International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 6, June-2014, pp: (213-217), Impact Factor: 1.252, Available online at: www.erpublications.com

Designing and Implementation of Low Cost GPS Receiver System using AT89C52 for Location Tracking

Manisha Saini[1], Pardeep Narwal[2], Umesh Gupta[3]
[1,2]M.TECH Student, Dept. of ECE, MERI Engineering College, Maharishi Dayanand University, Rohtak, Haryana, India
[3]Assistant Professor, Dept. of ECE, MERI Engineering College, Maharishi Dayanand University, Rohtak, Haryana, India

Abstract: Stand alone Global Positioning System (GPS) receivers are widely used now days in hiking, climbing, sailing, automobiles and in many other activities to accurately locating one's position. This paper describes a method to design a low cost (GPS) Global Positioning System receiver system to provide various positioning and navigational parameters like latitude, longitude, altitude and direction using 8051 Microcontroller. In this project, the hardware used is AT89C52 interfaced with REB 1315S2 GPS Receiver connected with an antenna to acquire signals from satellite. The data from GPS Receiver is extracted by using NMEA protocol with RS232 connector. The software used is KEIL VISION programmed in C language. Finally, the output is displayed to a LCD display. System testing conducted in different locations with different geographical view and weather conditions gives an accurate result as possible as many can give coming in market.

Keywords: GPS, NMEA, ASCII, RS232, NAVIGATION.

I. INTRODUCTION

In the olden days, before the existence of modern technologies, one was dependant on landmarks and distances estimated from travel times for navigation [4]. Nowadays, airplanes, missiles, spacecraft, large sea vessels, ships, vehicles that move on dry land and even pedestrians make use of modern technology for navigation. This technology is called GPS (Global Positioning System).

The **Global Positioning System** (**GPS**) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites [1].GPS consists of a network of 24satellites in six different 12-hour orbitalpaths spaced so that at least five are in view from every point on the globe [2].

This project will focus on the ground segment of GPS. The project is divided into two parts. The system hardware consist of GPS Receiver, AT89C52 Microcontroller, GPS antenna with RS232 connector and software part does programming in C language through KEIL VISION software in Microcontroller. The GPS Receiver is used to capture data but it is in ASCII character. This GPS data needs to be extracted and decoded in order to get the desired information. Hence the information is decoded by software programming and result is displayed on the LCD.

II. GPS BASIC WORKING

The basis of the GPS is a constellation of satellites that are continuously orbiting the earth. These satellites, which are equipped with atomic clocks, transmit radio signals that contain their exact location, time, and other information. The radio signals from the satellites, which are monitored and corrected by control stations, are picked up by the GPS re GPS receivers take information transmitted from the satellites and uses triangulation to calculate a user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map. A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude).

III. BACKGROUND THEORY

A. Calculation of latitude and longitude

From the numeric latitude or longitude, the two digitswhich are on the leftmost of the integer are the minutescharacter, the next two numbers represent the integer inminutes, and at the left is the whole minutes degrees [3]. For example 6049.15 N is 60 degrees and 49.15 minutes.
Thus this will results in latitude of 60.819 N.

[Latitude = 6049.15
= 60 + (49.15/60)
= 60.819 N]
Another example 10141.055 E is 101degrees and 41.055
minutes. And thus the longitude is 101.68425 E.
[Longitude = 10141.055
= 101 + (41.055/60)
= 101.68425 E]

B. Distance Between Two Points on the Earth

If point 1 (lat1, long1) and point 2 (lat2, long2) are two given points, R is radius of the earth and its value are 6372.8, D is the distance between the points on the Earth and d is the great circle distance between point 1 and point 2 [3].
cos d = [cos(latA) x cos(latB) x cos(lonB -
lonA)] + [sin(latA) x sin(latB)].
So d = in degrees.
= in radians.
D = R x (d in radians).
= in Kilometres. [3]

C. NMEA Protocol

The set of data or information from GPS receiver can be called a NMEA, which is stand for National Marine Electronics Association. These data strings based on ASCII are communicated at a rate of 38400 bits per second which is equivalent to the baud rate of 38400 characters per second [3].The GPS data is normally received and transmitted in a standard NMEA-0183 format. This GPS continuously outputs a lot of NMEA sentences such as GGA, GLL, GSA, GSV, RMC, and VTG. In this case, the only concerned was the ($GPGGA) sentence, which represents the Global Positioning System Fix Data for the GPS receiver.

IV. METHODOLOGY

Figure 1: Block Diagram of GPS Receiver System

Fig. shows the project methodology towards designing and implementation of GPS location tracker.

These are following steps:

- Initially to have communication between 8051 Microcontroller and GPS receiver an interfacing is achieved.
- The signal received from GPS receiver is then sent to 8051 Microcontroller for data extraction and display.
- The NMEA data received through GPS receiver will be decoded through program written in C language.
- The final step in the project development was to verify the hardware and software parts of system through several testing in different geographical locations. During the testing, the data collected was recorded and analyzed and shown on LCD.

Hardware Description

The system hardware consist of GPS receiver, 8051 Microcontroller, GPS antenna, RS232 connector.

In this project, the GPS module for GPS receiver system used is RoyalTek REB1315S2.The GPS module continuously track the satellites and acquire the satellite signals. The L1 frequency signals from the antenna are received by the GPS receiver. The GPS receiver generates the information strings in the NMEA-0183 (National Marine Electronics Association-0183) protocol format. The GPS receiver provides real time GPS position, latitude and longitude.

The 8051 Microcontroller AT89C52 is used as it is a low power, high performance CMOS 8 bit Microcontroller with 8kbytes of in-system programmable flash memory [5].

The antenna used is an active antenna. The antenna is tuned to the frequency of about 1575.42Mhz which is the Link1 (L1) frequency component of GPS satellite signals available for civilian use to receive satellite signals.

Software Description

In this project, KEIL VISION software is used as the platform to write the software part of the GPS Location Tracker. Initially, GPS receiver status must first be checked. The program is used to extract desired GPS data such as latitude and longitude of a particular location. The programming is done in C language using this software.

V. RESULTS AND DISCUSSIONS

Figure 2 shows GPS data collected and display by the GPS Location Tracker system developed in this project. The result showed the latitude and longitude were successfully extracted from the GGA data sentence and converted to decimal degrees. Theoretical values of Old subjimandi, Bahadurgarh, Haryana, India are 28.6881239, N for latitude and 76.930174, E for longitude. As well as experimental values using GPS Location Tracker unit are2841.2188, N for latitude and 7655.8113, E longitude but calculated by the method are 28.68698, N for latitude and 76.93018833, E for longitude.

Table 1: A Set of Latitude and Longitude at Bahadurgarh, Haryana, India

Time	Respond Time(min)	Experiment values Latitude	Longitude	DC Voltage (V)
0900	3.343	2841.2188	7655.8113	5.02
1000	3.143	2841.4032	7655.5213	5.015
1100	3.243	2840.9473	7655.6010	5.09
1200	3.010	2841.2599	7653.3553	5.01
1300	3.112	2840.0595	7655.2987	4.96
1400	4.200	2841.4577	7655.7097	4.61

Figure 2: Bahadurgarh, Haryana, India coordinates

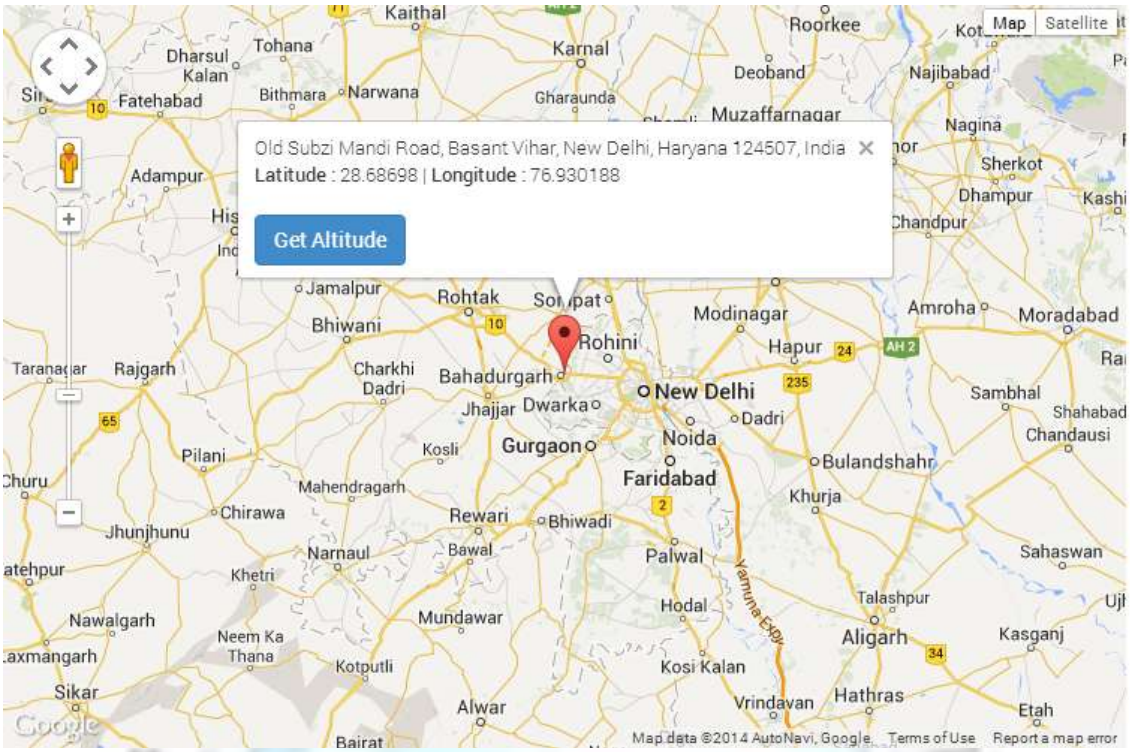

Figure 3: Google Map showing Old subjimandi, Bahadurgarh, Haryana, India

From the experiment at Bahadurgarh, Haryana, India (as shown in Table I), the average latitude and longitude is 2841.05773 N and 7855.21622 E. Figure show that data was consistent data received from GPS receiver, however once the weather turned cloudy GPS receiver showed failure in obtaining data from the satellites. Once the sky was cleared form heavy, the GPS Location Tracker unit started to receive strong consistent data from the satellites. From this experiment, the cloud was proven to be an obstacle for the GPS Location Tracker unit to receive signal from satellites.

Table 2: A Set of Latitude and longitude at different locations

Place name	Experiment calculated value		Theoretical value	
	Latitude	Longitude	Latitude	Longitude
MERI college	28.766241	76.758801	28.767583	76.758813
MDU Rohtak	28.87492	76.616419	28.87628	76.616425
Bahadurgarh	28.68698	76.930188	28.688123	76.930174
Janakpuri west	28.630423	77.07877	28.630336	77.07887
Nangloiextn.	28.676984	77.055112	28.677984	77.055007

The GPS receiver receives signals from number of satellites i.e. the receiver tracks the satellites which are in view. The information of these satellites are shown in LCD in terms of latitude and longitude are tabulated in table 1. The values of parameters given in table 2 are obtained from experiment values which are taken from LCD and then calculated by the method to check the difference between experiment calculated value and theoretical value. The results of the system are as accurate as the most sophisticated systems available in the market. The system displays all the necessary positioning and navigational parameters along with satellite information. Hence, this system can be used in number of fields like transportation, oil and mining industries, agriculture, animal tracking and space applications. Number of applications can be developed using this system and can be used various fields.

CONCLUSION

This project was successfully implemented and developed the outdoor tracking location unit using GPS REB1315S2. As a result, latitude and longitude of any location and distance between two points on the earth are measured with an average accuracy from actual value. It is recommended that the method can be further improvised by connecting USB to be compatible to PC or Laptop.

REFERENCES

[1]. Tom Logsdon, "Understanding the NAVSTAR GPS, GIS", 1st Ed, 1995.
[2]. R. Bajaj, S.L. Ranawera, D.P. Agrawal, "GPS: Location tracking technology", Computing in Science and Enginnering, april 2002,pp. 92-94.
[3]. Gilbert Strang and Kai Boore, "Linear Algebra, Geodesy and GPS", Fourth Edition: Wellesley-Cambridge Press, 2006.
[4]. Martin Vermeer. "Methods of Navigation." Internet: http://users.tkk.fi/mvermeer/nav_en.pdf, December 10, 2013 [April 1, 2014].
[5]. B.P. Kumar, V. Dhana Raj,etal, "Wireless Unmanned all Terrain Vehicle with Gsm and Gps", International Journal of Mechanical Engginering and Computer Applications, Vol1, Issue3,June 2013.