Integrated Vehicle Tracking System

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ABSTRACT
Tracking systems were developed to keep track of shipped goods. Passive systems were deployed for this purpose in olden days. However for applications requiring Real time location information, Active systems are required to transmit the location of the vehicle in Real time. This paper proposes an integrated tracking system design with GPS and GSM to incorporate location information and surveillance using SMS to determine the exact location of an object , person or other asset to which it is attached .Using GSM modem this information can be transmitted to a remote user. This system contains a single board system equipped with GPS and GSM modems along with PIC Processor. A software is developed to read, store, process and analyze the incoming SMS message. This system can be a valuable tool for providing real time control and monitoring.

Keywords
GPS, GSM, Microcontroller, Sensors, AT commands.

1. INTRODUCTION
The Global Positioning System - GPS is a world wide Radio-navigation system formed from a constellation of 24 satellites and their ground stations. With advanced Differential GPS systems, positions up to an accuracy of few centimetres can be located. Automatic Vehicle Location systems have been discussed under GIS environment [1].Vehicle tracking has become imperative in today's world as asset theft, vehicle theft and kidnapping have become quite rampant [2]. Video surveillance and tracking have also been designed [3]. This work attempts to design a tracking unit that uses a GPS system to determine the exact location of an object, person or other asset to which it is attached while the GSM modem transmits this information to a remote user. This system contains single board system equipped with GPS and GSM modems along with PIC processor which can be installed in a vehicle. When the object is in motion the location can be reported by SMS. The software developed helps to read. process, analyse and store the incoming SMS messages.

2. LITERATURE REVIEW
Many attempts to design tracking units using GPS and GPS/GPRS are done using tele-monitoring services[4,5]. New approaches of Automobile Localization System using GPS/GPRS standards with reasonable reduction in cost has been designed successfully [6] Various sensors have been deployed to take into account the weather conditions and errors arising due to them. Errors due to the difference between the actual North and magnetic north have also been resolved with sensors and optimized outputs have been achieved[7,8]. Advantage of the cell –ID positioning of the GSM protocol in which the technique of forced handoffs through programmed algorithm has been used to design systems which take care of the rising thefts of vehicles [9].

3. SYSTEM OVERVIEW
3.1 Introduction to system design
The single board module designed here consists of the GPS,GPRS and the microcontroller. The block diagram of the system is as shown in the Figure 1.

The GPS receiver used here is the ProGin SR-87 series as it incorporates high sensitivity, high performance, low power consumption with an on chip RAM of 1-Mb SiRF Star III chipset solution in a compact design. 20 satellites can be tracked at a time while offering fast time-to-first-fix and 1Hz navigation. Propriety NMEA –National Marine Electronics Association sentences are used to communicate with the receiver. This module communicates with application system via RS232 with NMEA-0183 protocol.

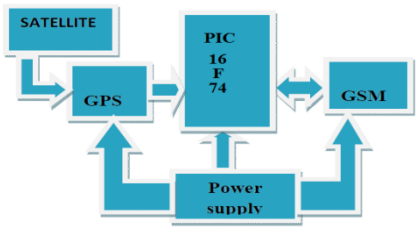

Fig 1 Block Diagram showing System Interconnection

3.2 Hardware Description
Two GSM modems, one to be installed on the vehicle to be tracked and another to be interfaced with the computer through which we can send the command codes have been designed. Both the modems can be tested from the hyper terminal available in Windows XP. Two types of AT commands, Basic commands and Extended Commands are used. Example of an AT command used is mentioned as follows. AT is used as prefix to indicate the start of a command line. Figure 2 illustrates the hardware setup for Vehicle Tracking System (VTS).

AT+CMGF: Message Format

AT+CMGF=<mode>; mode 0=PDU Mode while 1=Text Mode

Select the SMS format to be used in reading and writing messages.

Test command:

AT+CMGF=? Reports the supported value of <mode> parameter.

For example:

AT+CMGF=1

The above command will select the SMS format as text mode.

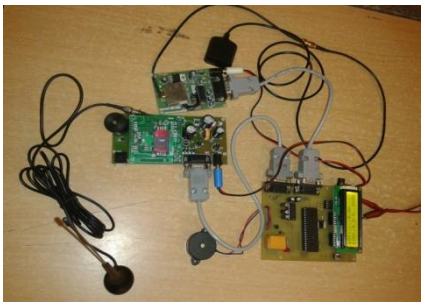

Fig 2 The Hardware Setup for VTS

The modem on interfacing as shown in Figure.3 with the computer has to be checked through the hyper terminal by sending the AT0 command and the modem acknowledges it by outputting an OK.

Fig 3 GSM Modem with the Computer

3.3 Software Description

PIC16F74 Microcontroller with a wide operating range has been selected for sensing the signals and to control the output signals. This microcontroller has a wide operating range ,consumes less power, typically less than 2mA at 5 volt supply. The PIC16F74 features 8 channels of 8-bit Analog-to-Digital (A/D) converter with 2 additional timers, 2 capture/compare/PWM functions and the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). Features like 4K on board memory, multiple A/D conversion channels and possibility for serial communication is exactly what we need from a tracking device. The proposed model can be controlled through the computer terminal as

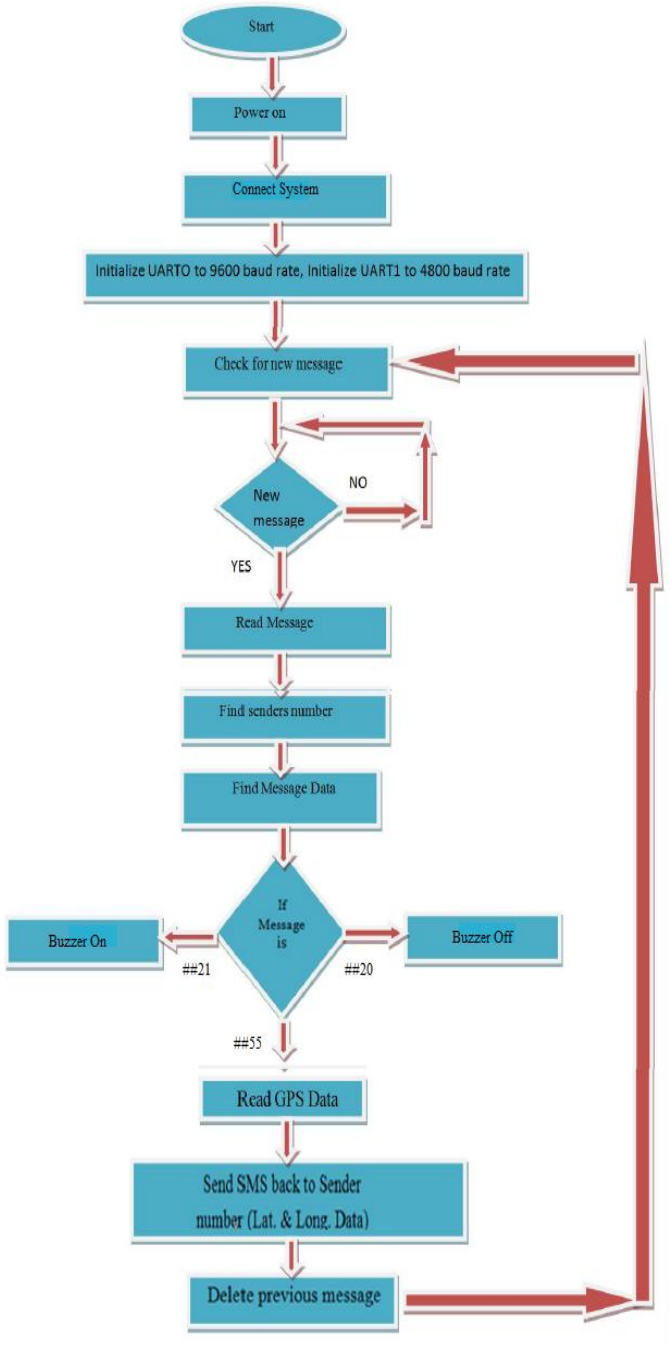

Fig 4 System Flow Diagram

well as with a mobile hand held device. The flow chart given, details the steps of the tracking system. The location of the vehicle can be identified with the help of the command #55 sent through a mobile or through the computer address which will track the objects.

The location of the vehicle can be tracked in terms of latitude and longitude. The vehicle can be controlled by passwords like #21 and #20 as shown in the flowchart.

Figure 5 shows the Input view while Figure 6 shows the Output location on the cell phone.

Fig 5 Input from Cell phone

Fig 6 Output location on cell phone

3.4 Tracking through a Computer Terminal

The Interface code of the PC and the tracking system has been designed in Microsoft Visual Studio's, Visual C#. After debugging and running the code we select the COM PORT at which the GSM modem is connected with the PC. The appropriate baud rate (generally 9600) is chosen to connect with the modem. When the modem gets connected a message as shown in figure 7 is displayed. The command message can be sent to the tracking system to get the location of the vehicle to be tracked by clicking on Message > Send (shown in figure 8).

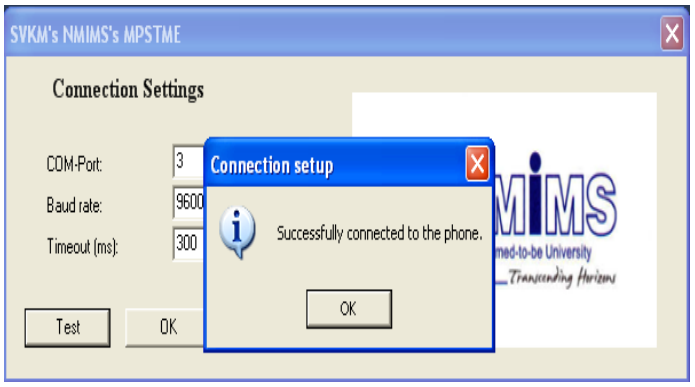

Fig 7 Connection with the Modem

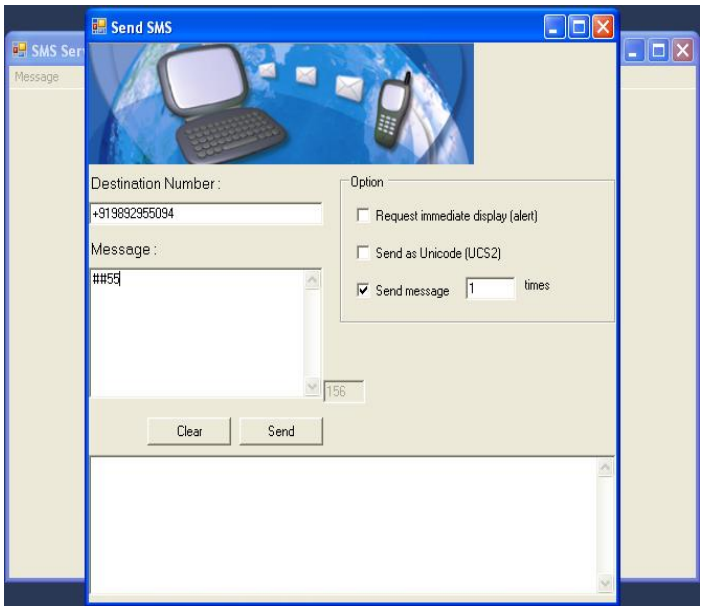

Fig 8 Sending SMS to VTS through PC

On receiving the SMS command the VTS retrieves the vehicles status and sends the location status in the form of latitude and longitude back to the requesting terminal. The location parameters received at the PC terminals are compared with the existing data base and the final location of the vehicle is available. On entering the location details obtained in SMS format from the system, it displays the location name where the vehicle along with the IVT (In-Vehicle-Unit) is located.

4. CONCLUSIONS

The GPS and GSM devices were tested and initial settings were initialized with the help of a PC extensively. Some of the software used were Advance Serial Port Monitor, Hyper Terminal, Diaffan and SMS Server Lite. SiRF proprietary NMEA sentences were used to communicate with the GPS receiver, whereas the AT commands were used for the GSM modem. The intermediate results of the portion of designs were tested with the help of the PC and with the LCD

interfaced with the system. The designed system is able to track any mobile asset which is found to be in the database as predefined. Successfully tracking the location of the desired vehicle from the college Mukesh Patel School of Technology Management and Engineering to the Mithibai College with proper outputs has been performed.

The developed system thus helps user to track the mobile vehicle by receiving SMS messages and also through the Computer. The limitation though being the information which is available in terms of the latitude and longitude. With this system it becomes easy for the users to keep track of their vehicles.

5. REFERENCES

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