Proc. Annual Symposium on Research & Industrial Training, 03(2016) 1-6
Department of Electronics – Wayamba University of Sri Lanka

GPS BASED PASSENGER GUIDE IN TRAIN

K.Athiththan*, L.D.R.D.Perera

Department of Electronics, Wayamba University of Sri Lanka, Kuliyapitiya, Sri Lanka
athiththen@gmail.com*

ABSTRACT

This project was to extract information of a train from GPS on locations where the train would stop at and the velocity of the train to display and guide passengers. Besides that the date stamp and time stamp will be extracted from GPS and displayed. GPS receiver, GPS antenna, Microcontroller, LED dot matrix display, Serial and SPI connections and Serial port to TTL converter were used to design the system. The latitude and longitude values and name of the station were already fetched in the microcontroller system. If the system gets encountered with the same latitude and longitude values which were got from GPS receiver and antenna, the pre-fetched location name will be displayed in the LED dot matrix display. The overall aim of this system was to ensure the easiness of travelling of passengers and make prototype of an automated passenger guide with a safe system having a least amount of failure, high availability and reliability.

Keywords: Global positioning system (GPS), RS232, Serial communication, SPI communication, dot matrix display (DMD), NMEA protocol, Geocoding

1. INTRODUCTION

GPS is well-known for its military uses and was first developed by the US to aid in its global intelligence efforts at the height of the Cold War. Since the early 1980s, however, the GPS has been freely available to anyone with a GPS receiver. Airlines, shipping companies, trucking firms, and drivers everywhere use the GPS system to track vehicles, follow the best route to get to a place in the shortest possible time[1].

Nowadays in Sri Lanka, people are notified regarding their journey in train by the voice out in the relevant stations. It informs them about the current location and the locations where the train will be stopping next. Besides that, there are name boards to indicate them the current location where the train stopped at. But the passengers face some problems to identify the stations due to the noisy environment and unclear messages delivered to the passengers.

During night time, due to the lack of facilities (electricity) in the rural stations, the name boards are barely visible sometimes. So people get annoyed and they refused to travel in trains. Especially, if a new person wants to go to a place, he/she needs some assistance from a guide due to their lack of knowledge in the railway root. They face lots of problem in identifying their destination. Sometimes they fail to reach their destination. Sometimes it may be the cause to miss their exams, interviews etc. It has always been an unwanted cost for the people when they happened to get down from the train at wrong station.

This proposed system would be the solution for these problems where the display will contain all the details about the current location which can be fixed inside the train; that is GPS based passenger guide in train.

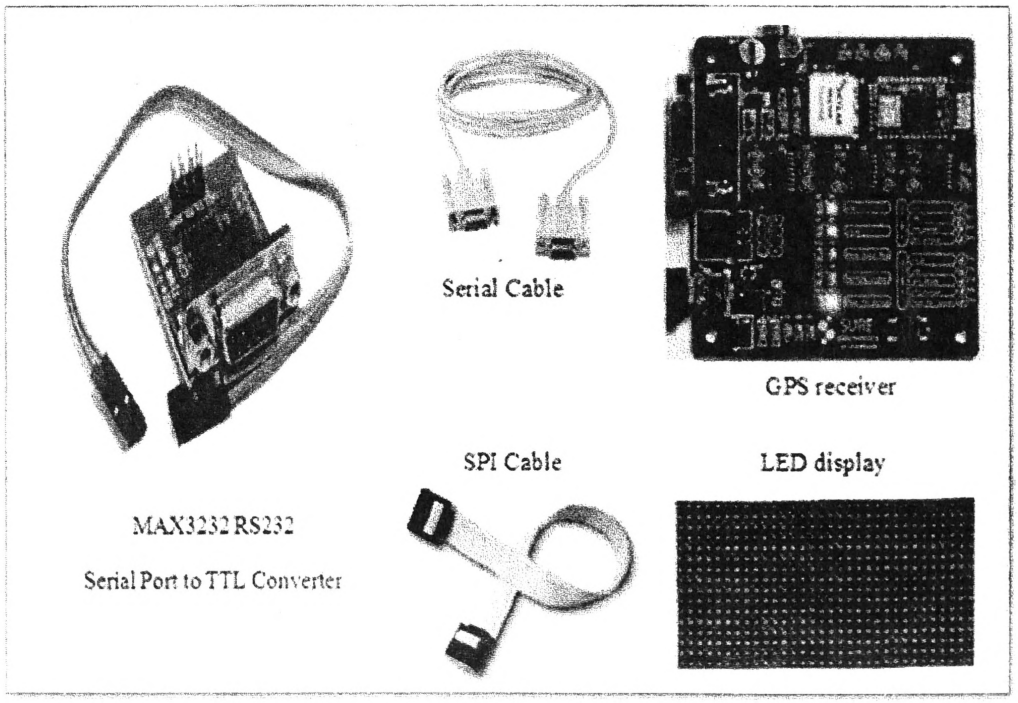

Figure 1: Components of the designed system

GPS receiver, LED dot matrix display, Serial cable, SPI cable and Serial port to TTL converter are the important components which were used to design the system.

2. EXPERIMENTAL

Mainly there are three important parts in a GPS: a constellation of between 24 and 32 solar-powered satellites orbiting the earth in orbits at an altitude of approximately 20000 km, a master control station and four control and monitoring stations and GPS receivers.

GPS is a network of orbiting satellites that send precise details of their position in space back to earth. Satellite transmitter and GPS receiver communicate with each other to extract data about the location where the GPS receiver exists. Besides that, if the receiver is placed in a moving object then the information of location will vary according to the movement of the object.

At a time the GPS receivers are able to get information from three or four satellites though there are nearly 30. For precise information, at least there should be three satellites. When a receiver receives signal from transmitters, the above mentioned three satellites should be trilateration.

2.1. Operation of the System

The system was designed with GPS and Arduino modules. Both these sub modules have a great involvement with the other parts like serial communication, string manipulation and display information.

The GPS receiver receives the micro waves and then converts it to NMEA GPS data format as a string. Then the Arduino code string manipulates to extract the required information[2].

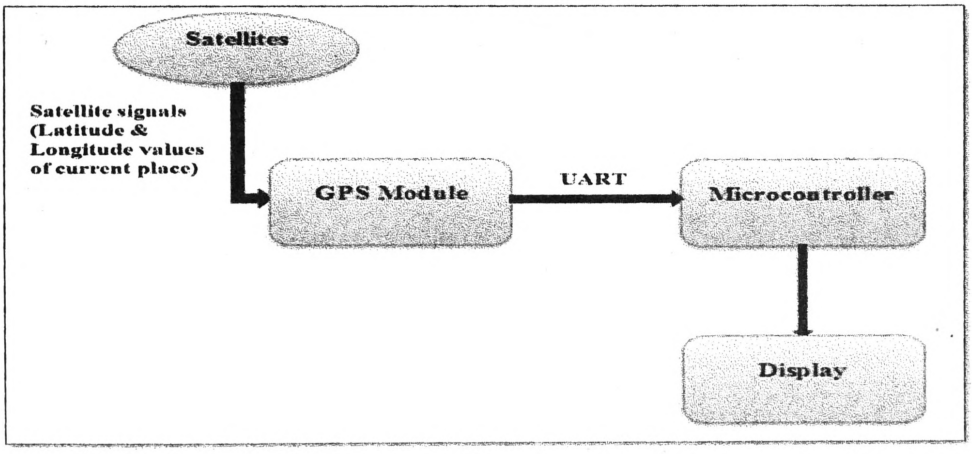

Figure 2: Block diagram of the designed system

This project has the following parts:

- Receive signals from satellites and send the signal to Microcontroller via serial communication.
- String manipulation to extract data from received signal
- Send the manipulated data to LED dot matrix display via SPI communication

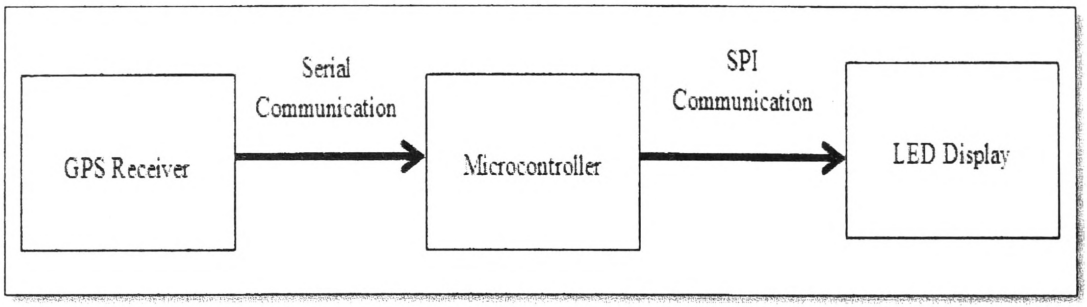

Figure 3: Devices and Communication types used

First of all, the GPS receiver was connected to the computer to make sure it's receiving signal by observing the command prompt. There is another indication to make sure it: a blue LED will blink according to the clock signal. The received signal is an NMEA GPS sentence (string). The received signal which starts with '$ GPRMC'[3] was fed to the microcontroller. It contains the detail of latitude, longitude, velocity etc. As the string is separated by commas, each wanted data can be extracted. Here an information is separated by commas are called offset. Altogether, there are thirteen offsets. Each offset has its own meaning. For an example, third and fourth offsets represent latitude and longitude of a location, respectively.

```
$GPGSV,3,2,11,24,30,124,,21,29,344,36,20,23,026,18,14,23,211,*7C
$GPGSV,3,3,11,22,18,274,19,13,10,037,,12,06,159,*46
$GPRMC,063718.000,A,0651.6867,N,07951.7133,E,0.00,351.25,281115,,,D*6F
$GPVTG,351.25,T,,M,0.00,N,0.00,K,D*38
$GPGGA,063719.000,0651.6867,N,07951.7133,E,2,6,2.06,104.5,M,-96.6,M,0000,0000*72
$GPGLL,0651.6867,N,07951.7133,E,063719.000,A,D*57
$GPGSA,A,3,15,29,21,22,18,20,,,,,,,3.40,2.06,2.71*02
$GPGSV,3,1,11,29,83,189,35,40,59,255,35,15,44,036,32,18,38,315,35*72
$GPGSV,3,2,11,24,30,124,,21,29,344,36,20,23,026,18,14,23,211,*7C
$GPGSV,3,3,11,22,18,274,19,13,10,037,,12,06,159,*46
$GPRMC,063719.000,A,0651.6867,N,07951.7133,E,0.00,351.25,281115,,,D*6E
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Figure 4: GPS receiver output in command prompt

The GPS receiver will be placed inside the train and the antenna will be placed on the roof of the train so that the antenna can capture a 360^0 angle. By tracking the train the latitude and longitude information will be extracted by Geocoding so that the details of the geographical indexes, especially the railway station will be extracted and displayed in the LED dot matrix display.

3. RESULTS AND DISCUSSION

The GPS receiver was connected to the computer and the GPS output was observed on the command prompt. It was then connected to microcontroller and a LCD. The proper output was observed. The time stamp and the data stamp were observed in the LCD.

The LCD output is shown below,

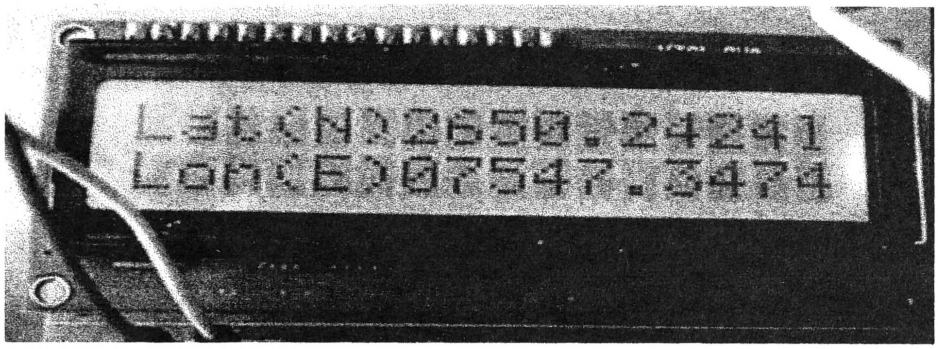

Figure 5: LCD output of Latitude and Longitude

Then the final requirement is to extract the latitude, longitude data and display the locations name in LCD.

Then the LED dot matrix display was connected to the microcontroller and some test code was fed into microcontroller and the required output was observed. It works with scrolling and some other additional features.

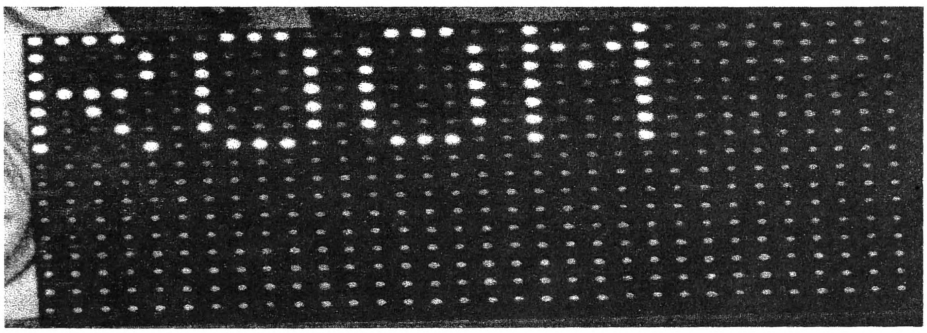

Figure 6: LED dot matrix output of the location name

It is a portable device, so it ensures the ease of installation in trains. It could be easily handled by any people and the whole railway transportation can use this product to notify the passengers.

The accuracy of the system depends on the weather conditions. If it is a cloudy weather the GPS receiver will not receive proper signal from the satellites. So the GPS antenna should be placed where it can capture huge range of the signal.

4. CONCLUSIONS

A prototype system was developed to display the location of a train. This prototype is a better one to be used in trains compared to the currently existing guidance for passengers. This will be a better solution to avoid the problems faced by the passengers at railway stations. The beneficiaries of this project are people who use train for their transportation and the railway department. It ensures the ease of travelling. So people can travel to any place without any uncertainty of their destination or the travelling route. Due to the various problems in the route it is difficult to notify the passengers regarding their travel time. The project can be enhanced using GSM and GPRS technologies. Using these technologies the GPS coordinates of the train can be sent to a server using the GSM and GPRS. So the location where the train travels will get updated. So people can get to know where the train is by logging in to the web page. As a further improvement an android based application also can be done with these technologies.

ACKNOWLEDGEMENT

The authors would like to acknowledge and extend gratitude to the persons who have helped to make this project a success.

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