INTERNATIONAL JOURNAL OF ADVANCE RESEARCH AND DEVELOPMENT

(Volume 4, Issue 8)

Available online at: www.ijarnd.com

Arduino based tracking system using GPS and GSM

Thin Thin Htwe[1], Dr. Kyaw Kyaw Hlaing[2]

Lecturer[1], University of Computer Studies, Pathein, Myanmar

Lecturer[2] University of Pathein, Pathein, Myanmar

ABSTRACT

The location tracking system is the combination of the Global Positioning System (GPS) and the Global System Mobile communication (GSM) technologies via the microcontroller. It is used to detect the GPS location of vehicles or any objects which are attached to a tracking device. The proposed system made good use of popular technology that combines a smartphone with an Arduino UNO. GPS is a satellite-based navigation technology that provides accurate location and information. The GSM module is used to transmit and receive an update from the object location to a database. Data from the numerous satellites are received by GPS receiver in the National Marine Electronics Association (NMEA) protocol form. The system SMS contains latitude and longitude of the location of the object. The NMEA code consists of a combination of information. Arduino is linked to the GPS and the GSM module in the serial connection. The GPS receiver sends data to Arduino. Then, Arduino instructs the GSM module to send the location data to the GSM enable device in a short message form. Thus, by using the tracking system, it is easy to calculate and get the estimate location and time for the vehicle to reach a given destination.

Keywords— *Arduino UNO, GSM module, GPS module, Mobile, LCD*

1. INTRODUCTION

In this paper, Arduino Uno training board, GPS receiver and GSM SIM 900A module are used as major hardware and basic C programming language is used for hardware description language to build small digital circuit. First, the sketch is uploaded into the Arduino programmable microcontroller board. After that GPS receiver tracks the satellite data and sends the Arduino Uno. And then, Arduino sends its data to the GSM module to SIM card number recommended by user. Under these circumstances, one can know the location where vehicles or moving objects have arrived as the short message from in the specified android mobile phone.

Arduino is an open-source electronics prototype platform based on hardware and software. The link can be established between the real world and the virtual world by connecting with Arduino to the Internet, either sending data to the Internet or responding to data on the Internet, or both. It can be to sense almost anything using the sensors for including light, temperature, pressure and sound. Arduino react depends on how program to be implemented. Arduino is a very popular and easy to use programmable board for creating our own projects. Arduino projects can be stand-alone or they can be connected to a computer using USB. Arduino microcontroller is responsible for controlling and interfacing between GPS module and GSM receiver. Arduino can sense the environment by receiving input from a variety of sensors and can display and monitor the sensor data. The Serial Monitor is part of the Arduino IDE software. Its job is to allow both send messages from computer to an Arduino board (over USB) and also to receive messages from the Arduino.

The Global Positioning System (GPS) is a satellite-based navigation system that sends data from satellites. Orbiting Earth to GPS receivers on the ground that can use that data to determine position and the current time anywhere on Earth. GPS module is used to determine position, time and speed. It measures the exact distance with few more satellites and the receivers determine the position of the user and displays it on the map of the electronic appliance. By using four or more satellites, the receivers can determine the three-dimensional position of the user which consists of altitude, latitude and longitude. GPS module sends the data related to tracking position in real time, and it sends so many data in NMEA format. In this paper, our study the concept of the GSM modules that is used a variation of time division multiple access (TDM) and is the most widely used of the three digital wireless telephony technologies TDMA, GSM and CDMA. GSM is the most widely used cell phone technology in the context of GSM phones and GSM network. GSM network providers put customer information on a removable SIM card.

1.1 System block diagram

The current design is an embedded application system. Arduino is based tracking system using GPS and GSM modules. This system is used for tracking and positioning of any location by using Global Positioning System (GPS) and Global System for mobile communication (GSM). Tracking of vehicle is a process in which one can track the vehicle location in form of latitude and longitude. GPS coordinates are the value of allocation. This vehicle tracking system can also be used for Accident Detection Alert System, Soldier Tracking System. A GPS system consists of group of satellites and well-developed tools as receiver. GPS module consist of U-blox NEO6M module and GPS antenna. It can be interfaced with UART, USB, SPI and DDC. NEO-6 modules include one configurable UART interface for serial communication. GPS receiver is the main device in this system. This component receives the coordinates from the satellite for each and every second, with date and time. The use of GPS receiver is processed by the

microcontroller to extract its latitude and longitude values. The microcontroller processes this data and sends the information to the mobile phone. It gives the precise information about location. A program has been developed that it is used to locate the exact position of the vehicle and also true navigated track of the moving vehicle on Google map.

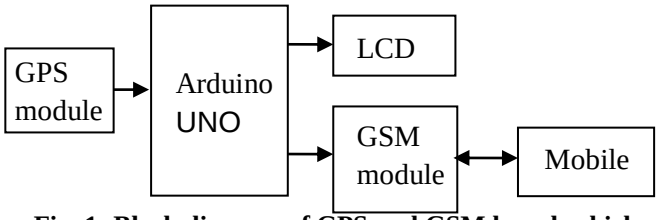


Fig. 1: Block diagram of GPS and GSM based vehicle tracking system

1.2 Liquid Crystal Display (LCD)

LCD modules that display characters such as text and numbers are the most inexpensive and simplest to use of all LCDs. They can be purchased in various sizes, which are measured by the number of rows and columns of characters, they can display. Some include a backlight and allow to choose the color of the character and the background color. Any LCD with an HD44780 or compatible interface should work with Arduino. The LCD used is a 16-character-by-4-row LCD with a backlight, basic schematic circuit diagram is shown in figure 2.

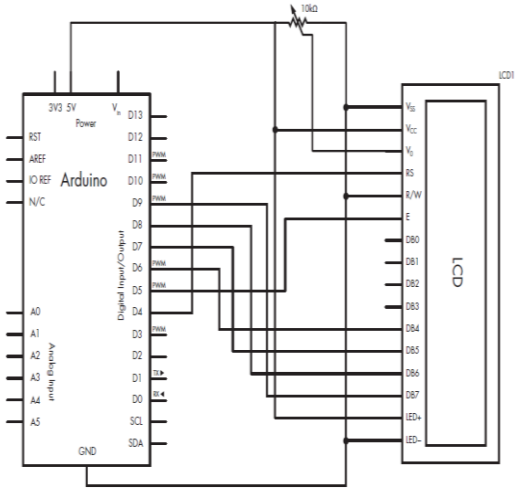


Fig. 2: Basic LCD schematic circuit

1.3 GPS Module

GPS module consists of U-blox NEO 6M module and GPS antenna. The NEO-6 module series is a family of stand-alone GPS receivers featuring the high-performance U-blox 6 positioning engine. The I2C compatible Display Data Channel (DDC) interface can be used either to access external devices with serial interface EEPROM or to interface with a host CPU. Its maximum bandwidth is 100kbit/s. NEO-6 modules are designed for use with passive and active antennas. The minimum gain and maximum gain are 15dB and 50 dB respectively and maximum noise figure is 1.5dB. GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary purpose of the 12 visible satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz). With this information and some math, a based receiver or GPS module can calculate its position and time.

The data sent down to earth from each satellite contains a few different pieces of information that allows GPS receiver to accurately calculate its position and time. An important piece of equipment on each GPS satellite is an extremely accurate atomic clock. The GPS receiver now knows the distance to each satellite in view. If the GPS receiver's antenna can see at least 4 satellites, it can accurately calculate its position and time. This is also called a lock or a fix.

1.4 GSM 900

GSM/GPRS modem is a digital mobile network that is widely used by mobile users. It is used to establish communication between a computer and a GSM system. The modem is coming RS232 interface, which allows to connect PC as well as microcontroller with RS232 chip. The baud rate is configurable from 9600-115200 through AT command. The GSM modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, voice as well as DATA transfer application in M2M interface. The onboard Regulate Power Supply allows us to connect wide range unregulated power supply. Using this modem, one can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands. Every command starts with "AT". That's why these are called as AT commands. AT stands for "attention". When a ten-digit mobile number is provided, the program instructs the modem to send the text message using a sequence of AT commands.

2. EXPERIMENTAL SETUP AND SKETCH

2.1 Experimental Setup

There are three main parts. Firstly, the GPS shield is connected easy to Arduino Uno. GPS Rx (receive) is connected to the Arduino Uno Tx (transmit) and GPS Tx (transmit) I s connected to the Arduino Uno Rx (receive). This is because the Uno (Tx) D11 transmits to the GPS (Rx) and conversely the Uno (Rx) D12 receives from the GPS (Tx). GSM Rx (receive) is connected to the Arduino Uno Tx (transmit) and GSM Tx (transmit) is connected to the Arduino Uno Rx (receive). This is because the Uno (Tx) D1 transmits to the GPS (Rx) and conversely the Uno (Rx) D0 receives from the GPS (Tx) shown in figure 4 and figure 5. The Rs, R/W, DB4, DB5, DB6, DB7 of LCD are connected to D7, D6, D5, D4, D3 and D2 of Arduino as shown in figure 5.

2.2 Sketch of the GPS and GSM module

By using software serial library and liquid crystal library, the sketch is written Arduino C language Serial data transfer rate is specified as 96000baud. Without using GPS library and GSM library, GPS format and AT commands are used, respectively. Then, a connection of LCD is defined and second counter is also prepared for time elapsed for GPS satellite searching time. According to NMEA data string, the raw data from satellites contains position, local time, and speed of object. Among them, position data and local time and date are collected by GPS shield and send it to Arduino to do the process of data expression on LCD. The prescriber's android phone number is already mentioned in the sketch including with secret code. When the code message is sent to the GSM module, it is checked and confirmed whether code and phone number is matched or not. If these are identical, the GPS location data are sent to the predetermined phone which is sent the message code. The conditions and configurations of GPS and GSM are displayed on the LCD time to time. Data can be refreshed at the desired time interval. The program chart of the tracking system as shown in figure 3.

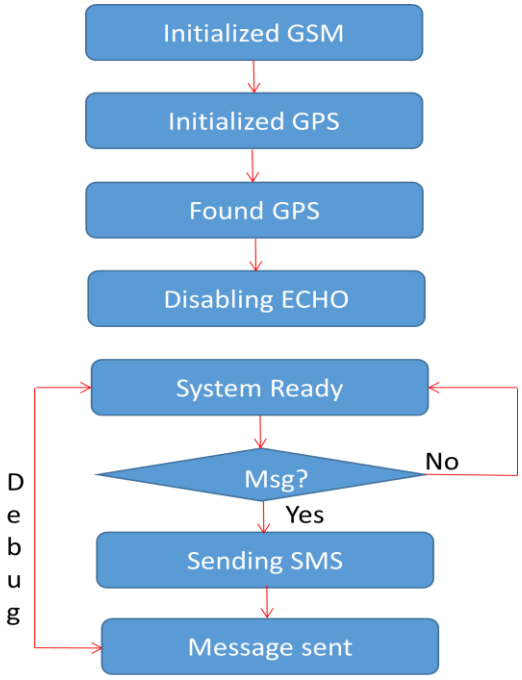


Fig. 3: Program (sketch) of the GPS and GSM module work

2.3 Software implementation for GPS tracker in Proteus

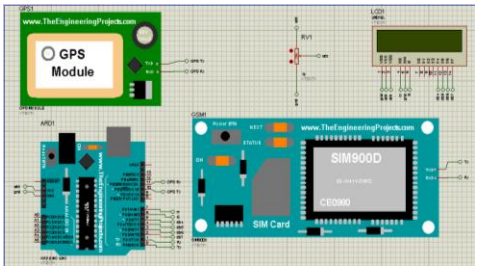


Fig. 4: GPS tracker circuit in Proteus

2.4 Hardware implementation for GPS vehicle tracker

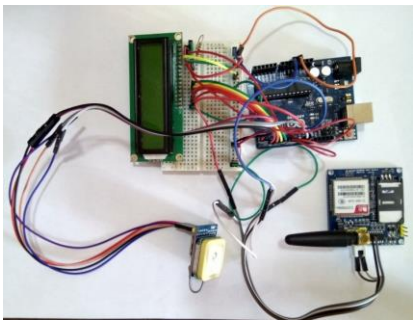


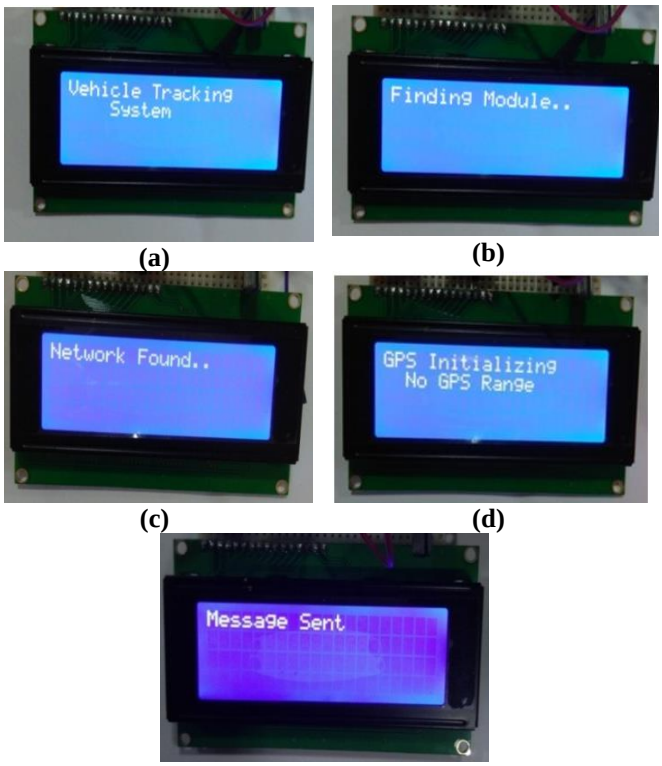
Fig. 5: Hardware implement for GPS and GSM based vehicle tracking system.

3. EXPERIMENTAL RESULT

In this paper, GSM module used to send receive message from another GSM number. If the people, who wants to know the vehicle location, they have to send find message. Firstly, GPS location received from the Arduino based GPS tracking system is noted and GPS location from Samsung and Huawei mobile phones are recorded at the same place. The value of the latitude can be displayed on the 16x2 LCD as shown in figures. The yellow circles are represented by the satellites which are strong signal strength and red circles are satellites which is weak signal strength. The latitude and longitude location are displayed in the dd.ddddd format. It can be changed to dd.mm.mmmmm format by manual or software .GPS converter, GPS location and map view software can be download via "play store" in any android phone .The GPS location on the map in two different software. The comparison of GPS location data of Arduino based GPS system and the different mobile phones are tabulated in the table 1.

Table 1: Comparison of Location of Different GPS

Location		
Arduino based GPS	**Samsung GPS**	**Huawei GPS**
96.16666°=96°9.9996'E	96° 9.884'E	96° 10.0013'E
16°.905785=1654.3471'N	16°54.262'N	16°54.3478'N



(a) **(b)** **(c)** **(d)** **(e)**

Fig. 6: Result for GPS tracker showing location of Vehicle on LCD

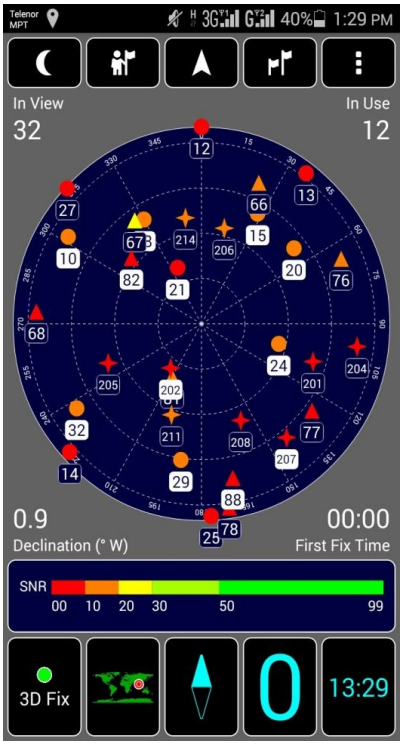


Fig. 7: Satellite list above the location

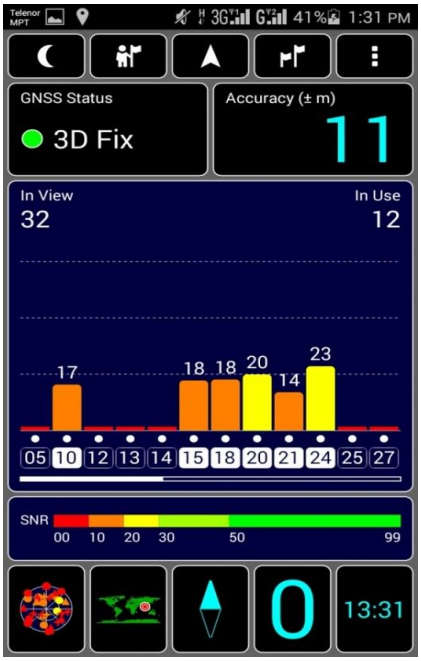


Fig. 8: SNR level of satellite above location

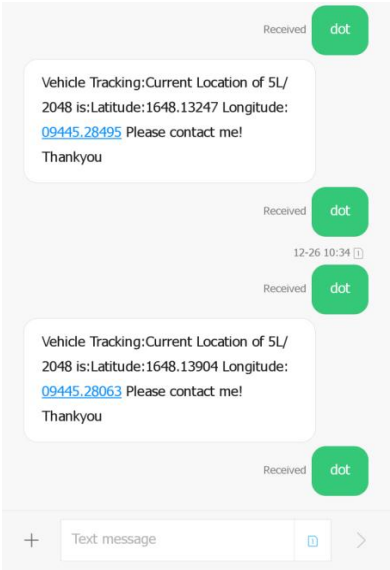


Fig. 9: Latitude and longitude data from satellite to mobile phone

Fig. 10: Lat/Long converter

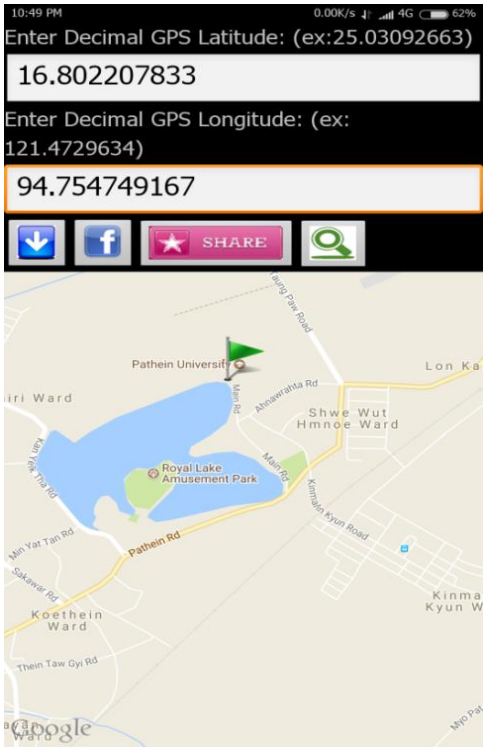


Fig. 11: GPS location on google map

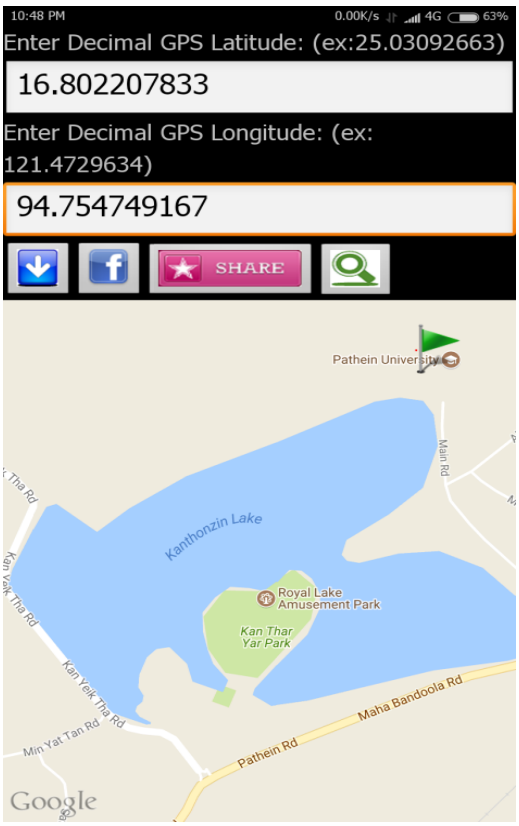


Fig. 12: GPS location on different google map software.

4. CONCLUSION

An android based GPS and GSM integration for vehicle and another objects tracking can be useful instead of using GPS network alone. Tracking system is nowadays the most important system for the people because of our objects is secure. They want their own things security in safe hands this is the main reason. This system is completely integrated and it provides GPS coordinate to a mobile phone where these coordinates are mapped on a Google map. GSM module used in this paper to send and receive messages and can also interfaced with Arduino when using AT command. It can be further extended for multiple applications such as Anti-theft system for

cars and bites, managing of public transports likes buses, train and fish boats, and many more similar applications thus, this system can proof to be very helpful in future.

5. ACKNOWLEDGEMENT

We would like to thank our teachers and our friends for the support at the University of Computer Studies, Pathein and University of Pathein.

6. REFERENCES

[1] Banzi M, 2009" Getting Started with Arduino' New York.
[2] Boxall J, 2013 "Arduino Workshop", No Starch Press, San Fransisco.
[3] Goransson A, 2013 "Android Open Accessory Programming with Arduino: John Wiley, New York.
[4] Monk S, 2010 "30 arduino projects for the evil genius" McGraw-Hill Education, New York, Chicago, San Fransisco, Athens, London, Madrid, Mexico City, Milan, New Delihi, Singapore.
[5] Monk S, 2010 "Arduino + Android Projects for the Evil Genius" Tab, New York.
[6] Purdun J, 2012 "Beginning C for Arduino" Apress, New York.
[7] Trimble, 2007 "GPS. The First Global Navigation Satellite system' Navigation Limited 935 Stewart Drive Sunnyvale, New York.

BIOGRAPHY

Daw Thin Thin Htwe
Lecturer
University of Computer Studies, Pathein, Myanmar.

Dr. Kyaw Kyaw Hlaing
Lecturer
University of Pathein, Pathein, Myanmar.

