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GPS Tracking of Transport System for VIT University

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Abstract

Vellore Institute of Technology (VIT) University is a renowned university located in south India, with a population of nearly 25000 students as of July, 2014. VIT has a large campus area of nearly 350 acre in the Vellore campus with over 50.83 lakh sq. ft. built-up space. For the convenience of its students, VIT runs shuttle cabs and buses throughout the campus. We have designed a system for tracking these transport vehicles and informing the students about their location. In our design, the location of these vehicles is acquired via a Global Positioning System (GPS) module and sent over to a web server using General Packet Radio Service (GPRS)/Global system for mobile communications (GSM). Students can access this using an android application on their smart-phones. This can also be displayed on android devices which will be placed at the Shuttle and bus stops present all throughout the campus. The location can be also be used by the management for keeping a track of their vehicles for security purposes.

Keywords: Vehicle tracking, GPS, GPRS, Arduino, My SQL, PHP, Android application.

I Introduction

VIT has its own transport system consisting of buses and shuttle cabs for the better conveyance of its students. The buses provide free service to the students for travelling from one building to another throughout the campus. The buses also ply to the nearby towns of Gudiyattam, Walaja, Ranipet, Arcot etc. The buses are set to

make trips around the campus at fixed timings during the regular class hours and also during the night for transport from the ladies hostel to the library. The students can also make use of the shuttle service for travelling anywhere within the campus.

In VIT, sometimes the students have their classes in different academic buildings. They need to change from one academic building to the other within a span of time. Because of the large campus area, they make use of the shuttle and bus services provided by VIT University. Time-table for the buses is displayed but it sometimes becomes inconvenient for the students in-case a bus gets delayed. The students are generally unaware of the location of the buses and so might have to wait for a time to catch the next bus. In-case the bus has departed; the waiting time goes in vain. Currently there is no solution for this problem. At the most students can call their friends to know the location. This becomes inconvenient if followed on a regular basis. Being a student, we have come across situations like these. We would like to overcome this problem so that everyone can commute conveniently throughout the campus.

In our design, we have developed a solution to this problem. We have made use of GPS along with GSM/GPRS, arduino and android technology to tackle the problem in an efficient way.

We have compared our solution with the existing solution in section II. In section III, we have discussed the working mechanism along with the flow chart, followed by our results and discussions in section IV. Finally the paper is concluded in section V followed by acknowledgement and then the references.

II Literature Survey

As discussed by B.P.S. Sahoo and Satyajit Rath[2], the location coordinates are displayed on an LCD and also sent as a text message to the mobile phone using SMS technology. According to our design, we are displaying the real time location on Google maps using an android application which is convenient for the students. Raj Kishen Moloo, Varun Kumar Digumber[3] provide us with the different solutions which are available in Mauritius. These solutions include additional functionality that the location can be displayed in Google maps, or an email alert can be sent or the speed data of the user can be monitored. They implement these solutions by reducing the cost using a mobile phone instead of SIM card operated devices, which only add to the cost. Pham Hoang Dat, Micheal Drieberg and Nguyen Chi Cuong[4] have discussed ideas similar to those of the above two papers, with no additional functionality.

Eddie Chi-Wah Lau[5] has developed a bus tracking system so that students of UCSI University, Kuala Lumpur can make use of the designed system to move across the large campus area. This design mainly focuses on providing the time at which the buses will arrive by displaying it on the LED panel which is installed at the bus stop. In our design we are focusing on the real time tracking of the buses and shuttle cabs so that students can locate where the buses or cabs are, by using their app or the devices installed at the bus stop. By doing so they will not only estimate the

time at which the buses or cabs will arrive but will also help the management to track their vehicles.

SeokJu Lee,Girma Tewolde and Jaerock Kwon[1] in their work used the concept of GPS module along with the GSM/GPRS module. The location is displayed on google maps by using an app. We have taken our design to one step forward by allowing the design to be two way. The students can access the location of the buses and shuttle cabs by using their app while the cab drivers will also be notified to serve a stop when a minimum number of students send a request for the same. Cab drivers can also communicate with one other in order to inform who is serving the stop to avoid further confusion. Our main focus is to solve the existing problem of VIT University and our design will not only help in saving the time of students, but it will also aid the VIT Management to track down their vehicle.

III Proposed Method

In our proposed mechanism, we are tracking down the location of all the shuttle cabs and buses running throughout the campus. GPS modules can be installed in all the transport vehicles, using which their location is acquired. This location is in the National Marine Electronics Association (NMEA) standard. From this data the latitude and the longitude are extracted. These coordinates are then sent to the microcontroller on-board the vehicle. This board is also connected to a GPRS module. The microcontroller communicates with the GPRS module and sends these coordinates to it. They are then sent online to a MySQL database[1], which is a relational database management system. This database is coded using the PHP coding language.

An android application will access these coordinates via GPRS and plot them on a map. This map has a restricted boundary covering the area of VIT University alone, using geofencing[3]. The location is displayed as a black dot. We have made a provision for displaying all the transport vehicles on a single map. Each transport vehicle will have its own display device, which will display the location of every other vehicle. For each vehicle, its own location will be displayed using a black dot and that of the other vehicles will be displayed with a blue dot. Using this, the drivers will have an idea of the location of other vehicles. Students can access this app using their android based smart-phones and so it will become convenient for them to know the location of the cabs and buses. A provision is made for the students who are unable to access this application by installing android based devices at the stops.

We have included an additional functionality of intimating the shuttle drivers regarding the need for shuttle service. The students can intimate the shuttle driver for request of service by pressing a button present in the app. When a student presses the button, a signal is sent to the counter present on the MYSQL Server. For each shuttle stop, a separate counter will be present. A central microcontroller is always connected to the MYSQL server. This microcontroller monitors the counter for each and every shuttle stop. When the number of requests at a particular stop exceeds seven, within a span of five minutes, the microcontroller intimates all the shuttle drivers regarding the need for service by displaying that stop with a red marker. Once

this signal has been sent, the microcontroller instructs the MYSQL server to clear the counter for that stop.

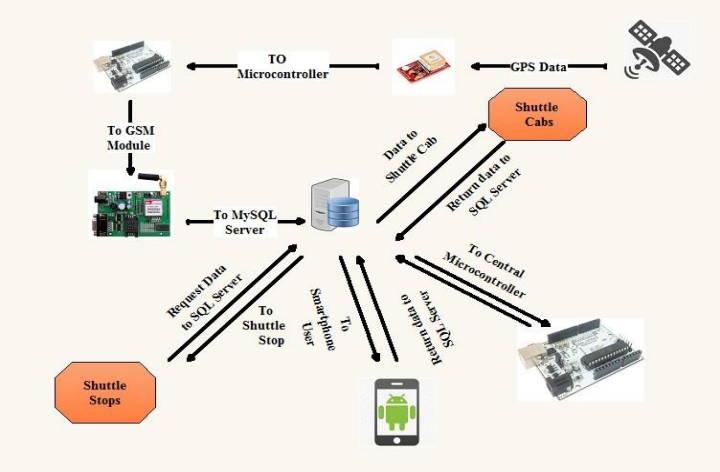

Figure 1: Algorithm

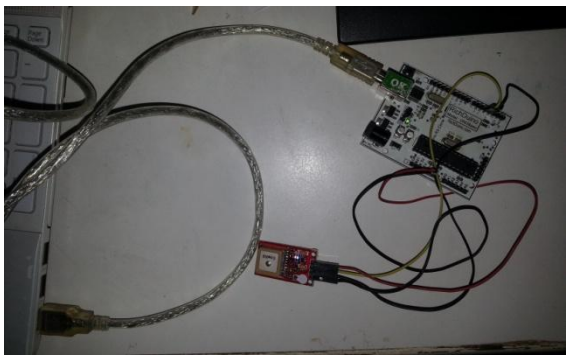

Figure 2: Circuit Diagram

Finally, our map will feature three indicators- black marks for the shuttle's location, blue mark for the location of other shuttles and a red mark for the stop to be served. Based on this, a driver can estimate its proximity to the stop to be served and hence the nearest driver can service the stop. A button will also be present inside the shuttle cab so that the nearest driver can signal the other drivers that he will service the stop in order to avoid confusion amongst the drivers.

IV Results and Discussions

To test our proposed mechanism, we obtained the location of the GPS module on the arduino board. We obtained the co- ordinates of a path from the Main gate of VIT University to the Technology Tower building and logged this data into a text file.

The circuit shown in Figure 2 shows our GPS module connected to the arduino board, which in-turn is connected to the laptop via the USB port. This data obtained is collected by the computer in a text file. The data obtained is in the form: Longitude,

Latitude, Altitude. It is then converted into a KML file, which is a format accepted by Google Earth. When opened with google earth, it showed the path followed followed by us, as depicted in Figure 3.

Figure 3: Tracked GPS Data

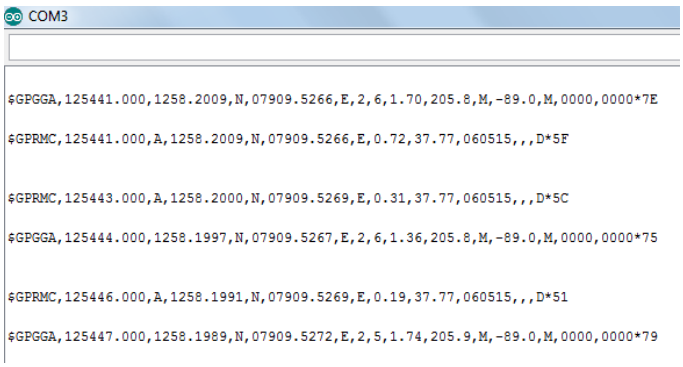

Figure 4: GPS Co-ordinates

The GPS data is obtained in the Global positioning System Fixed Data (GPGGA) and Global Positioning Recommended Minimum Specific GNSS data (GPRMC) format. A sample GPGGA format data, with the GGA header[6] is shown in figure 5. This message can be broken down to give information such as UTC time, latitude, N/S indicator, longitude, E/W indicator and related data. The data can be processed to obtain the latitude and the longitude of the particular GPS module. A sample GPRMC data format, with RMC protocol header[6] as shown in figure 6, gives us additional information like GPS Receiver status, Speed over ground, Course over ground and Date. Figure 4 shows the GPGGA and GPRMC data obtained from our module. The latitude and longitude are 1258.2009 and 7909.5266 respectively. These latitude and longitude are in the format 12 degrees and 58.2009 minutes and 79 degrees and 9.5266 minutes. When converted to degrees, it yields 12.970015 degrees North and 79.15877 degrees East. When these coordinates are entered into Google Maps, it gives us the location of VIT University where the data was acquired.

V Conclusion

Thus we see that the VIT transport vehicles can be successfully tracked using our proposed solution with the help of a simple GPS, GSM system on an android app. The location from any GPS module can be sent online with the help of GSM system using a microcontroller and its location can be seen on an android app. This system helps the students in knowing the location of cabs and buses and proves to be a great time saver. The same can also be used by the VIT management in keeping

$GPGGA, 161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 1-4
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Figure 5: GPGGA Format

$GPRMC, 161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status[1]	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation[2]		degrees	E=east or W=west
Mode	*A*		*A=Autonomous, D=DGPS, E=DR*
Checksum	*10		
<CR> <LF>			End of message termination

Figure 6: GPRMC Format

a track of the vehicles and also in monitoring the speed of the vehicles. Thus, with the help of a few components, a great number of purposes can be served. This type of a system can also be implemented in the public transport buses to limit the speed of the buses and to ensure passenger safety.

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