



SMS-Based Tracking, Navigation and Broadcasting System

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Abstract—Short Message Service (SMS) is one of the cheapest and best ways for sending and getting precise information with a limitation in size. In this study Standalone programs are developed for both server side and client side to communicate via SMS service provided by GSM service providers in the locality. The usage of SMS in GSM based mobile communications is successfully tested for getting GPS co-ordinates of the client location using a Android based Smartphone and dynamically plotting the co-ordinates, path etc. using Google Maps API in the server. Based on this study, importance of SMS based applications in various domains are discussed in the present paper.

Keywords— Global System for Mobile Communications (GSM); Global Positioning System (GPS); Short Message Service (SMS);

I. INTRODUCTION

Short Message Service (SMS) is a text based messaging service available in cell phone or a mobile communication system, which uses standard communication protocol that allow the exchange of limited size text messages (e.g. 160 7-bit characters in GSM mobile handsets). This technology is widely used in day to day applications throughout the world. For example Text message services generated by users - include financial, news, sports, language and location based services, mobile commerce such as shopping, stocks and share prices, mobile banking facilities, reminders about programs and booking services.

The GSM is originally Group Special Mobile, which is a standard developed by the ETSI (European Telecommunications Standards Institute) to describe the protocols for digital cellular networks used by mobile phones i.e. Second Generation (2G) networks. Later it became the global standard for mobile communications. The GSM standard was developed as a substitute for first generation (1G) analog cellular networks. This standard initially described a digital, circuit-switched network which was optimized for full duplex voice telephony. This is later extended to include data communications, by circuit-switched transport and then subsequently by packet data transport via General Packet Radio Services (GPRS) and Enhanced Data rates for GSM Evolution (EDGE or EGPRS). Later, the third generation (3G) UMTS standards were developed by the 3GPP, followed by fourth generation (4G) LTE Advanced standards, and they are not a part of ETSI GSM standard.

Smartphone is a mobile phone with many advanced computing capabilities, features and connectivity than the basic features available in normal mobile phones. The early generation smartphones typically included the features of a mobile phone with those of other popular consumer devices, such as PDAs, a digital camera, a multimedia player and a GPS navigation unit (optional). Modern smartphones along with all the features, they also include the features of a touch screen system, including browsers for web browsing, Wi-Fi, and some 3rd-party applications and accessories. The most popular smartphones available today in the worldwide market are powered by Android from Google and iOS from Apple, mobile operating systems. In the present study a 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.

The Global Positioning System (GPS) is a satellite navigation system that provides information about location and time in all weather conditions, spatially anywhere on Earth. Four or more GPS satellites are used to provide GPS information when there is unobstructed line of sight from earth. The GPS system provides important capabilities to military, commercial and civil users around the world. The United States government maintains this, and is freely accessible to anyone, anywhere with a GPS receiver.

The GPS receiver calculates its position using precision timing of the signals sent by satellites above the Earth. The GPS satellite transmits messages continuously that include: the time at which the message was transmitted and the satellite's position at that particular time of message transmission. To determine the transit time of each message the receiver uses the messages it receive and then the distance to each satellite is computed using the speed of light. The distance calculated and locations of the satellites are used to compute the receiver's location using navigation equations assuming the GPS receiver is located on a sphere. This location is displayed as latitude and longitude; elevation or altitude information based on height above the geoid.

II. RELATED WORKS

A novel technique for sending GPS coordinates to other mobiles through Short Message Service (SMS) based on Global Positioning System (GPS) technology was developed [1] and the application enables the users to get their current

location coordinates (latitude, longitude and altitude), view their locations on the Google maps and enables the user to share his location with their friends through a web server using internet connectivity in their handhelds.

This technique is developed using two algorithms namely Kalman filter and velocity renovation [2], which can be used along with GPS as a basis for location tracking, to send GPS coordinates to other mobiles phones using short message service (SMS) based on Global Positioning System (GPS) technology.

A system involved the development of a hardware device which consists of a GSM modem and a GPS unit which can be installed on a vehicle and can be used to track its location [3]. The hardware device communicates by sending SMS to the GSM phone in turn connected to the server. The server then runs a route prediction algorithm, helping users sending SMS messages to know the current location of the vehicle.

Usages of Short Message Services are increasingly being relied upon day by day to broadcast critical information during emergencies. A software is developed [4] to inform the service centre for instant help, to save the life of the people by sending the nearest emergency service and/or police officers. By making use of the GPS services available in cell phones the accurate position of the accident location or emergency is reported via SMS.

Commuters in India face a lot of vehicular problems which usually go unreported and thus, unattended. This is because making a location aware complaint is an inconvenient affair. Work [5] presents the architecture of a Voice Enabled Global Positioning System (GPS) based approach for reporting vehicular complaints on an Android platform. The complaint is registered via the Short Message Service (SMS) over the Global System for Mobile Communications (GSM). GPS tracking enhances the accuracy and competence of the complaint system by mapping the location where the complaint was issued. This will aid the authorities to identify the spot and have the problems resolved responsively.

III. APPLICATION DEVELOPMENT

Based on the literature survey presented in the previous section, an idea is conceived for developing an application both server and client side to track location, navigate and broadcast the same in case of emergency. The basic hardware and software development requirements are presented in the subsequent section:

A. Hardware Requirements

A GSM modem with Subscriber Identification Module (SIM) as shown in Fig 1. RS232 Serial cable, Personal Computer (acting as server), Smartphone with in-built GPS receiver (running on Client side) and a working SIM.

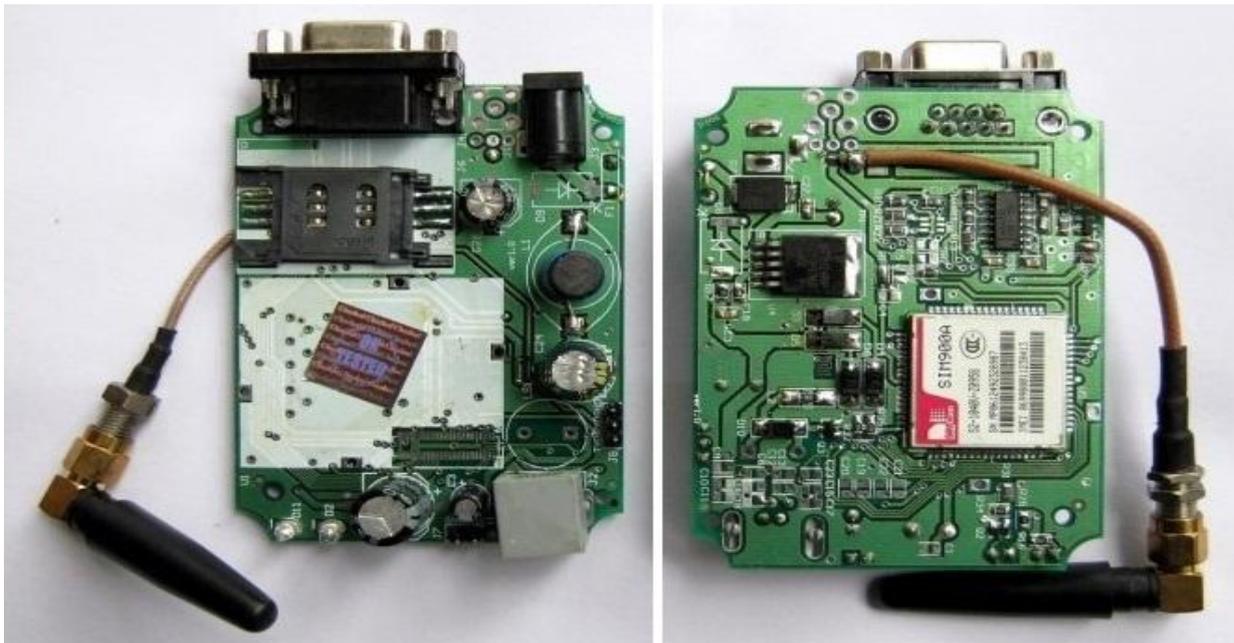


Fig. 1. GSM Modem based on SIM900A Chip (SIMCOM) - Top view (Left) and Bottom view (Right).

B. Software Requirements

Microsoft Windows Operating system on PC (Windows 7 professional 64 bit is used for the present study), Android OS for Smartphone, and Android Software Development Kit with Eclipse IDE for App development, Python programming environment is chosen for the developing the server side application and Qt for developing GUI interface [6] and Google Maps API.

C. Application Architecture

The architecture of the application developed has two components as shown in Fig. 2. Firstly, Client based application receiving GPS data and sending the data to the server via SMS with the help of mobile communication towers spatially distributed and operated by service providers. Secondly, the server application receiving data, analysing, storing and dynamically plotting the location and in case of emergency broadcasting can be done from server.

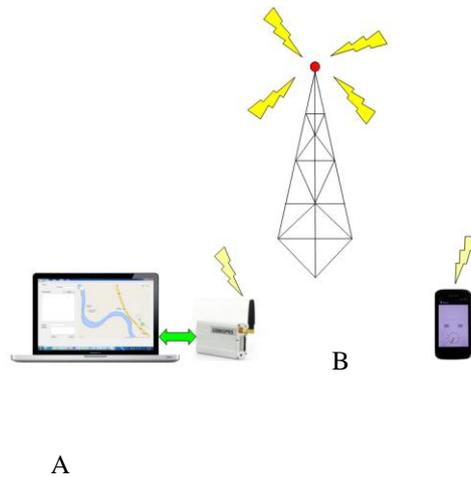


Fig. 2. Model showing (A) Server based application on a PC with GSM Modem receiving and broadcasting (B) Mobile communications tower (C) Client Application on smartphone sending GPS co-ordinates via SMS

D. Server Side

The GSM modem with a working SIM is interfaced with the PC using RS232 serial cable using a COM port. The server side application is basically developed using python programming. PyQt4 is used to develop the graphical user interface consisting of a drop down menu for selecting the COM port and starting, stopping the application activity. The monitoring for fresh SMS starts once COM port is connected. A Button is used to delete stored SMS incase the memory for storing SMS exceeds limit. The received SMS can be seen in the Text Area provided in the GUI.

As soon as an SMS with GPS data is received the GPS co-ordinates are stored inside a database file with the help of Sqlite available in Python programming environment. The co-ordinates are fed to the Google Maps API and immediately they are plotted after contacting Google Maps server via internet.

Broadcasting or a chat window is designed in the GUI for sending information to the client or any other destination in case of emergency or can provide navigation services if required. The GUI can be visualized in Fig. 3. with all the necessary provisions.

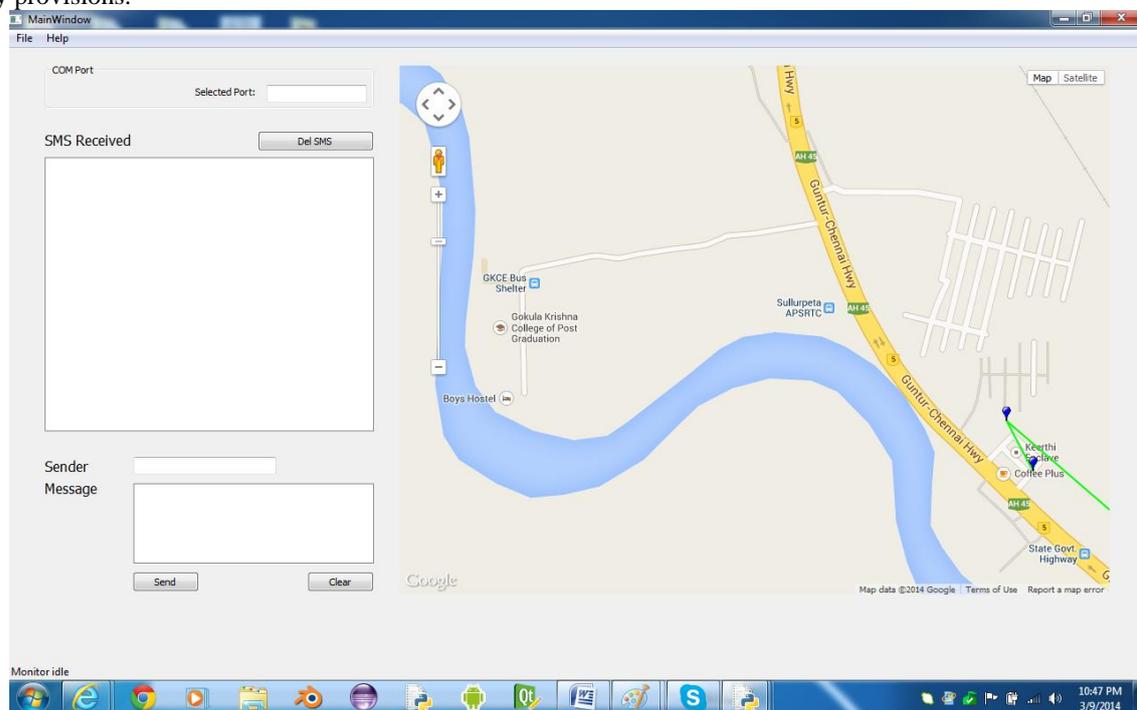


Fig. 3. GUI based Server Application developed using QT and Python .

E. Client Side

The client side application is developed using Android Software Development Kit and target Android version is 4.0. Widely used Eclipse IDE programming environment is chosen for completing the task. The client android app GUI consists of a Text Box for entering the mobile number (in this case the working SIM used in GSM modem connected to server) and two clickable buttons to start and stop sending SMS.

A Celkon A97i model Smartphone hosting Android OS version 4.0.3 is used for testing the android application developed as shown in Fig. 4.



Fig. 4. Android Application on client side smartphone.

IV. CONCLUSIONS AND FUTURE WORK

A SMS based Tracking, Navigation and Broadcasting application is successfully tested. The use of this application is wide as discussed in related works. This application can be used in SOS in case of emergency by sending the GPS location which helps in tracking down. The client can also dynamically interact with the server side for navigation incase he is lost and searching for the right address. This application can also be used in traffic design studies for optimizing the signal timing at busy intersections and thereby providing alternate routes to commuters.

The application developed in the present study is only a precursor and to demonstrate the use of SMS and GPS for different domains. There is lot of scope for future work in this area and the server side can be fully automated (presently user intervention is required for broadcasting).

ACKNOWLEDGMENT

I would like to acknowledge our Head of Department and principal for the guidance and extending full support to make the present study successful.

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