AUTOMATIC BUS RECOGNITION THROUGH MOBILE

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Abstract— **This paper presents a GPS (global positioning system) to track the vehicle in the remote areas. Here based on the latitude and longitude values of the vehicles anywhere on the globe, a microcontroller which will process the information and switch the GSM (global system for mobile communication) to send SMS to the users about present location, time, date, speed of the vehicle. In this method we give mobile number, bus number, line number, speed, date, to the controller center. Those who are subscribed to the controller centre it automatically sends the sms to the user through GSM modem. Here we create a program to the controller center to send an sms message to a User. Whenever it arrives near to the junction or crosses the junction it automatically update the further information regarding the location by using the GPS system and sends the SMS to the user by using the GSM modem. GSM modem and micro controller are combined for the purpose of automatic bus recognition with a smart phone. The method works in real time applications in terms of recognition rate and reliability.**

Keywords— **GPS, GSM Modem, Microcontroller, SMS**

I. INTRODUCTION

In this modern era of communication and automation usage of every new technology is increased. In this speed age usage of vehicles increased whenever we are waiting for a bus at the bus stop ,when the bus arrives but that bus go through another way. In which way the bus goes one doesn't know and finally waiting for the bus becomes wastage of time so, in order to reduce these types of problems we use automatic bus recognition through mobile. In this, we use GSM Modem, GPS, and Microcontroller for broadcasting the bus number, time, date, mobile number, and information about the route map given to these modem. The system described can be used to localize and recognize text in urban scenes; the system employs a GSM Modem and GPS placed in bus, and an antenna that is mounted on top of the bus. In most urban scenarios, people every day faces difficulty in getting into the right bus. In this paper, we propose an innovative method for localizing and recognizing in a completely automatic bus recognition through mobile. In this method use only a standard smart phone no specific device is required. The method employs a careful combination of GSM Modem and GPS by which a satisfactory recognition performance is achieved.
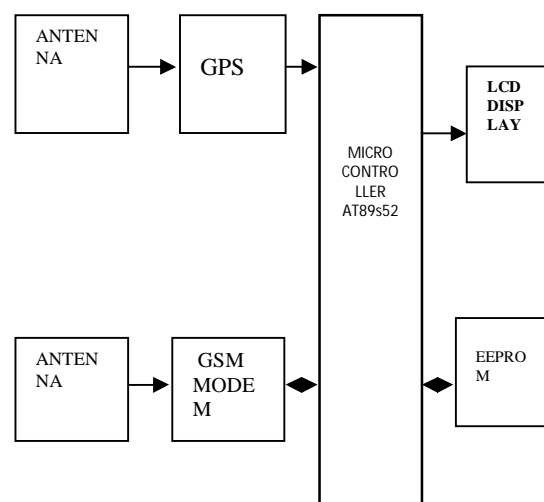
II. BLOCK DIAGRAM

Fig. 1 Block Diagram

A. *Antenna:* It is used to receive the signals from different places.

B. *GPS:* The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defence. It is mainly used to track the signal anywhere on the earth.

C. *GSM Modem:* A GSM modem is a specialized type of modem which accept a sim card and it is mainly used to send sms to all users.

D. *Micro Controller:* A microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Here we have used AT89S52microcontroller .the AT89S52 is a low power, high performance CMOS 8-bit microcontroller with 8k bytes of in system flash programmable and erasable read only memory.

E. *LCD Display:* A LCD dot matrix display is a display device used to display information on machine, clock, and many other devices requiring a simple display device of limited resolution .The display consists of a matrix of lights or mechanical indicator arranged in a rectangular configuration such that by switching on or off selected lights, text or graphics can be displayed.

F. *EEPROM:* It is used to store the mobile number.

III. OUR METHOD

To design the BUS Navigation System, we combined the GPS's ability to pin point location along with the ability of the Global System for Mobile Communications (GSM) to communicate with a control centre in a wireless fashion. The system includes many GPS-GSM Mobile Navigators and a base station called the control centre. In this method we give mobile number, bus number, line number, speed, date, to the controller centre. Those who are subscribed to the controller centre it automatically sends the sms to the user through GSM modem. Here we create a program to the controller centre to send an sms message to a User. The program directs the GPS-GSM mobile navigator to read and delete an incoming short message. The print command is a BASCOM-AVR instruction that sends output to the serial port. The rs232_r subroutine is used to read input from the serial port. When a bus enters into the city automatically it will send sms to all users. Whenever it arrives near to the junction or crosses the junction it automatically update the further information regarding the location by using the GPS system and sends the SMS to the user by using the GSM modem. GSM modem and micro controller are combined for the purpose of automatic bus recognition with a smart phone. The method works in real time applications in terms of recognition rate and reliability.

A.   *GSM:* Global system for mobile communication is a globally accepted for standard digital communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specification for a pan European mobile cellular radio operating system at 900GHZ. It is estimated that many countries outside of Europe Will join the GSM partnership.

A GSM network consists of several functional entities whose functions and interfaces are defined. The GSM network can be divided into following broad parts.

1. The Mobile Station(MS)
2. The Base Station Subsystem (BSS)
3. The Network Switching Subsystem (NSS)
4. The Operation Support Subsystem(OSS)

The below mentioned figure describes the simple architecture diagram of GSM Network:
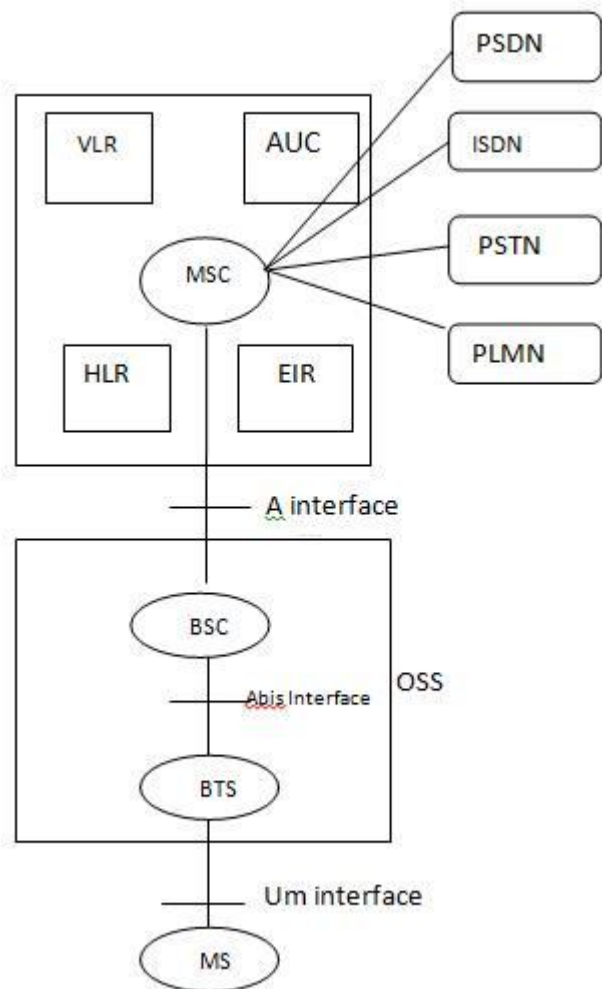

Fig. 2 Architecture of GSM Network

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

A. Home Location Register (HLR)
B. Visitor Location Register (VLR)
C. Equipment Identity Register (EIR)

D. Authentication Centre (AuC)

E. SMS Serving Centre (SMS SC)

F. Gateway MSC (GMSC)

G. Tran's coder and Adaptation Unit (TRAU).

A. *Home Location Register (HLR):* It is a data base used for storage and management of subscription. It stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status.

B. *Visitor Location Register (VLR):* It is a data base that contains temporary information about subscribers that is needed by the Msc in order to visiting subscriber's service. When a mobile station roams into a new Msc area, the VLR connected to that Msc will request data about the mobile station from the HLR.

C. *Authentication Centre (AuC):* It provide authentication and encryption parameters that verify the users identity and ensure the confidentiality of each cell.

D. *Equipment Identity Register (EIR):* It is a data base that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations.

E. *Gateway Mobile Switching Centre (GMSC):* It is a node used to inter connect two networks. It is often implemented in an Msc.

F. *Tran's coder and Adaptation Unit (TRAU):* The TRAU is the equipment in which coding and decoding is carried out as well as rate adaptation in case of data.

IV. NAVIGATING WITH GPS

A. *GPS Fundamentals:* GPS became available in 1978 the successful launch ofNAVSTAR1. NAVSTAR 1 was the first of four NAVSTAR satellites launched that year, creating an operational satellite navigation system for the military. GPS satellites are incredible instruments. Each satellite contains four atomic clocks that operate on a level of one second of error in three million years. so each satellite can operate autonomously yet remains synchronized. GPS satellites transmit ranging codes based on a signal's time of arrival, not position and motion. Using ranging code from four satellites, a GPS receiver can calculate its own position in three-dimensional space, including the receiver's velocity. The NAVSTAR system breaks down navigation into two domains, Standard Positioning Service (SPS) and Precise Positioning Service (PPS). PPS accuracy is published at 21-m horizontally and 29-m vertically. The early NAVSTAR SPS was so accurate that it was considered a threat, so the gap between SPS and PPS was intentionally widened. The accuracy level of the SPS was decreased to 100 m in the horizontal plane and 160 m in the vertical plane. The decrease, called selective availability (SA). GPS

applications based on latitude, longitude, and time. Latitude and longitude are fundamentals of navigation. Sometimes it's difficult to remember which is which. I use the mnemonic "it's a long way from the North Pole to the South Pole." Longitude lines run from the North Pole to the South Pole and are measured in half circles from the Royal Green which Observatory in Green which, UK. Longitude lines run from0 to 180° east and 0to 180° west (see Figure1).Latitude lines run in parallel from the equator to the North and South Poles. Latitude lines run from 0° at the equator to 90° at the North and South Poles. As the lines of latitude get closer to the poles, they become smaller.
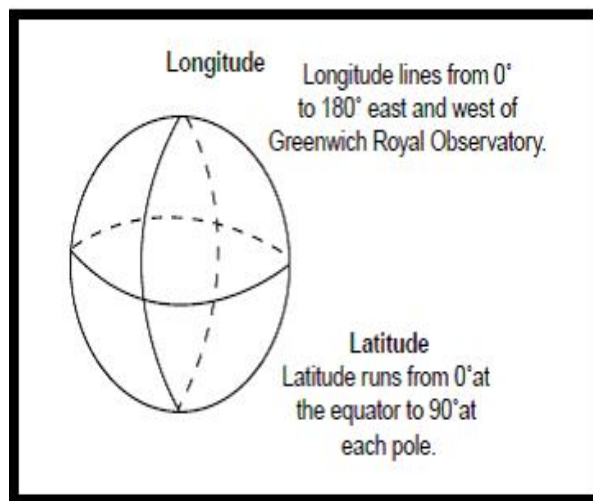

Fig.3 Longitude lines run east and west from pole to pole. Latitude lines run north and south, parallel to the equator.

B. *Receiving the data:* Most GPS receivers output data in NMEA-0183 format. NMEA stands for the National Marine Electronics Association. The data is sent via RS-232 at4800 bps, with most GPS receivers providing a serial port that outputs NMEA GPS messages at 1-s intervals. NMEA messages are sent by talkers (identified by a two-character ID string with a "GP" prefix) and received by listeners. The messages are one-way: from talker to listener. Thus, an application program's control of the receiver's output is limited. Data enters your application program at 4800bps at 1-s intervals, period. The data rate and burst time can't be changed. An NMEA sentence contains an address field, data field, and check sum. The address field is composed of a sentence formatter and talker identifier. The latter indicates where the data comes from. For GPS, the talker identifier is GP. Two useful GPS talker identifiers are RMC and GGA. The sentence formatter indicates the content of the data field. The general NMEA message format is:$<Address>,<Data>*<Checksum><CR><LF>$The address field, $<Address>$, is broken down as $<talker><sentence formatter>$. All fields are comma delimited except $<Checksum>$, NMEA GPS messages.

The most useful lone is the RMC message, which contains all of the basic information required to build a navigation system. It contains time, status, position, speed, course, and date. Looking at the RMC message, the first chunk of data encountered is $GPRMC. As the NMEA sentence describes, this is the talker and sentence formatter. Universal Time Coordinated UTC data follows the sentence formatter; the time is given in hours minutes, seconds, and decimal seconds. Next is the GPS status indicator (A), which indicates whether or not the incoming GPS data is valid. The V in this field seems to indicate that the data is valid; however, it means the opposite. An A in this field means that the data is indeed valid. There are many reasons why a GPS receiver would output invalid data. For example, the receiver might not have acquired enough satellites for   a position fix yet, foliage or buildings might block the GPS signals, or the GPS almanac or ephemeris data could be out of date. Invalid data output from a receiver is almost always temporary, and a V usually will become an A within seconds or minutes. The next two fields cover latitude and determine whether the latitude is in the Northern or Southern Hemisphere. Following the latitude fields are the corresponding longitude and east/west indicators. The two fields after that, speed (knots) over ground and course (degrees) over ground, are handy. Next is the date, and then the magnetic variation (east or west).The RMC message is available on almost all receivers that output NMEA messages. As stated, GPS receivers supporting NMEA messages output data at 1-s intervals at 4800 bps, so processing data at 1200- to 1800msintervals ensures enough time to fill up a receiver buffer and transfer the data to a holding buffer. The data in the holding buffer can be parsed and processed while new information enters the receive buffer. The structure contains the proper data types to contain the RMC data fields. You can create similar structures for additional NMEA messages that an application needs.   After the GPS receiver deposits data in a buffer named INPUTQUEUE [ ], the data is transferred to another buffer called INPUTMSGBUFF [ ]. The latter is used to extract the RMC or other NMEA messages of interest. To extract the data, create a pointer and have it point to INPUTQUEUE [ ]. For transferring data, you need to dereference the pointer to INPUT-MSGBUFF [ ].When a message is in a buffer, the talker and sentence formatter can be identified and processed. This bit of code collects a sequence of messages so multiple messages can be processed. This allows you to create custom structures, spanning the data from multiple messages. For example, a structure can be created that holds speed, course, latitude, longitude, the number of satellites in view, and dilution of precision values.

C. *Waypoint Navigation:* Waypoint navigation is based on great circle navigation. Great circle navigation is general and good for planes, boats, and cars. Waypoint navigation systems navigate via latitude and longitude pairs. The navigation computer accesses a list of latitude/longitude pairs and calculates the distance and bearing from one point to another. Information presented is usually the current distance and bearing from your present position to the next waypoint. Often, a dynamic directional pointer is displayed, which you follow to the next waypoint. Before navigating, the data from the GPS receiver must be converted to a form acceptable to the great circle navigation algorithms (i.e., the distance and bearing formulae). All NMEA data is emitted as ASCII data. Latitude and longitude data received from a GPS receiver in NMEA-0183 format is in unit's ddmm.mmmm, where dd equals degrees, mm equals minutes, and .mmmm is decimal minutes. These units are not appropriate for the distance and course calculations; they must be converted to degrees and decimal degrees, then to radians. The first step is converting the latitude and longitude data from the form ddmm.mmmm to dd.dddd. This is a straightforward algorithm, but It still takes a substantial amount of code. To determine the algorithm, first separate and save dd from the incoming latitude and longitude string. Then, divide mm.mmmm by 60, resulting in an exponent of zero and a new mantissa, 0.dddd. Third, add the saved dd to the result, yielding dd.dddd. After you finish converting latitude and longitude, radian conversion is possible. The formula to convert from dd.mmmm to radians is: radians = dd.dddd57.3After performing the distance and bearing calculations, the data needs to be converted back to dd.mm.mmmm. This is done by following the formula degrees = radians ×57.2957795Now, you can tackle the knots and nautical miles(NM) conversions. All speed and distance data contained in NMEA messages is in terms of knots and nautical miles. Now, convert knots to miles per hour and nautical miles to statute(land) miles .The conversion to nautical miles is NM = radians ×3437.7387. Next, you can convert nautical miles to land miles (MI) using MI = NM × 1.150779. Converting from land miles to feet (FT), the formula is FT = MI × 5280.

D. *Navigation Formulas:* To compute the great circle distance between two pairs of latitudes and longitudes, use d =acos(sin(Lat1)× sin(Lat2) + cos(Lat1) ×cos(Lat2) × cos(Lon1 – Lon2))This formula accurately yields the distance between two points on the globe. Now that distance is calculated, the next thing to do is calculate the bearing from one point to another. Bearing tells you which way to go. It is defined as the angle measured horizontally from north to the current direction of travel. North can be true north or magnetic north. Again, the great circle distance (d) between two points must be previously calculated. The classic bearing formula is:

$$c = \text{acos}\left(\frac{\sin(Lat2) - \sin(Lat1) \times \cos(d)}{\cos(Lat1) \times \sin(d)}\right)$$

Where d equals the great circle distance. The result (c) must be qualified by testing whether or not sin (Lon2 –Lon1) is negative. If negative, the true is determined by 360° – c. Add 360° if the result is negative, creating an angle value that points from one way point to another. Many different sources are available to determine waypoints. Inexpensive PC-based mapping programs provide methods of converting map points to latitude and longitude. Converting from an address to latitude and longitude value is called geo coding. Converting from latitude and longitude values to an address is called reverse geo coding. Using the algorithms provided here and a GPS receiver, you can create your own way point-capturing program. Simply provide some code that will save the incoming RMC message when you pass. Over a location the saved message contains the latitude and longitude of the - point passed over. You can use a collection of these values to create accurate maneuver lists for roads, trails, rivers, and lakes.
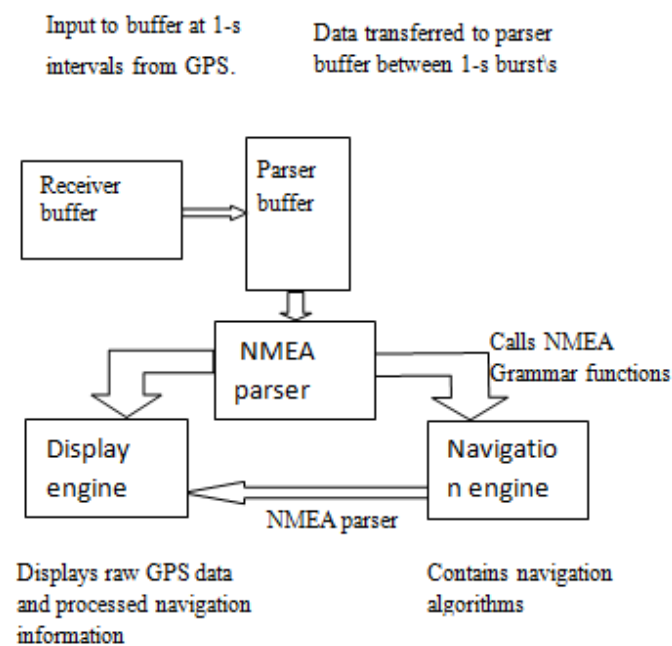

Fig. 4 The simple navigation system architecture

The above figure illustrates the main components of a simple navigation system. Data is input from a GPS receiver serially to an input buffer at 4800 bps, 8 data bits, 1 stop bit, and no parity. The data is input periodically at 1-sintervals. During the time between the input data bursts (typically 200 to 800ms), the input buffer data is transferred to a parser buffer. The data in the parser buffer is used as input to the NMEA parser that separates the data into different components— latitude, speed, and so forth. Data from the NMEA parser Is made available to the display and navigation engines. The navigation engine computes the distance, bearing, and direction pointer, then gives the information to the display engine for rendering and display. The source and destination latitude and longitude values supplied in the program text are for south eastern Michigan. To create a dynamic navigation

program based on this code, use the latitude and longitude received and parsed from a GPS receiver as the source coordinates, and continuously calculate the distance and bearing to the destination coordinates. Try different latitude/longitude source and destination pairs in your city and compare how well the output valves match reality.

V. GPS-GSM MOBILE NAVIGATOR

A. *Hardware:* The navigator is based on a microcontroller-based system equipped with a GPS receiver and a GSM module operating in the 900-MHz band. We housed the parts in one small plastic unit, which was then mounted on the bus and connected to GPS and GSM antennas. The position, identity, heading, and speed are transmitted either automatically at user-defined time intervals or when a certain event occurs with an assigned message (e.g., accident, alert, or leaving/entering an admissible geographical area).This information is received by the system in the dispatching or operations centre, where it is presented as a Short Message Service (SMS) message on a PC monitor. SMS is a bidirectional service for sending short alphanumeric (up to160 bytes) messages in a store and forward fashion. If the only data received is time and position, then the data can be displayed on a digitized map and also recorded in a database file; the recorded information can be replayed later for debriefing or evaluation of a mission.
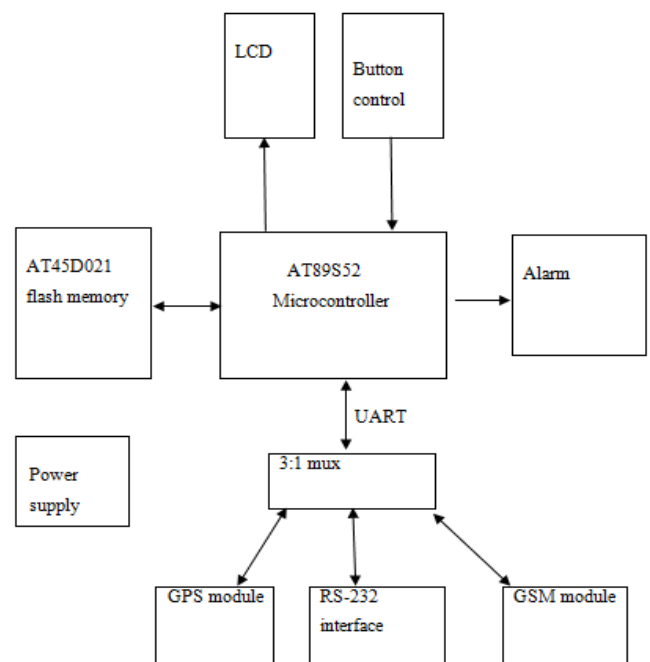
VI. HARDWARE BLOCK DIAGRAM

Fig. 5 The AT89S52 microcontroller is the basis for the GPS-GSM mobile navigator.

The hardware block diagram is shown in the above Figure. The AT89s52 microcontroller assures that all of the components work well together; it controls all incoming and outgoing messages as well as the I/O channels, serial interfaces(RS-232), peripheral devices (e.g., LCD and buttons), and all other parts. The GPS module receives the GPS signals and outputs the data to the AT90S89s52microcontroller via a TTL-level asynchronous serial (UART) interface. The microcontroller works with the GSM module by communicating with the GSM network. The interface between the GSM module and AT89S852 is also TTL async serial. An RS-232interface is used to exchange data with the PC. Because the AT89s52 has only one UART, a three channel multiplexer is used to switch among three working modes. The location information and other data is stored in the 2-Mb serial data flash memory of theAT45D021. The flash memory stores up to 2160 pieces of location information in 12h, because the GPS-GSM Mobile Navigator saves GPS signals every 20 s. Four buttons, an LCD, and a buzzer enable you to display the system status and information and control the navigator.

A. *System Features:* As we explained, the GPS module outputs the ship location information such as longitude, latitude, and Greenwich Time every 2 s. The location information is then stored every 20 s in flash memory, which has enough power to memorize the track of a ship even when the power is off. The location information and the status of the GPS-GSM Mobile Navigator are sent to the control centre. .Meanwhile, the mobile navigator receives the control information from the control center via the same SMS. Next, the GPS-GSM Mobile Navigator sends the information stored in flash memory to the PC via an RS-232 interface. (Note that you can set up the navigator using an RS-232 interface.)There are two ways to use the mobile navigator's alarm function, which can be signified by either a buzzer or presented on the LCD. The first way is to receive the command from the control center; the second way is to manually send the alarm information to the control center with the push of a button. The GPS-GSM Mobile Navigator is powered by either a rechargeable battery or DC input.

B. *Getting GPS Data:* After the GPS module computes the positioning and other useful information, it then transmits the data in some standard format—normally in NMEA-0183format. When you're building this project, it's nice to be able to buy standalone GPS OEM modules. Just check the pages of Circuit Cellar for manufacturers. We used a Sandpiper GPS receiver from Axiom for this project. The Sandpiper is intended as a component for an OEM product that continuously tracks all satellites in view and provides accurate satellite positioning data. With differential GPS signal input, the accuracy ranges from 1 to 5 m; however, without differential input, the accuracy can be 25 m. The Sandpiper has two full-duplex TTL-level asynchronous serial data interfaces (ports A and B). Both binary and NMEA initialization and configuration data messages are transmitted and received through port A. Port B is configured to receive RTCM DGPS correction data messages, which enable the GPS unit to provide more accurate positioning information. But, we didn't require the use of port B for this project. About 45 s after the GPS module is cold booted it begins to output a set of data (according to the NMEA format) through port A once every second at 9600 bps, 8 data bits, 1 stop bit, and no parity. We use only the most useful RMC message—Recommended Minimum Specific GNSS Data—which contains all of the basic information required to build a navigation system. We only need position and time data, so the UTC position, longitude with east/west indicator, and latitude with north/south indicator are picked out from the RMC message. All of this data will be formatted into a standard fixed length packet with some other helpful information. Next, this data packet will be transmitted to the control center and stored in the AT45D021's flash memory. The data packet is a 42-byte long ASCII string, which includes the package ID, system password, terminal ID, Position data, UTC, and other operational information.

C. *GSM transmits Data:* Today, GSM is also the most widely used communications standard in China, and covers almost all of the country. SMS is one of the unique features of GSM compared to older analog systems. For point to point SMS, a message can be sent to another subscriber to the service, and an acknowledgment of receipt is sent to the sender. SMS also can be used in Cell Broadcast mode to send messages such as traffic or news updates. Messages can be stored on the SIM card for later retrieval. SMS is effective because it can transmit short messages with in 3 to 5 s via the GSM network and doesn't occupy a telephony channel. We used the FALCOM A2D from Wave-com for this project. The FALCOM A2D is a dual band embedded GSM module (GSM900/DCS1800). It features the following services: telephony, SMS, data, and fax. The GSM module has one TTL-level serial data interface. We use AT commands to control and program the FALCOMA2D. The data and control commands are exchanged between the microcontroller and GSM module through the serial interface. We use some of the SMS commands to communicate with the control center. First, initialize the GSM module with AT commands AT+CSCA and AT+CMGF. Using the former sets the SMS center number to be used with outgoing SMS messages. Remember, the number will be saved on the SIM card just like in normal mobile phones. There are two different modes—Text mode and Protocol Data Unit (PDU) mode—for handling short messages. The system default is PDU mode; however, Text mode is easier to understand. So, use the AT+CMGF=1 command to set

the module to the GSM07.05 standard SMS Text mode. The AT+CMGS command is used to send a short message. The format of this command is: AT+CMGS=<da><CR>Message Texts<CTRL-Z>Here,<da> is a subscriber's mobile phone number that you want to send the short message to. The GSM module can receive incoming short message and save them on the SIM card automatically. You can use the AT+CMGR command to read an incoming short message from the SIM card storage, and then use the AT+CMGD command to delete it when you're finished. If you want to read an SMS message, then send a AT+CMGR=x command to tell the GSM module which short message you want to read. Next, check the serial port to receive the message from the GSM module. Rs232_r is a subroutine used to receive data from the UART.

Figure 6 Circuit Diagram

Operation:

The project is vehicle positioning and navigation system we can locate the vehicle around the globe with 8052 micro controller, GPS receiver, GSM modem, MAX 232, EEPROM. Microcontroller used is AT89S52. The code is written in the internal memory of Microcontroller i.e. ROM. With help of instruction set it processes the instructions and it acts as interface between GSM and GPS with help of serial communication of 8052. GPS always transmits the data and GSM transmits and receive the data. GPS pin TX is connected

to microcontroller via MAX232. GSM pins TX and RX are connected to microcontroller serial ports. Microcontroller communicates with the help of serial communication. First it takes the data from the GPS receiver and then sends the information to the owner in the form of SMS with help of GSM modem. GPS receiver works on 9600 baud rate is used to receive the data from space Segment (from Satellites), the GPS values of different Satellites are sent to microcontroller AT89S52, where these are processed and forwarded to GSM. At the time of processing GPS receives only $GPRMC values only. From these values microcontroller takes only latitude and longitude values excluding time, altitude, name of the satellite, authentication etc. E.g. LAT: 1728:2470 LOG: 7843.3089 GSM modem with a baud rate 57600.GSM is a Global system for mobile communication in this project it acts as a SMS Receiver and SMS sender. EEPROM is an Electrically Erasable read only memory which stores is used to store the mobile number. The power is supplied to components like GSM, GPS and Micro control circuitry using a 12V/3.2A battery .GSM requires 12v,GPS and micro controller requires 5v.with the help of regulators we regulate the power between three components.
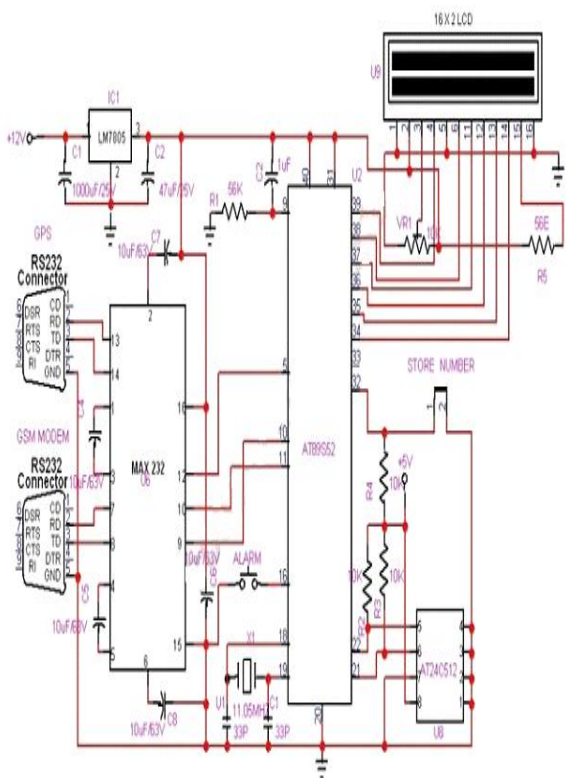
VII. CONCLUSIONS

By implementing AUTOMATIC BUS RECOGNITION THROUGH MOBILE the physical work of the human can be reduced to a maximum extent. The user can get the valuable message from the GSM MODEM through GPS. The time can be saved to some extent by the implementation of the above described paper.

VIII . ACKNOWLEDGMENT

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