Vehicle Transportation Information Using Global Positioning System

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***Abstract*:-** Short Message Service (SMS) is one of the cheapest and easy communication service which used to exchange the information between the subscriber. The purpose of SMS service in GSM network is to get current information of the vehicle to the subscriber. In this paper, transportation system is focused on GSM based mobile communications to track and find the proper location of moving vehicle in a specific area. The presented module involved the development of a hardware device containing a GSM modem and a Global Position System unit that can be present in vehicle and used to track its location. The system is communicated via SMS with a server based GSM phone.

Keywords:- *Global System for Mobile Communications (GSM), Global Positioning System (GPS), Short Message Service (SMS), Base Station (BS).*

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I. INTRODUCTION

Global system for mobile (GSM) is the first cellular system to provide voice and data communication services over a large geographical area. GSM system is basically support a various types of services like telephone service, bearer services or data services & supplementary services. The features of GSM is subscriber identity module (SIM) which is memory device that store the information of such as subscriber identification number, network and county where the subscriber who subscribe their services.

Short messaging service (SMS) is the popular service of GSM network to continuously providing the subscriber or network information. In GSM network, every subscriber who exchange our own information in a text, audio & video with each other. The message (text only) from the sending mobile is stored in a central short message center (SMS) which then forwards it to the destination mobile.

SMS supports national and international roaming. This means that you can send short messages to any other GSM mobile user around the world. With the PCS networks based on all the three technologies, GSM, CDMA and TDMA supporting SMS, SMS is more or less a universal mobile data service.[7]

GPS provides continuous positioning and timing information, any-where in the world under any weather conditions. Because it serves an unlimited number of users as well as being used for security reasons, GPS is a one-way-ranging (passive) system. That is, users can only receive the satellite signals. This chapter introduces the GPS system, its components, and its basic idea. [2]

In the present study an Android based Smartphone with GPS receiver is used showing the versatility of Android SDK for developing a client based application for sending GPS data of client location via SMS.

II. GSM ARCHITECTURE

The GSM architecture consist of three interconnected subsystem i.e base station subsystem(BSS), network & switching subsystem(NSS) and operational support subsystem(OSS).[5]

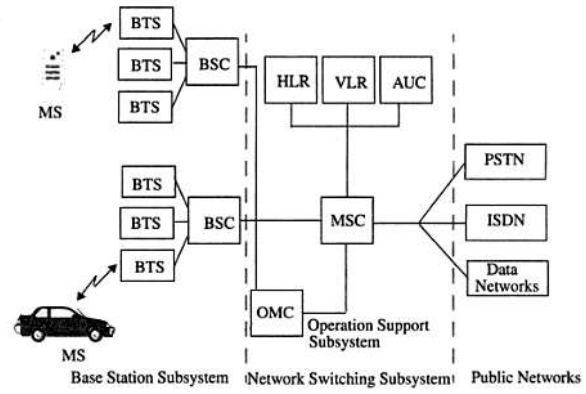

Figure1:- GSM Architecture

Following is the simple architecture diagram of GSM Network:

The added components of the GSM architecture include the functions of the databases and messaging systems:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)
- SMS Serving Center (SMS SC)
- Gateway MSC (GMSC)

The MS and the BSS communicate across the Um interface, also known as the air interface or radio link. The BSS communicates with the Network Service Switching center across the A interface.

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III. WHAT IS GPS?

The Global Positioning System (GPS) is a satellite-based navigation system that was developed by the U.S. Department of Defense (DoD). Initially, GPS was developed as a military system to fulfill U.S. military needs. However, it was later made available to civilians, and is now a dual-use system that can be accessed by both military and civilian users.

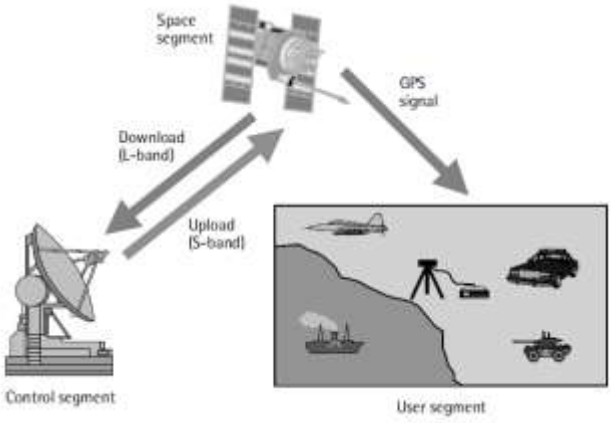

Figure 2:- Three segments of GPS

GPS consists of three segments: the space segment, the control segment, and the user segment. The space segment consists of the 24-satellite. Each GPS satellite transmits a signal, which has a number of components: two sine waves (also known as carrier frequencies), two digital codes, and a navigation message. The codes and the navigation message are added to the carriers as binary biphasic modulations.[1]

The control segment of the GPS system consists of a worldwide network of tracking stations, with a master control station (MCS). The primary task of the operational control segment is tracking the GPS satellites in order to determine and predict satellite locations, system integrity, and behavior of the satellite atomic clocks, atmospheric data, the satellite almanac, and other considerations.

The user segment includes all military and civilian users. With a GPS receiver connected to a GPS antenna, a user can receive the GPS signals, which can be used to determine his or her position anywhere in the world. GPS is currently available to all users worldwide at no direct charge. [1]

IV. Overview of Transportation System

In vehicle transportation system is the biggest transportation in local area. This system provides the information about location of vehicle through GPS to subscriber. In this system, we focus on to develop the communication in vehicle to provide continues information of road stoppage [3].

We developed the system which is present in vehicle and frequently send the current location information via GPS satellite to Base Station (BS) and it releases the message to the phone server. The server stores the information of vehicle location and sends SMS via base station (BS) to client mobile user .[1]

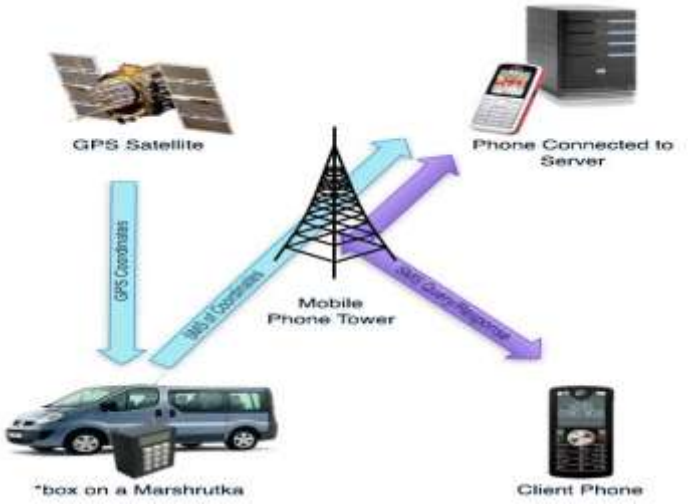

Figure 3:- Vehical Tranportation System

V. GPS POSITION CALCULATION

To provide an introductory description of how a GPS receiver works, error effects are deferred to a later section. Using messages received from a minimum of four visible satellites, a GPS receiver is able to determine the times sent and then the satellite positions corresponding to these times sent. The x, y, and z components of position, and the time sent, are designated as $[x_i, y_i, z_i, t_i]$where the subscript i is the satellite number and has the value 1, 2, 3, or 4.[4] Knowing the indicated time the message was received t_r, the GPS receiver can compute the transit time of the message as $(t_r - t_i)$. Assuming the message traveled at the speed of light, c, the distance traveled or pseudorange, P_i can be computed as

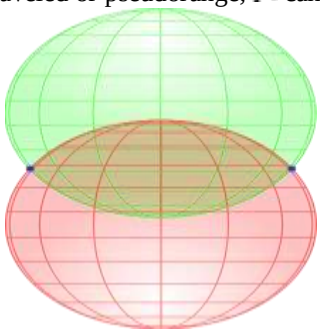

Figure 4:-Two sphere surfaces intersecting in a circle

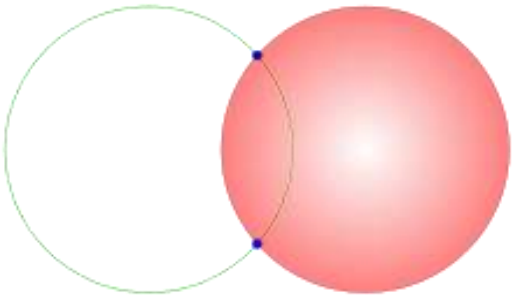

Figure 5:- Surface of sphere intersecting a circle (not a solid disk) at two points

A satellite's position and pseudorange define a sphere, centered on the satellite, with radius equal to the pseudorange. The position of the receiver is somewhere on the surface of this sphere. Thus with four satellites, the indicated position of the GPS receiver is at or near the intersection of the surfaces of four spheres. In the ideal case of no errors, the GPS receiver would be at a precise intersection of the four surfaces. [3]

If the surfaces of two spheres intersect at more than one point, they intersect in a circle. The article trilateration shows this mathematically. A figure, Two Sphere Surfaces Intersecting in a Circle, is shown below. Two points where the surfaces of the spheres intersect are clearly shown in the figure. The distance between these two points is the diameter of the circle of intersection. The intersection of a third spherical surface with the first two will be its intersection with that circle; in most cases of practical interest, this means they intersect at two points. Another figure, Surface of Sphere Intersecting a Circle (not a solid disk) at Two Points, illustrates the intersection. The two intersections are marked with dots. Again the article trilateration clearly shows this mathematically. [5]

For automobiles and other near-earth vehicles, the correct position of the GPS receiver is the intersection closest to the Earth's surface. For space vehicles, the intersection farthest from Earth may be the correct one.

The correct position for the GPS receiver is also the intersection closest to the surface of the sphere corresponding to the fourth satellite.

VI. OPERATION MODES

In the above diagram it is seen that the GPS modem and the GSM modem containing the SIM card have been connected to the connecting PCB with the help of the coding in the microcontroller. There is an antenna connecting the GSM modem to receive the GPS signal in the form of frames. As soon as the system is turned on the GSM and the GPS gets initialized respectively. [5]

Figure 6:- Power on mode

When the system is turned on the GSM modem and then the GPS modem gets initialized respectively. The LCD screen shows the message "GPS-GSM based navigation system".

Figure 7:- Initializing the GSM

After the GPS-GSM based navigation system is turned on, the GSM modem gets initialized so that the message that contains the location can be sent through SMS which will be tracked by the GPS modem.

Figure 8:-Initializing GPS modem, wait for 60 sec

After the GSM modem gets initialized, the GPS modem will get started, which will have the countdown showing from 60 to 00 measured in seconds.

Figure 9: -SMS in form of longitude and latitude on the LCD display

As soon as the GPS gets initialized the system is ready to display its location in the format that contains the latitude and longitude.[6]

1. GSM log file operational commands

```
Terminal log file
Date: 9/14/2014 - 12:44:15 PM
-----------------------------------------------
AT
OK
*NOTE-2014.09.14@12:44:41 - TO INITIALIZE GSM
AT+CMGF=1
OK
AT+CMGS="08087252770"
> PROJECT TESTING
+CMGS: 245
OK
-----------------------------------------------
Date: 9/14/2014 - 12:50:01 PM
End log file
```

Figure10:- GSM log file

2. GPS Frame Received

```
Terminal log file
Date: 9/14/2014 - 12:29:15 PM
-----------------------------------------------
$GPGGA,,,,,0.00,,,M,0.0,M,,0000*48
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPGSV,3,1,12,01,00,000,,02,00,000,,03,00,000,,04,00,000,*7C
$GPGSV,3,2,12,05,00,000,,06,00,000,,07,00,000,,08,00,000,*77
$GPGSV,3,3,12,09,00,000,,10,00,000,,11,00,000,,12,00,000,*71
$GPRMC,,V,,,,,,,,,,N*53
$GPGGA,,,,,0.00,,,M,0.0,M,,0000*48
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPRMC,,V,,,,,,,,,,N*53
$GPGGA,,,,,0.00,,,M,0.0,M,,0000*48
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPRMC,,V,,,,,,,,,,N*53
$GPGGA,,,,,0.00,,,M,0.0,M,,0000*48
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
$GPRMC,,V,,,,,,,,,,N*53
$GPGGA,,,,,0.00,,,M,0.0,M,,0000*48
$GPGSA,A,1,,,,,,,,,,,,,,,*1E
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Figure11:- GPS frame log fil**e**

VII. FINAL OUTPUT

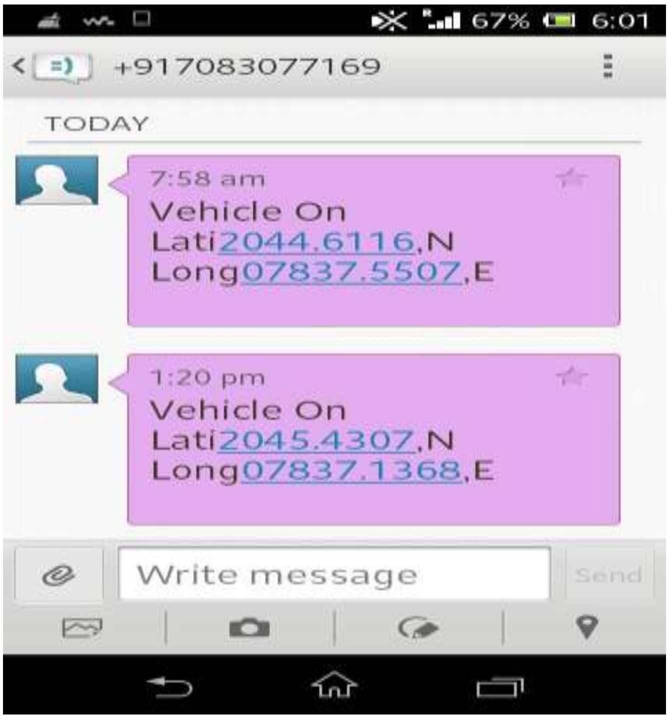

Figure 7- Vehicle location information SMS on Client phone

As shown in the figure 7, the location is displayed having the current location of the system the user will receive via SMS.[6]

CONCLUSION

The present work developed the vehicle transportation system which giving information of locations. In this module, the recent GPS techniques have been used for tracking & searching the location of vehicle. This vehicle can be used to transport goods from one place to another. This system has been provided the current information of actual location of the object via SMS to the subscriber mobile phone. This system can be used for different application like school, colleges etc. where current information of the vehicle is required.

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