arduino MEGA2560 which is attached to the vehicle. In the other end (main vehicle station) one GSM mobile phone is used to send and receive the information. So the GPS system will send the longitudinal and altitude values corresponding to the position of vehicle to GSM Modem. Imagine a person has forgetting where the car has been parked, he will send an SMS to the vehicle GPS, The SMS sent would come through the GSM service provider and then reach the vehicle, because the vehicle has a GSM device with SIM card. This GSM modem will receive the SMS and send to the Arduino MEGA2560 in the vehicle. The Arduino MEGA2560 will receive this SMS and compare the password and the command. If everything matches then it will perform the request required by the owner with a link that has longitude & latitude for Google Map in order to show the location of the vehicle. Figure 1 shows the architecture of real time GPS tracking system.[8]

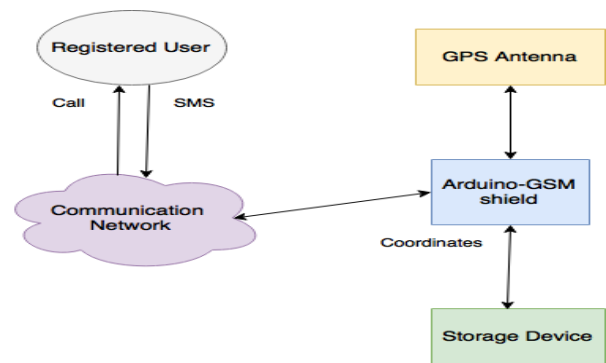


Fig.1. Architecture of Real-time GPS tracking system.

#### A. block diagram

The Block diagram of Vehicle tracking system based on GSM and GPS technology is shown in the Figure 2. It consists Arduino MEGA2560 with power supply, Adafruit FONA 808 Shield - Mini Cellular GSM + GPS for Arduino, Lithium Ion Polymer Battery - 3.7v 1200mAh, Passive GPS Antenna uFL - 15mm x 15mm 1 dBi gain, Slim Sticker-type GSM/Cellular Quad-Band Antenna - 3dBi uFL, SIM Card (2G network), Ethernet Shield, micro SD card (2GB).

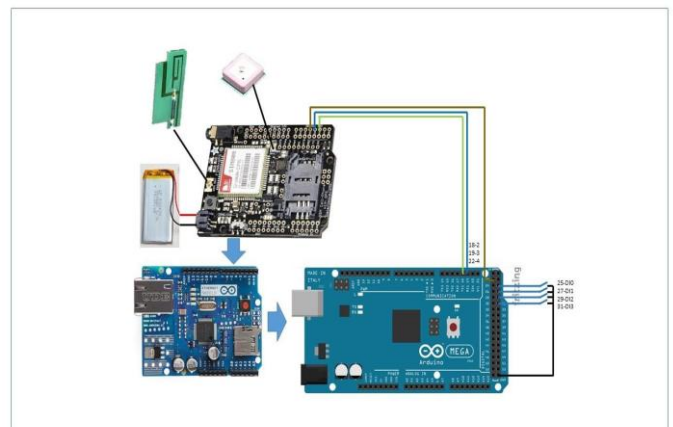


Fig. 2: Block diagram of Vehicle tracking system based on GSM and GPS

#### B. Circuit Descriptions

An Arduino MEGA2560 is used for interfacing to various hardware peripherals. The current design is an embedded application, which will continuously monitor a moving Vehicle and report the status of the Vehicle on demand. For doing so an Arduino MEGA2560 is interfaced serially to a GSM Modem and GPS Receiver. A GSM modem is used to send the position (Latitude and Longitude) of the vehicle from a remote place. 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. The Global Positioning System (GPS) is a satellite based navigation system consists of a network of 24 satellites located into orbit. GPS works in any weather circumstances at anywhere in the world. 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. The GPS modem will continuously give the data i.e. the latitude and longitude indicating the position of the vehicle. The GPS modem gives many parameters as the output such as the vehicle is moving or parked which then the data will be sent to the mobile at the other end from where the position of the vehicle is demanded. This vehicle tracking system takes input from GPS and sends it through the GSM module to desired mobile using mobile communication.

Introducing Adafruit FONA 808 GSM + GPS Shield, an all-in-one cellular phone module with that lets you add location-tracking, voice, text, SMS and data to your project, in Arduino shield format for easy use. This shield fits right over your Arduino or compatible. At the heart is a powerful GSM cellular module (we use the latest SIM808) with integrated GPS. This module can do just about everything: Quad-band 850/900/1800/1900MHz - connect onto any global GSM network with any 2G SIM, with fully-integrated GPS that can be controlled and query over the same serial port Make and receive voice calls using a headset or an external 32W speaker and electret microphone Send and receive SMS messages Send and receive GPRS data (TCP/IP, HTTP, etc.). [9] Figure 3 shows the GPS module.



Fig. 3: GPS module

The 3dBi GSM antenna is slim, compact and sensitive, with a 3dBi gain. The antenna juts out from its base with stick-on back so you attach it to an enclosure if you're making something like, say, a DIY phone. It has a tiny uFL connector on the end - which is perfect for the 1946 - but will also work well for any other RF project on the 850/900/1800/1900/2100 bands, such as any other Cellular or GSM/GPRS device. [10] Figure 4 shows GSM module.



Fig. 4: GSM module

#### IV. WORK FLOW

This flowchart show how the system runs for real time GPS tracking system in figure 5.

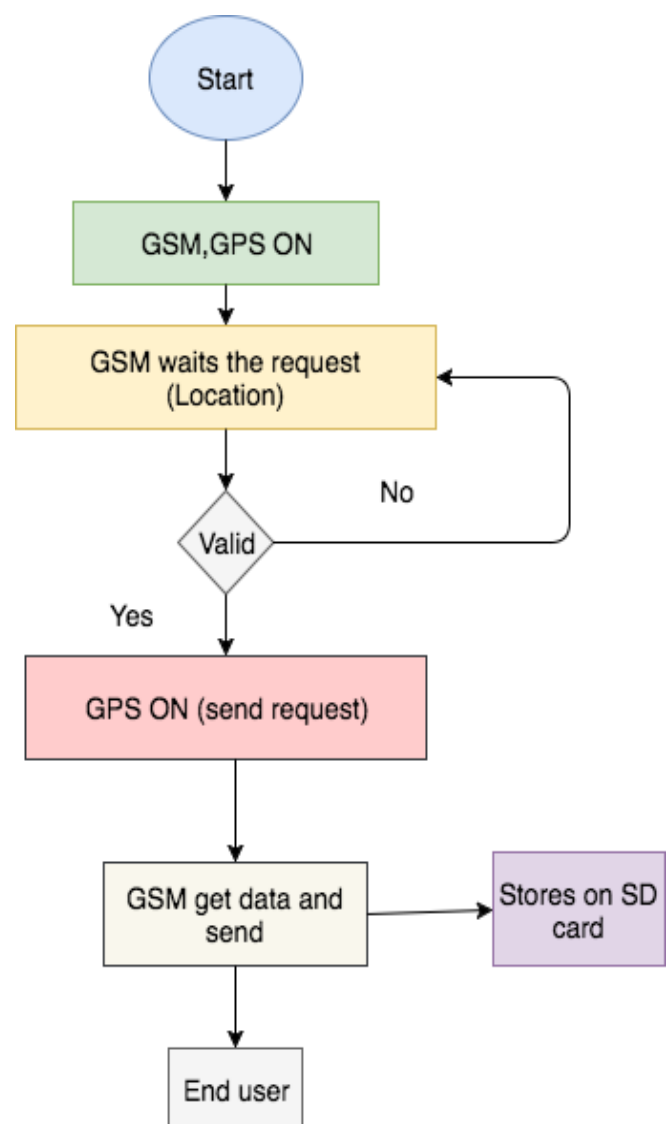


Fig. 5: Flow chart GPS tracking system.

This explain When GPS tracking system install in a car, the system will run automatically and get the data update while move by sending SMS messages. The system will wait for the user to send the SMS to the GSM that is installed in the car if the number that is matched to the number is already

registered in the system which will process the request to the next step. The GPS will provide the data that has been request by take the coordination of the current location of the car and send it to the GSM which will process the data to the user mobile phone via SMS. Also the data data will be stored into the system as history recorded which allow the user to see all the history of the system since it has been installed. when the user receives the SMS which will be in form of link that can take the user to google map which will help to see the current location of the vehicle in accurate of 10 meter.

Also, this GPS tracking system has figure which can let the user to monitor the speed of the vehicle that goes over speed. this can be achieved by let the GPS running continuously with making simple calculation by taking the distance and the time. Ever time the system get the speed, it will compare it with the speed that has been already saved and when it is match it will send SMS directly to the owner of the vehicle in order inform that the car is passed the speed limit. Figure 6 show the flow chart of the speed control in GPS tracking system.

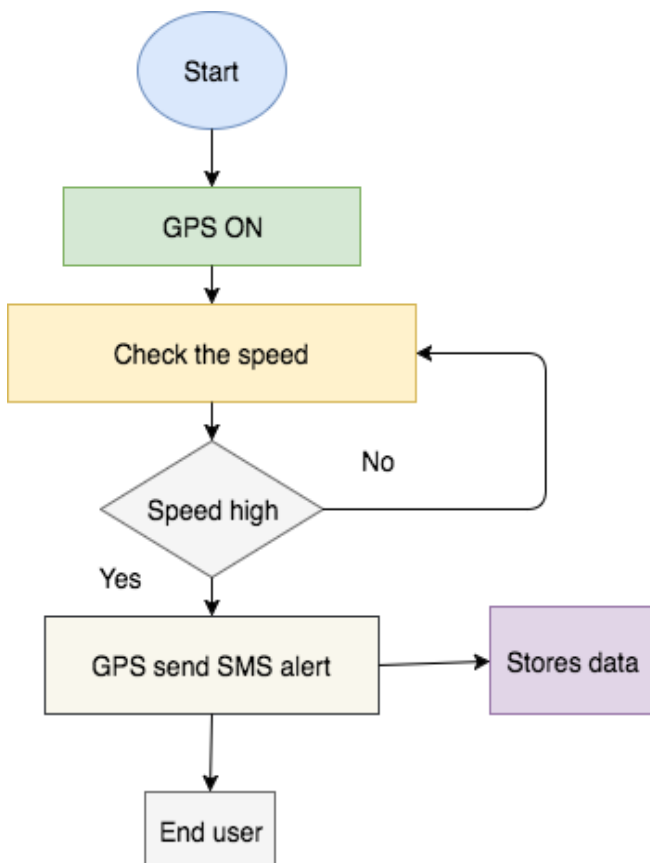


Fig. 6: Flow chart GPS speed monitor

## V. CONCLUSION

In this paper that demand for vehicle tracking systems used to track the vehicle by using GPS and GSM which is one of the biggest technological advancements to track the activities of the vehicle. This system can be used in both cases of personal as well as business purpose to improves safety and security, communication medium and performance monitoring .Vehicle tracking systems

becoming increasingly important in large cities and it is more secured than other systems. Now a day's vehicle theft is rapidly increasing, with this we can have a good control in it. This technology can also help to advance the system of transportation and can be used in many organizations for security purpose and tracking purpose. Also, this system become more useful by adding different type of sensors which help to protect the owner as well as who tends to use the vehicle by decreasing the chances of losing life in such accident. Whenever accident is alerted the system send the location to numbers that already stored in order to get the help as soon as it could especially when the accidents occurred in deserted places and midnights. This vehicle tracking and accident alert feature plays much more important role in day to day life in future. Also, this system can be added to it sensors which can be used to measured the temperature inside the vehicle and when the temperature get high can be informed the user to leave the vehicle which help to protect the children's life in cities where the temperatures is high.

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