

Real Time Tracking System using GPS

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Abstract— Public transportation is highly cost effective and environmental friendly solution for commuters. But the unreliability of the system because of lack of communication often prevents its widespread use. This paper describes the solution which makes the public Transportation more intelligent.

The emphasis of this paper is on prediction of the bus arrival time, distance and geo-location based on various aspects like bus availability, average running speed and bus current location. For analysing these aspects, we have developed range of algorithms like dividing routes into segments, mapping bus location onto segment and finding accurate information for user's query.

Required resources are classified into two modules namely the GPS(Global Positioning System) module for tracking the bus's potential GPS logs and the network infrastructure that allows the users to communicate, by querying for the bus information and receiving response on different platform like SMS, Android.

Index Terms— Android, Global Positioning System (GPS), Intelligent Transportation System, Travel Time Prediction, Real Time Tracking System, Short Messaging Service (SMS).

I. INTRODUCTION

Passengers in Metro cities like Pune often faces problem of uncertainty of public transportation system. This leads to the use of private vehicles. It happens because there is no such system in India which gives accurate information. This is really a low thing in this high computing technological world. Providing real-time bus arrival information would enhance the credibility of the public transit system and thus render it more competitive among various transportation modes. If commuters had an easy way to see which bus is near to their location and approximate time it would take to reach the stop, in real time, they could make a more accurate, decision of whether or not to wait at a stop.

One important parameter in travel time prediction model is travel time data. Travel time data can be obtained through various traffic surveillance devices. With the emergence of Global Positioning System (GPS) technologies, traffic data collection can be performed more efficiently and safely. GPS provides us with a more perfect and convenient way for the travel time prediction Application development.

A technology central to several functions of real time tracking system is the GPS. Advancement in mobile computing have made possible transmission of GPS data for long distance transmission in real time. GPS and Geographic Information System (GIS) combined together provide us with visualization of vehicular

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movements and tracing them to the global position. In this paper we present a project that consists of developing an application keeping in mind to allow the user to get the current details of the bus they are interested in. And for this purpose we have developed an android application and a Short Messaging service application that allows the user to send request for the destination stop and as a response to this the server sends an estimated prediction arrival time for the user enquired bus.

The primary goal of this research is to enable passengers to easily access estimated bus arrival time they are interested in, along with this the user is also made available with a real time map marking for each of the bus with a label that identifies the location of each bus.

II. BACKGROUND AND RELATED WORK

With the survey of the various intelligent transportation systems, we have come forward with some of the points like

a. Implementation requires genuine study of the traffic hours; this is due to the tremendous fluctuation in the traffic on the roads.

So a survey analysis of the various hours is considered, giving us the speed required to cover the distance during the various hours of the day.

b. Secondly while giving the response to the user, number of validation needs to be considered like

- If the bus had already passed the user requested pickup bus-stop,
- Is the bus running today or is cancelled, etc.
- Change in bus route.

After validating all this facts the server has to calculate the bus arrival time for the user requested location. And then forward the calculated values in response to the user.

- Continuously updating the GPS logs for each bus.
- Maintaining the proper hierarchy of the GPS data record files for the analysis.
- Showing the continuous updation of the intended bus on the Google map to the user adds excitement to the project.

III. ARCHITECTURE DESIGN:

The architectural design gives a brief idea about the details of the system architecture.

The GPS enabled devices keep forwarding the data continuously to the application server. Based upon the request from the user the application server sorts out the required bus details and then forwards the calculated details to the user The database stores all the static data related for details calculation. The user specifies its request through an Android application or

Short messaging service aggregator

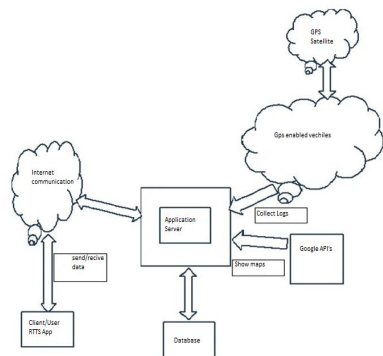
IV. IMPLEMENTATION OF SYSTEM

This paper we implemented as a final year Engineering project. We took five sample routes of Pune City (India). All the GPS logs were collected in real time using GPS enabled mobile. Project model is developed into three main tasks phases namely:

1. Route organisation.
2. Development of the server side Program
3. Communication between the Server System and the User.

A. Route Organisation:

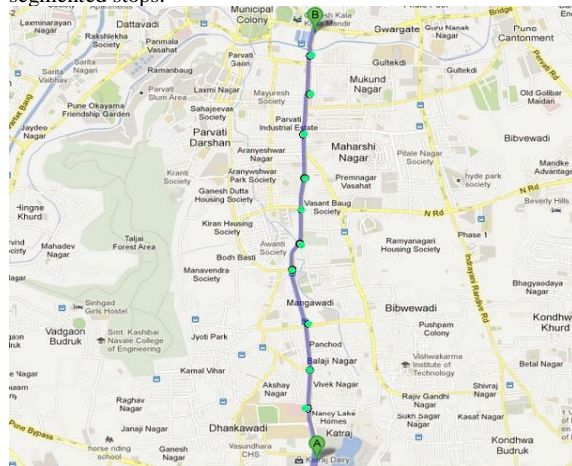
In order to calculate the distance between two earth position the Haversine formula is being used based on the latitude and longitude. The Google API's helps in more proper speculation of the required information. The user sends the request from the android application or through short messaging service.



longitude. But the formula gives the distance is in one straight line between two points on the globe. So for our application we need to divide our route into number of small segments, each of the segments is called as links. Each of these segments is of 100 meters approximately. The routes with their intermediate stations are stored within a file along with their latitude and longitude in the sequence of arrival for the bus in one direction.

Route link development allows us for calculation of the bus arrival time and for identifying the nearest bus stop within the current bus position radius.

The route segmentations are also useful for mapping the location to the map. Figure 1 explains route segmentation of Katraj to Swargate stops of Pune City. Green dots shows segmented stops.



B. Development of the Server Side Program:

The sever side functionalities are divided into number of tasks namely:

1) Collection of the GPS logs:

The system tracks vehicles, by using an on-vehicle GPS-based vehicle computer, which transmits vehicle position data to a central station, those details are being used by the system continuously in order to calculate the current location of the bus and predicting the arrival time. This information is made available to the traveller information system. The GPS log also allows us to locate the current bus position on the map.

The GPS logs are stored into a file data structure. Each record consists of the GPS identification, time label, latitude and the longitude of the bus location.

2)Obtaining the current bus Direction:

In order to predict the bus arrival time the most crucial factor is list of buses that are going in destination direction. Bus direction can be obtained based on the current bus position and the previous logs history and the static bus schedule. But however even this do have an exception. What if the bus has to turn around because of some incident, this would lead to enormous wrong conclusion creating havoc to the user queries. So in order to get the right direction, along with the bus previous log details and schedule we need to compare its previously running station for the specific route and bus number along.

3)Real Time Bus Tracking:

a) Nearest Bus-Stop (link) for Current Bus Position:

In order to predict the arrival time of the bus we need to determine the exact location of the bus within their intermediate links along the bus route, which are statically stored, based on the current GPS location.

So here we calculate the nearest intermediate link by calculating the distance between bus current position and all of the links. Whichever link distance is the nearest is consider as the segment of the current bus.

This segment help to calculate the prediction travel time for each of the individual link on the remaining route for the respective bus.

b)Average Speed Derivation:

Looking toward the uncertain nature of the traffic condition, a great variance can be recorded. Therefore it is necessary to estimate average traffic time spend by the bus during the various hours of day. The main traffic seen on the road is because of the official working peoples going on their regular routine. During the official hours the traffic is comparatively very low that of the office starting hours and the after the official hours. So we have to consider average value of speed during the various hours of day.

For predicting the travel time we need to consider the average travel time in various traffic condition based on the previously collected data. Then the bus time can be predicted based on the average time, and the current bus travelling speed for the route intermediate segment.

The average speed calculation also includes the distance between the current position of the bus and the previously passed all the intermediate station and the future stations also.

The first method estimates the average time speed:

$$V_i = avr + bvai/a + b \quad (1)$$

V_i = predicted speed of route segment i (to the immediate downstream route segments),

V_r = current speed of bus derived from GPS data,

v_{ai} = historical average speed of route segment i in current time period, and

a, b = weighting factors defined in Equation 1.

$= S_{if}$ and $b = S_{ib}$

where S_{if} is the distance from the current bus location to the end of the route segment i , and S_{ib} is the distance from the beginning of the route segment i to the current bus location.

c) Prediction of the Arrival Time for the Bus

Based on the above [1] and, the bus arrival time to downstream stations can be calculated as shown in below equation

$$T = S_i/v_i + t_{i+1} + t_{i+2} + \dots + t_{i+n} + td \quad (2)$$

Where

S_i = distance from the current bus location to the end of route segment i ;

t_{i+1} = travel time of each segment, estimated based on the average travel speeds of individual route segments in current period;

n = number of route segments before reaching the station of interest; and

td = sum of average dwell time at each bus station that the bus will pass by, which could be estimated on the basis of historical dwell time data for different time of day.

The algorithm also considers the dwell time of the bus at each bus station that add to the more preciseness of predicting the arrival time.

It is more reasonable for the proposed algorithm to develop a prediction model based on the average speeds of route segments rather than the historical average velocity. It also leads to a superior result, because this model only estimates the speed to the end of the route segment instead of the speed to downstream bus stations, when the bus is far from the station.

d) Communication System between the Server and the User

a. Android Application:

The real time tracking system has developed an android application that allows the user to send their request to the system server for the bus details. On receiving the request the system has to first find the user intended buses, and calculate the distance for each one of them. Upon proper calculation the server sends the proper response to the user containing the list of available buses to him and their arrival time for each one of them. Based upon the user schedule convenience the user selects the bus and for more reliability and user convenience the android application is also sending with a Google map locator variable that shows the location of the selected bus out of the available bus on the Google map. The android application is provided with the two tabs:

First one showing the list of available buses for the user enquiry. Second showing the Google mapping location of the opted bus by the user.

b. Text Messaging Capabilities

Understanding the non-availability of the smart phones with the user, we are implementing a SHORT MESSAGING SERVICE (SMS) for our application. Major crowd travelling through local buses is having the SMS facility available instead of the Smart phones and Internet facilities in their cell phones; this is based on a general observation.

User has to simply text source and destination location to server to receive the current bus location. Upon receiving the enquiry SMS the system has to first match the query parameters. After calculating estimated time it will respond to user through SMS.

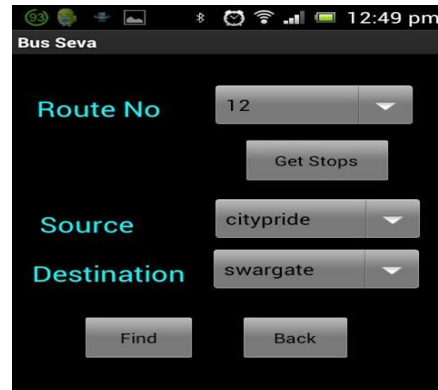


Fig 3: User Input Window

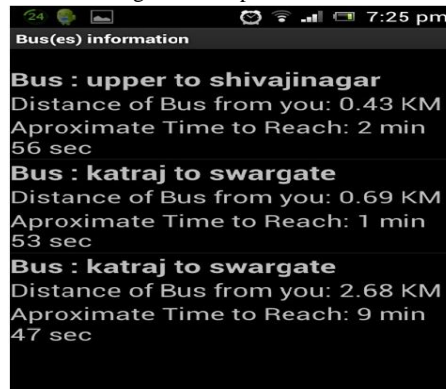


Fig 4: All Buses Information

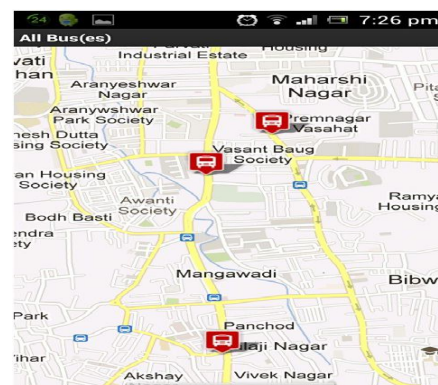


Fig.5 Bus Location on Google Map

V. CONCLUSION

With Real Time Tracking System using GPS the management of time get ease to a great extent. The implementation exceeds the various requirement in many ways like real time positioning for user requirement, providing dynamic updates to all the user, providing Static in addition. Also the aspects like ease of user convenience is also given priority while developing the entire system.

The important points highlighted in the system is consideration given to aspects like official working hour, specific week day, special festival occasion while calculating the traffic aspects.

More appropriate data results can be formed With the increase in the number of segments of the routes. This helps in deriving more precise result for estimation of bus arrival time.

The commuters becomes capable to decide their schedule and manage accordingly to leave from their work space or homes for the travel. This paper had kept forward a project that can help to improve the transportation system to get convert into an intelligent transportation system. Not only to the bus but the same system can help a lot in managing the delivery system by extending the project.

VI. ACKNOWLEDGMENTS

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