

Evaluation of Position Tracking System Using GPS Technology

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Abstract

In this paper we introduce the Position tracking system by using wireless sensor technology. In This paper present the development of the position tracking system's hardware prototype. Specifically, the system will utilize GPS to obtain a object's coordinate and transmit it using GSM modem to the user's phone through the mobile network.[1] an position tracking systems in real time has playing key role in present day scenario. Tracking System consists of a two units: one is Tracker Unit this unit senses the position and stores that information in the database and uses this data to locate the position of the vehicle on the Google maps. This paper a new technique proposed that interfaces database (vehicle information) with the Google maps. That map indicates the position of vehicle and alerts the person who is monitoring the information.[8]

Keywords: Position, Tracking, SiRF Star III single-chip ET-314 GPS receiver module [12], GSM module and ATmega16L AVR microcontroller, Lab VIEW

INTRODUCTION

A Position tracking system combines the installation of an electronic device with object, with purpose-designed computer software at least at one operational base to enable the owner or a third party to track the object location, collecting data in the

process from the field and deliver it to the base of operation. Modern tracking systems commonly use GPS or GLONASS technology for locating the object, but other types of automatic location technology can also be used. Object information can be viewed on

electronic maps via the Internet or specialized software [2][4]. The objective of this paper is to track the position of object and the working of GPS receiver with change in altitude.

After capture, the tracking data can be transmitted using any choice of telemetry or wireless communications systems. GSM is the most commonly used service for this purpose. The transmitted data is received by the central monitoring station and stored in database. The designed Virtual Instrument (VI) connects the database and the Google maps and displays the position of vehicle on the Google maps [3].

GPS based position tracking system uses GPS receiver to capture the current Location. The data provided by GPS is not in human understandable format. This raw data needs to be processed to convert it into useful information that can be displayed. A CPU is required to process this raw data. GPS receiver can also provide information of altitude, time of GPS fix, status of GPS fix, and number of satellite used to compute current location information along with location and speed. GPS fix means last reported location. For tracking purpose only location data is required for transmission. Other data provided by GPS receiver is used to determine the validity of location information.

SYSTEM ARCHITECTURE

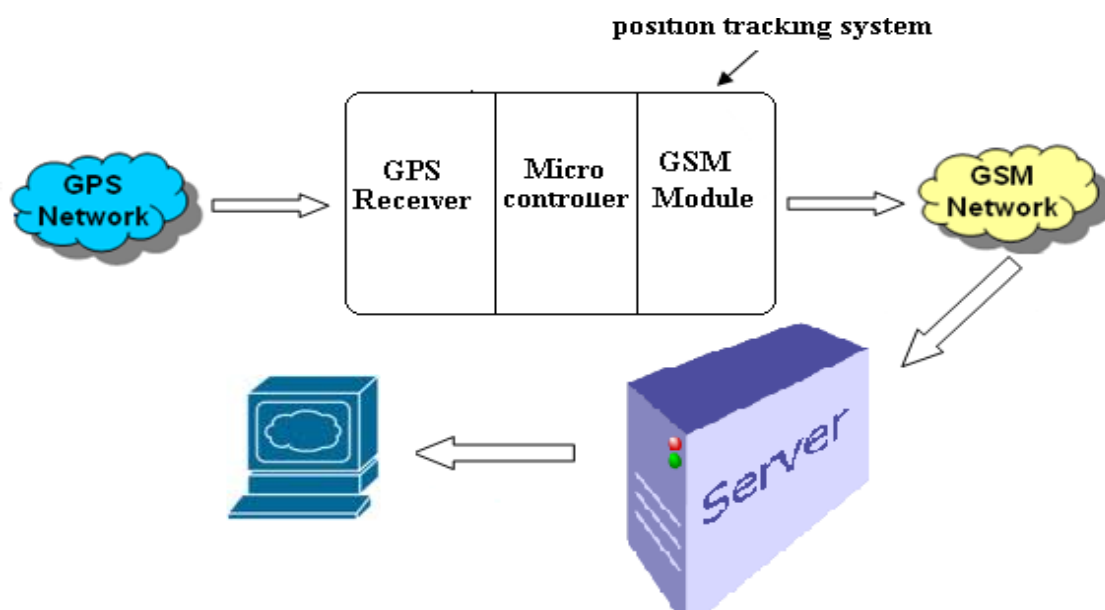


Figure 1: Hardware Block diagram of the System

The raw data provided by the GPS receiver is captured by the CPU and processed to extract the required location information. CPU holds all the required information that is to be transmitted to remote server. It also controls data transmission module to exchange information with remote server. It actually acts as a bridge between GPS receiver, vehicle and remote server. It receives commands sent by server through data transmission/receiving module and performs corresponding action required by server.

Above is the basic architecture of the main project. In this project the GPS receiver to capture the current Location. The raw data provided by the GPS receiver is captured by the CPU and processed to extract the required location information. CPU holds all the required information that is to be transmitted to remote server. It also controls data transmission module to exchange information with remote server. It actually acts as a bridge between GPS receiver, vehicle and remote server. It receives commands sent by server through data transmission/receiving module and performs corresponding action required by server. Here our main concern is working of system so later part of the project is not described further.

GLOBAL POSITIONING SYSTEM

The Global Positioning System (GPS) is a navigation and precise-positioning tool. GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include time and message was transmitted, precise orbital information of the general system health and rough orbits of all GPS satellites.

The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite. These distances along with the satellites' locations are used with the possible aid of trilateration, depending on the algorithm is used, to compute the position of the receiver. This position is then displayed, perhaps with a moving map display or latitude and longitude; elevation information may be included. Many GPS units show derived information such as direction and speed, calculated from position changes. Three satellites might seem enough to solve for position because space has three dimensions and a position near the Earth's surface can be assumed.

The three components that make up the GPS are the space, user and ground segments.

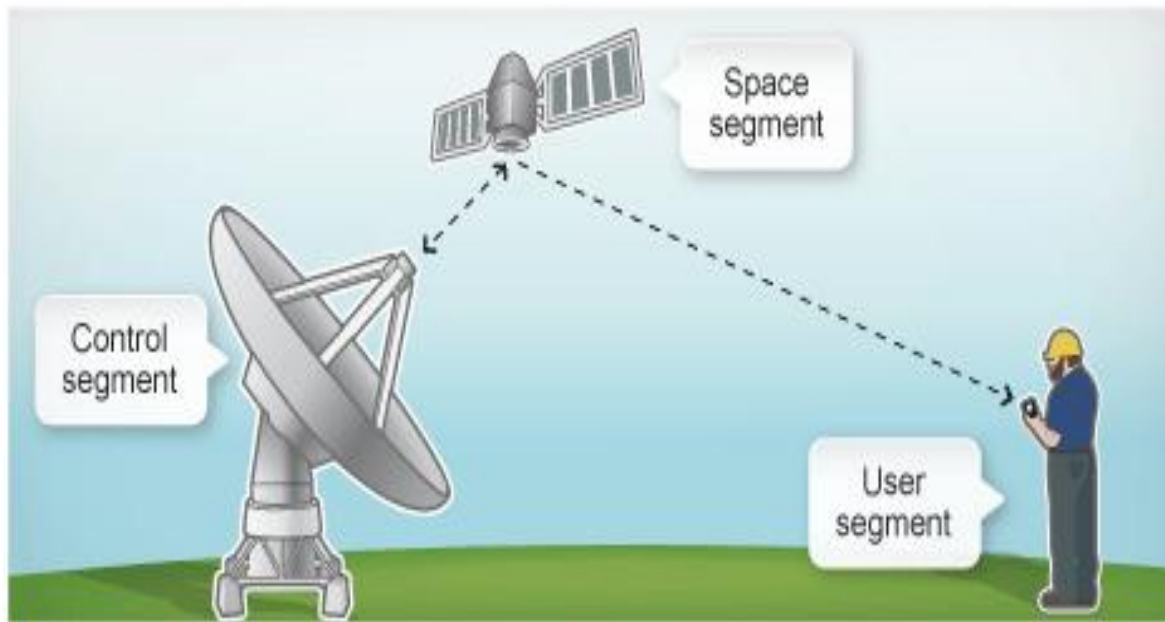


Figure 2: Segments of GPS

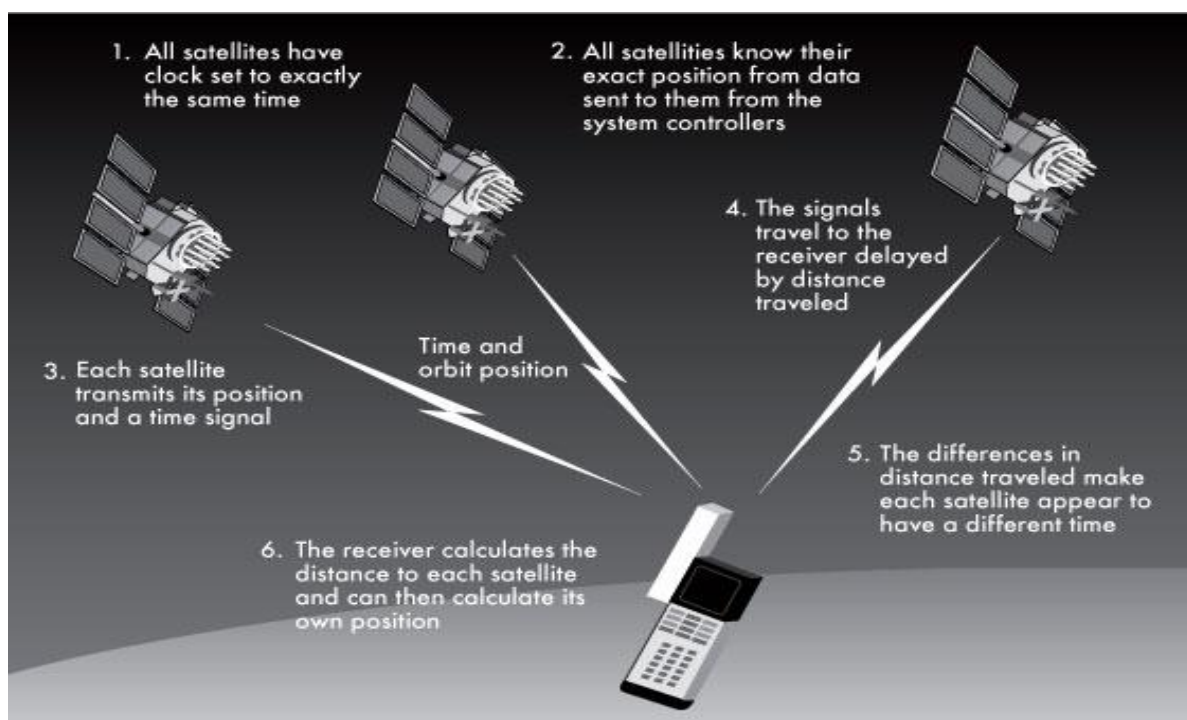


Figure 3: GPS Satellite system

The space segment consists of satellites powered by solar cells that constantly adjust the solar panels toward the sun and the antennas toward Earth.

The user segment consists of receivers that are able to detect, decode and process GPS satellite signals.

The ground segment consists of monitor stations and a master control station, which monitor and control the satellites. The monitor stations receive data (orbits, altitude, location, speed) from the satellites and send this data to the master control station, where it corrects the orbital and clock information known as ephemeris data, and update the satellites via ground antennas. See figure 3.

The GPS satellites transmit radio signals where it contains data (coded information) over to the GPS receivers. The data consists of ephemeris data, almanac data and a pseudorandom code. Ephemeris data is the corrected orbital and clock information sent from the master control station to the GPS satellites, this data is valid for a few hours and is transmitted as coded information to the GPS receiver to provide its orbital information on where each satellite should be, interpreting the path that the satellite is following as it orbits.

Almanac data is used to identify satellites that are nearby for the acquisition of GPS signals. This data is continuously transmitted by each satellite notifying its status, current date and time to the GPS receivers. With the ephemeris and almanac data, the GPS receiver knows the

position of the satellites at all times. The data signal travel at the speed of light.

The time difference is determined by the pseudorandom code which is an I.D. code that distinguishes which satellite is transmitting information. Both the satellite and receiver will generate the same code at the same time, however due to signal propagation delay; the satellite's signal will lag behind the receiver's signal when it reaches the earth. This delay is the time difference.

Therefore, the distance between the GPS receiver and each satellite can be computed using the following equation:

$$\text{Distance} = \text{Speed} \times (\text{Time difference}) \quad (1)$$

The user's location can be determined by "triangulating" the distances from several satellites to determine the 3-dimensional positioning. This mathematical principle is known as trilateration.

$$\alpha + \beta = \chi. \quad (2)$$

IV. LOCATOR SYSTEM

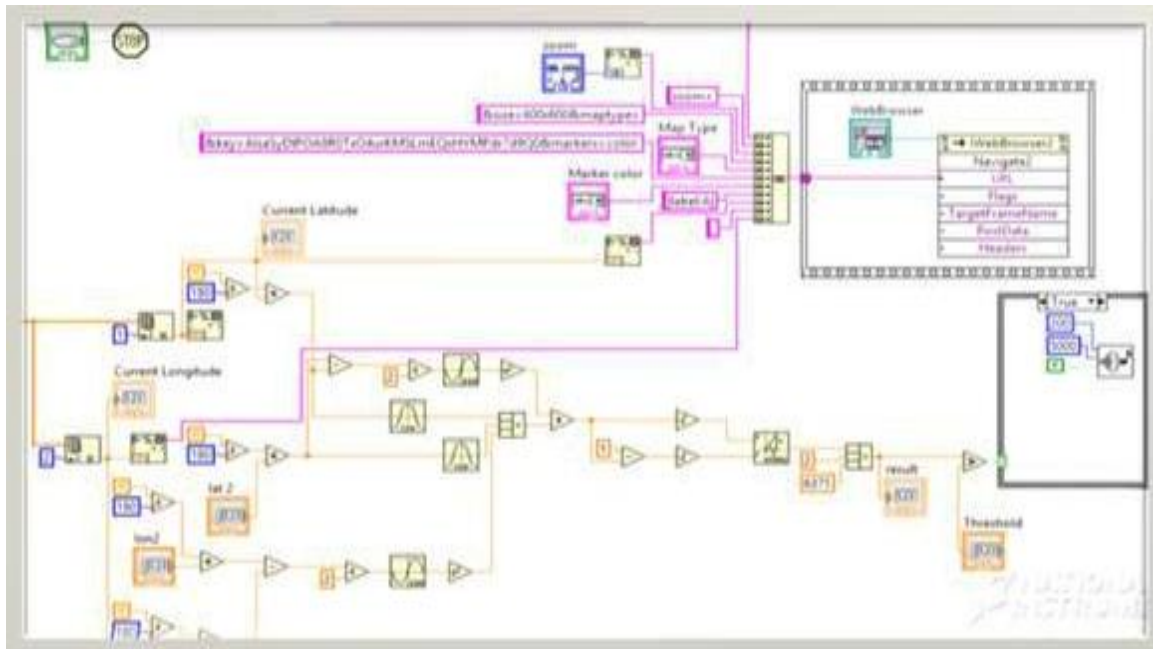


Figure 4: Block diagram for track the vehicle

RESULTS AND EXPERIMENT DATA

The following tests were run specifically on the hardware. The form that these tests were recorded.

A. Test Descriptions

T1 - To communicate Position tracking system with Hyper Terminal we connect GPS port of Position tracking system with serial port of computer using serial communication cable (RS-232) to check the output of GPS receiver which gives data In NMEA form.

T2- This test include journey from Powertech Automation solution Pvt. Ltd. Pardesipura Indore to LIG square Indore to check all the functions of Position

Tracking system. In this test we continuously monitor the LCD screen and record data.

B.Results: To check the accuracy of recorded data we upload it on internet and we found that there is 10 meter deviation in recorded reading from actual reading because ET-314 GPS Receiver Accuracy is 10 meter.

T3- In this test we check whether the position tracking systemsend data on Powertech automation server or not.

T1 Results: We got data on Powertech Automation Server



S.No.	Latitude	Longitude	Name of Place
1	22.7529	75.8683	Powertech Automation Solution Pvt.Ltd Electronics Complex Indore
2	22.7509	75.8694	
3	22.7491	75.8698	Readymade Complex Indore
4	22.7469	75.8713	
5	22.7465	75.8261	
6	22.7455	75.8713	Pardesipura square Indore
7	22.7450	75.8720	
8	22.7446	75.8726	
9	22.7439	75.8739	
10	22.7435	75.8745	
11	22.7429	75.8756	
12	22.7423	75.8764	

13	22.7419	75.8769	
14	22.7428	75.8781	
15	22.7412	75.8783	
16	22.7406	75.8795	
17	22.7401	75.8800	
18	22.7399	75.8805	Patnipura Square Indore
19	22.7393	75.8814	
20	22.7386	75.8821	
21	22.7382	75.8838	
22	22.7365	75.8857	
23	22.7359	75.8879	
24	22.7349	75.8881	
25	22.7344	75.8889	LIG Square Indore

CONCLUSION

This project proves that a low cost GPS based tracking system can be developed and has met its objectives of tracking the vehicle. The overall cost of this GPS based tracking system is totals to about 4000. An accuracy of is achieved in clear sky condition and direct line-of-sight. However, in urban cities, multipath effect will prove to be an issue as it will induce further errors. The GPS based tracking system has passed field trials and functional tests with the testing results recorded for evaluation and its performance was assessed to be beyond satisfactory. Nevertheless, there is still room for improvements.

VI.ACKNOWLEDGMENT

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