BUS TRACKING SYSTEM USING IoT

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Abstract—Unusual and unexpected conditions on the roads affect the smooth operation of the bus system and the movement of vehicles. Also, everyday problems such as traffic congestion, unexpected delays, randomness in passenger demand, and irregular vehicle dispatching times take place and as a result of which the schedule of the passengers are affected and they have to wait for the arrival of their respective bus. The inconvenience of the passenger can be avoided by introducing a system which provides real-time information about the location and estimated time of arrival of the buses. This project focuses on the implementation of a Real-Time bus Tracking System (RTBTS), by installing GPS (Global Positioning System)-module devices on college buses which will transmit the current location on the GPS Receiver. The GPS Receiver will be interfaced with a computer and an interface driver will auto save data in a dot text file which will continue to do until the GPS module is connected to a bus. From here the application will retrieve data and store it in web server from where the system will display real-time information of the bus. The real-time bus tracking system is a standalone system designed to display the real-time locations of the buses provided by the college.

Keywords—Global Positioning System (GPS), Bus tracking, Android phone, Internet.

I. INTRODUCTION

One of the fastest and most dynamic business sectors today is the mobile phone industry. The need to communicate efficiently and instantaneously is always a necessity. The market sector, ever-growing and demanding consumers always want to have better than ever. Mobile phone makes our life easier. We cannot avoid it because communication is a part of our daily life. The invention of mobile phone has gone tremendous leaps in innovation and new applications. Originally, it was intended to be a telephone that can be carried wirelessly at greater distances. Advancement in communications, upgradation in radio frequency and developments on the internet had given mobile phones more sophisticated but easy to use in applications. For instance, authors in propose an accurate map-matching algorithm for location tracking of a mobile user that can be potentially used by privacy adversaries to accurately reconstruct a user’s actual trace. Mobile phones are now equipped with navigation systems such as GPS that aids travelers, tourists, adventurers and navigators for getting the most accurate view of their present location. It also assists them in searching for the nearest establishment such as restaurants, hotels, malls, bank, police station and other places of interests.

We are going to track the bus using GPS to get the exact location of bus. There is an Android Application for public or bus user which will help to track bus and get the exact location of bus. The application will also tell the estimated arrival time (ETA) of bus to the user. ETA is calculated when user is standing on bus stop and the nearest bus coming towards the bus stops at which user is standing. This paper presents a system for college bus transportation which is successful in producing an intended or desired solution or result. Real time tracking of the bus allows the user to have more time for activities instead of waiting for a delayed bus and the notification system ensures the individual safety of each student. The tracking is achieved by reading the geographic coordinates of the bus from the GPS module and uploading it to a MySQL database in the remote server. This information can then be accessed by a user base that includes the students, bus drivers and college administration through a mobile application which takes the location from the database and plots it on a map.

II. COMPONENTS

The proposed prototype of the system use the following components:

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A. **Global Positioning System (GPS) sensor**

GPS sensor is a global navigation satellite system that provides geo location and time information to a GPS receiver anywhere on or near the earth where there is an unobstructed line of site to more than four GPS satellites. Hindrances like mountains and buildings block the relatively weak GPS signals. The GPS does not require the user to transmit any data and it operates independently of any the internet reception, though these technologies can enhance the usefulness of the GPS positioning information.

B. **Raspberry pi**

It is a low cost, credit-card sized computer that plugs into a monitor or TV and uses a keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, to learn how to program in languages like scratch and python. Raspberry pi 3 is the latest version of the credit card sized computer form raspberry pi foundation.

C. **Android based mobile**

Mobile application will allow us to view the user interface. It will help the user to login and get the related bus information using GPS sensor. It is user friendly device and it is cost effective.

III. **SOFTWARE SPECIFICATION**

In this prototype, the front end development was done using Java and embedded C in Android Studio and Raspberry pi where in the android application was built using Android Studio and hardware functionality using Raspberry pi respectively. The backend database were developed using MySQL. The push notification service was implemented using cURL requests to the Firebase Cloud Messaging service.

A. **Abbreviations and Acronyms**

- GPS: Global Positioning System
- ETA: Estimated Time Arrival
- SQL: Structured query language
- URL: Uniform Resource Locator

IV. **ALGORITHM**

Map Matching Algorithm

The algorithm uses the following steps:

**Step 1**: Find the closest node from the first GPS point (i.e., initial point).

**Step 2**: In this step we have to check whether the next point is an outlier. If the point is not an outlier, then select all the road segments that pass through the closest node, otherwise take this point as the initial point and go to step-1.

**Step 3**: Using the weighting formula, choose the correct link. The initial point and its next point should be matched to this link.

**Step 4**: Determine the vehicle position on the correct link for each of the two points.

**Step 5**: Check whether the next point is an outlier. If it is true, then go to step-1 and take it as the initial point. If not, map this point on the same link and determine its position and continue this process until the above conditions are true, otherwise go to step-1.

**Step 6**: Repeat step-5 until all points has been matched.
V. MATHEMATICAL MODEL

**SYSTEM S=ANDROID APPLICATION FOR BUS MODULE SYSTEM**

$S1 = \{S1', I, \delta, O\}$  
$S1' = \{GPS, GPRS\}$  
$I = \{Bus Route, Bus number\}$  
$\delta \rightarrow \{Function to determine current GPS location using Location based services\}$  
$O = \{Latitude, Longitude, Speed\}$

**System S2 = Server side System**

$S2 = \{S2', I', \delta', O'\}$  
$S2' = \{Internet, Database server\}$  
$I' = \{Longitude, Latitude, Speed, Route, Bus number\}$  
$\delta' \rightarrow Cal$  
$F(M) = \sum_{i=1}^{n} Cal$  
$Cal = \{R, Dist, Va\}$  
$R = Routes, Dist = Distance,$  
$Va = Average velocity$  
$R = \{R_1, R_2, R_3, \ldots, R_n\}$  
$R_1 = \{Source, L_1, L_2, L_3, \ldots, L_n\}$  
where $L_1, L_2, L_3, \ldots, L_n$ are intermediate Geographical points  
$Dist = \{D_1, D_2, D_3, \ldots, D_n\}$  
where $D_1, D_2, D_3, \ldots, D_n$ are distances between these points  
$Va = Average velocity$ from prediction system  
$Time = Dist/Speed$ \{Dist, Time, average velocity of the current segment\}

**System S3=Android Application for user Module System**

$S3 = \{S3', I'', \delta'', O''\}$  
$S3' = \{GPS, GPRS\}$  
$I'' = \{Bus Route, Bus number\}$  
$\delta'' \rightarrow \{Function to determine current GPS location using Location based services and sent to web service\}$  
$O'' = \{Distance, Arrival Time of bus\}$

VI. ARCHITECTURE

The project is about college bus tracking system and this application enables the user to find out the bus location information so that user does not get delayed. The main aim is to collect the data from GPS and deliver it to server from where it will be fetched by android application and bus real time location can be viewed on google map which is integrated on to the android application.

The user can log on to the application and can know about the scheduled routes of the college bus. From the users perspective we are doing this project so as to save time. Bus tracking application is a application for smart phones that works on android operatin system. This application at a specific pick up point will send the current location of the bus to students when they request. This app generates prediction of bus arrivals at stop along the route.

The objective is to provide that the system will help the user to know if a bus is on scheduled or has been cancel due to technical or weather issues. System will also tell the users whether they have missed a bus so that they don’t have to wait for the bus.
VII. CONCLUSION

In this paper the design and implementation of an interactive, affordable, simple, flexible and scalable adaptive interactive bus transportation system are stated. Our system contains different technologies together such that it contains IoT unit to send the bus information to the application server and the application server has MYSQL database which provides the required information. The project is user friendly and cost effective and this software can also be used for any type of public transportation services.

VIII. FUTURE SCOPE

The software can be modified and developed as per the users requirement in future use. This application can be used to predict the location of any traffic congestion that will occur. It is flexible, simple, user friendly and easy to use.

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