Intelligent Vehicular Tracking System for Smooth Public Transport

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Abstract— Many approaches had been proposed for travel time prediction in recent years. Travel time prediction for urban network in real time is challenging, because we have to overcome several factors: complexity and path routing problem in urban network, nonexistence of real-time sensor data and lacking real-time events consideration. In this paper, we propose a heuristic approach based on real-time travel time prediction model which contains real-time and historical travel time predictors to forecast travel time for public transport system. The proposed framework uses three GPS-Data fields (Date-Time, Latitude, and Longitude) to estimate Travel Time, Distance and Speed. As a case study, we have maintained a database for day-to-day traffic behavior of Pune, India. The implementation of this framework will show that using only three GPS data fields, travel time prediction can be achieved.

Key words: Speed, distance, traffic, time prediction, GPS data fields

I. INTRODUCTION

Intelligent vehicular tracking system is more focusing on the public transport system and making it more interactive. There are many methods proposed to predict the travel time and other factors related to it. As we know that public transport service or any system which is in the field of transport for them tracking of their vehicle is the essential part, since tracking of their vehicle can help them for the purpose of security, for the purpose of the business development and on the data collection of the vehicle they can also work on the improvement and the expansion of their own business.

In today's world those who are in the business of the service providing they have to be very particular and perfect in case of it .They have to think of the users who are using that service; if users are happy and satisfied with the service they can use that service on the large extend which in return providing them a good future for their business.

The main thing in case of tracking is that it is a very vast area for development. The data that we collect is in huge amount and using that data for tracking is also a very tedious job. The main ai of any vehicular tracking system is that it should provide results on demand or whenever is needed that should be accurate. For the purpose of the effective tracking. Vehicle Tracking System consists of device enabled with GPS & GPRS connectivity to track the position of the vehicle & control the vehicle.

A vehicle tracking system comprises of device enabled with GPS & GPRS connectivity of an electronic device in a vehicle. It is designed with purpose to permit the owner or a third party to track the vehicle's location, collecting data in the process your computer through remote web server .Vehicle tracking systems usually are powered by internal power supplies. It provides important information ensuring secure and quick operation of small to large fleet of vehicle operations. With a GPS vehicle tracking system, vehicle coming times are predicted more accurately, control and remove unauthorised usage, and notification can be sent when a driver speeds or departs from the designated route. Additional benefits are more safety and security assistance for drivers losing direction or for vehicle breakdowns. In the unfortunate incident if transportation is stolen at any given time, users can track their vehicle's accurate location with the help of this system. Vehicles are tracked by logging in a website with provided login details.

II. BACKGROUND

In the last years many methods were carried out to implement the vehicle tracking, for that purpose some used sensors, cameras and GPS devices. With the sensors the vehicle was ready to track but there were many limitations. There was a limited scope of the sensors they could track the vehicle to the particular area only which are in the range of the receiver. so the scope vehicle tracking became restricted to a particular area which is within the perimeter of the sensor. In case of cost, high quality sensors were expensive as well as sensors were very sensitive .When they were mounted on the vehicles because of the movement of the vehicles they got damaged. Because of damaged sensor performance of the tracking system started degrading. So it was not a efficient idea to track the vehicle.

Image processing approach was also used to track the vehicle. Cameras were installed in the various part of the city and pictures were taken. After processing those pictures the information was taken. The idea of camera was not so efficient since high specification cameras were needed and angle of the camera where it was set also important. This method was not so reliable since information collected from it was not accurate and the amount invested for this and the outcome coming fro it was not up to that extent.

GPS-tracking is considered to be the most reliable and efficient system since it uses the data from the satellites. So the scope of the system can be increased to a very large geographical area .Data coming from GPS device is very reliable and accurate .Time longitude latitude these three are the GPS-data fields; with the help of these data fields correct location can be calculated. GPS device is rough and tough to use so mounting it on the vehicle is less risky. So GPS-device is a correct and more efficient way to track the vehicle.

In this paper, we will see the approach of using GPS-device for travel time prediction will be done

III. INTELLIGENT VEHICULAR TRACKING SYSTEM (IVTS)

It combines the use of automatic vehicle location in individual vehicles with software that collects this data for a complete picture of vehicle locations. Mainly, GPS device is used for locating the vehicles.

A. GPS Device:

[1] GPS device has brought to the transportation engineering community a new perspective to gather vehicle information.

These devices are enabled to collect Geo Positioning System traces, called GPS-Data, including device-ID, location in coordinates, time, speed and distance. This information might be saved into the device for its future analysis, it can be used on vehicle to vehicle analysis systems, or send it to a server in Real-Time for its immediate analysis, for instance it can be used to explain the vehicular dynamics of urban cities as micro and macroscopic simulations, traffic flow and travel time estimations.

A GPS tracking unit is a device that uses the Global Positioning System to determine the exact location of a vehicle or other asset to which it is attached and to record the position of the asset at regular intervals. This allows the location of asset to be displayed against a map backdrop either in real time or when analyzing the track later, using GPS tracking software. This data tracking software is available for smartphones with GPS capability.

A GPS device will be mounted on each bus. It will provide us the location of the bus in the form of latitude and longitude. It will send this data to the central server.

B. Traffic Flow Background:

Traffic is one of the most important factors that will affect time prediction. Traffic will be divided in 3 categories- heavy, medium and low. On the map, it will indicated by color lines- red line for heavy traffic, yellow line for medium traffic and green line for low traffic. Based on these traffic conditions, speed will be assumed as it is not feasible to measure precise speed of the moving vehicle. This data will be stored in the database.

Traffic conditions can be obtained by using Google API. GPS coordinates are sent as input to the API. distinguishing source code text.

Refer figure 1 for monitoring traffic conditions.

Traffic condition	Color	Speed
Heavy	Red	15
Medium	Yellow	25
Low	Green	35

Table 1: Traffic-speed database table

C. Distance:

From GPS device, we will get the location of moving vehicle and location of the busstop is static. Using these coordinates, we can find the distance between vehicle and busstop.

Following formula is used to calculate the distance:

```
double theta1 = long1 - long2;
double dist1 = Math.sin(deg2rad(lati1)) * Math.sin(deg2rad(lati2)) + Math.cos(deg2rad(lati1)) * Math.cos(deg2rad(lati2)) * Math.cos(deg2rad(theta1));
dist1 = Math.acos(dist1);
dist1 = rad2deg(dist1);
dist1 = dist1 * 60 * 1.1515;
if (unit == 'K') {
dist1 = dist1 * 1.609344;
} else if (unit == 'N') {
dist1= dist1 * 0.8684; }
```

IV. SYSTEM ARCHITECTURE

As shown in Fig.3, GPS device mounted on the bus provides GPS coordinates of the bus to the centralized server. Using those coordinates, location of the bus is estimated. By knowing the location of the bus and busstop, we can determine the distance between them.

We give GPS coordinates of bus as input to the Google API which in turn provides us the traffic conditions near that location. Speed corresponding to that traffic condition i.e. red, yellow or green is obtained from the database.

As mentioned earlier, there may be certain conditions causing delay like weather conditions, bus failure etc. So, considering these delays and distance and speed calculated before, remaining time is estimated required to reach the busstop. And this estimated time is displayed on the busstop for convenience of passengers.

Time T = TIMEFORMULA + Delay.

Where TIMEFORMULA is the time that is calculated by the proposed algorithm

Delay = time required by (traffic+ traffic signals + weather + malfunctioning of the bus.)

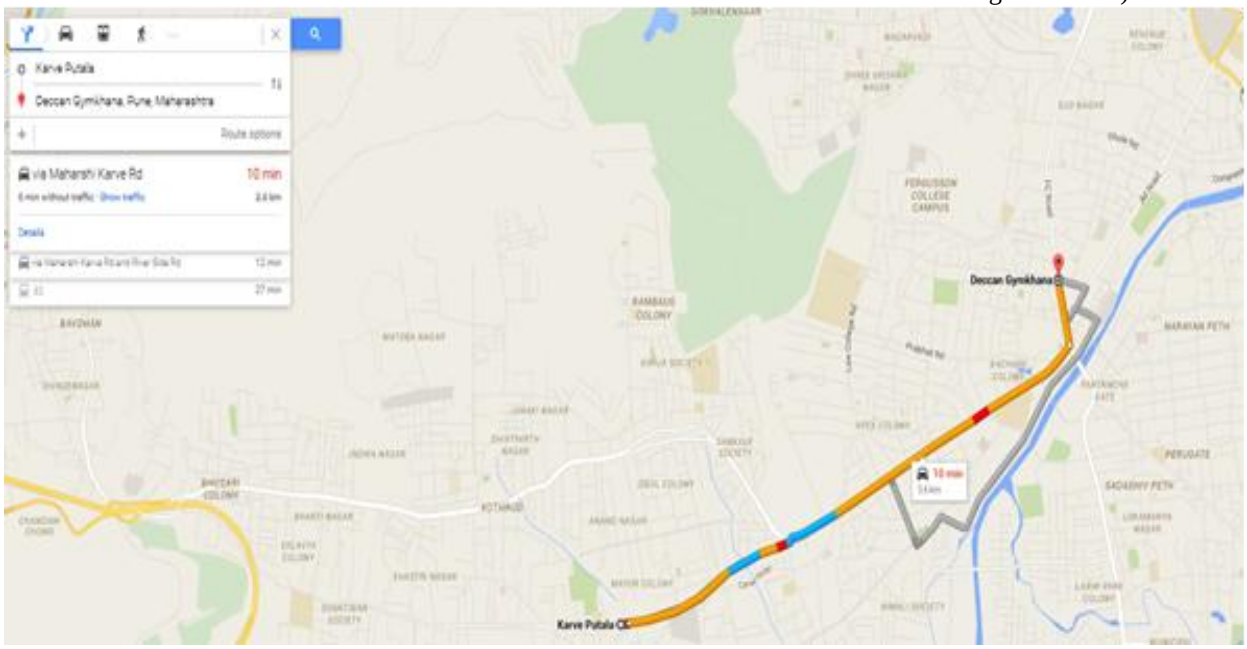

Fig. 1: Google map showing traffic condition between Karve statue to Deccan Gymkhana, Pune

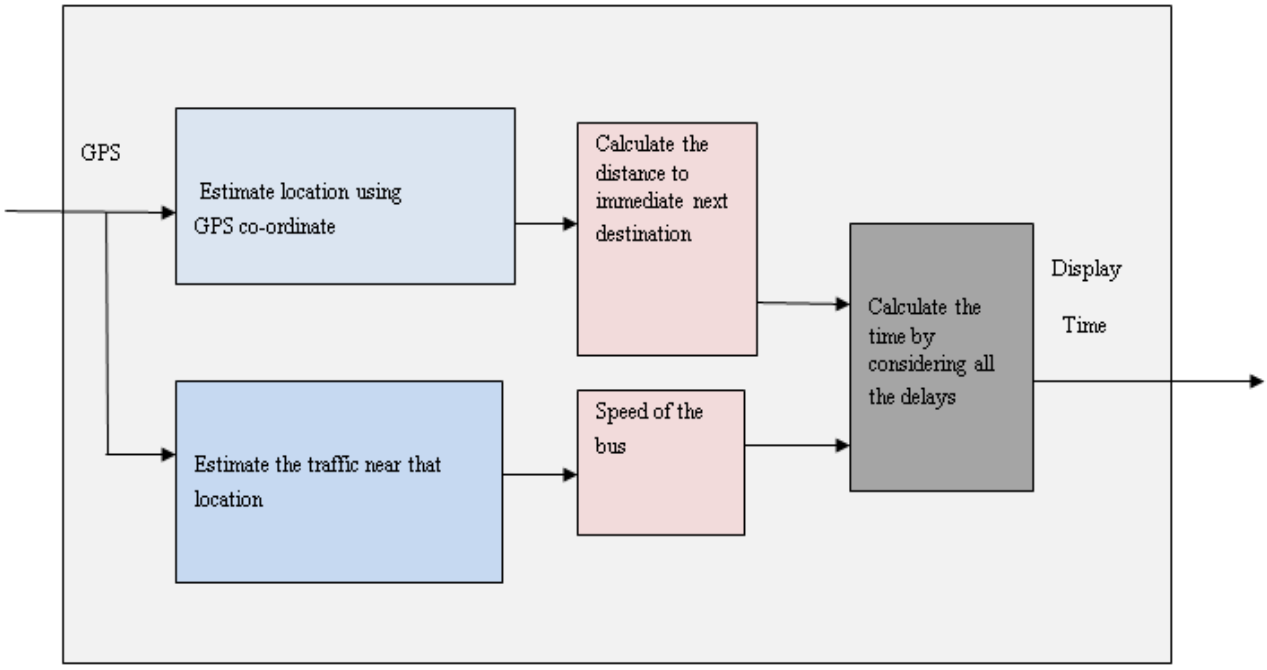

Fig. 2: System Architecture

V. PROPOSED APPROACH

Get the GPS co-ordinates of the bus from the system controller i.e (long_bus, lat_bus)

These GPS co-ordinates of the bus can be fetched by a GPS device .This device is supposed to be set on every public transport facility under surveillance. The GPS device sends the GPS co-ordinates after appropriate time intervals.

Get the GPS co-ordinates of nearest bus stop i.e (long_stop,lat_stop)

Based on the records in the database and the necessary comparisons made, the nearest bus stop is estimated.

Calculate the distance from bus to the next bus stop using distance formula mentioned in [3.3]

The formula gives approximately correct distance i.e. also considering the arc distance and not just the straight distance.

Get the the traffic condition and intensity in that area using Google API

By sending request with ((long_bus,lat_bus), (long_stop,lat_stop),distance).

Retrieve the speed of the vehicle from traffic condition using traffic_speed table

Traffic_speed (color,approx_speed).

This can be achieved by maintaining the heuristic information of of the day to day traffic behaviour in a database. The color denotes the intensity of traffic at a particular instance. Through a thorough study of the traffic behaviour, we assign the speed for these intensities.

Now calculate the approximate time to reach the bus stop

We use the basic traditional approach to calculate the time that the bus requires to reach its next bus stop i.e.

Time=distance/speed

There are some factors which are necessary to consider while estimating the time. These are:

Delay= traffic_intensity + weather condition + vehicle malfunction

Final_time=Time+Delay

Display final time on display board. This is the final step.

VI. EXPERIMENTAL RESULTS

For the proposed approach, we are using technologies like Java, MySQL and Android. Java will include calculation of parameters like location, distance, time etc. MySQL is used to store the database. Database includes tables like busstop details, bus details, users, trackbus etc. Android application is used as an interface which will give location in terms of longitude and latitude of the vehicle. This application has a facility that it can work with GPS device or a smartphone

Fig. 3: Screenshot of the Android application for getting location of the bus

Retrieves the real time GPS coordinates of the current location. The device updates the GPS coordinates every fixed time interval. It sends these coordinates to the server for further processing.

A. Database Schema:

busdetails(busId, busFrom, busTo, busRouteFrom, busRouteTo, busNo, daysofweek, distanceinKM, timeinmin, imeino)
stops(stopId, stopDesc, latitude, longitude)
trackbus(trackid, tripId, lat, lng, cdate, stopId)
users(user_id, displayname, useremail, created_at, userpass, imei, role, phonno)

VII. Conclusion and Future Scope

With the ever growing technology, Travel time prediction has become one of the important constraints for many applications. Real-time travel time forcaste for urban network is a complicated task and that is why it is regarded as theoretically feasible but practically difficult to accomplish using traditional models. The proposed real-time heuristic information based model IVTS, demonstrates that Time Travel Prediction for urban network could be achieved by utilizing the raw data of GPS data fields and traffic behavior. The proposed model provides dynamic combination of real-time and historical database records promotes the Time Travel Prediction precision one step further. The proposed model shows that precision of the time travel prediction can be achieved in tolerable range.

As future work, we propose to make an android application for the passengers. This application will tell the status of the public transport facility under surveillance and the amount of time left for the public transport facility to reach its next halt. The model can also be implemented to track the position of vehicle on digital maps via an online monitoring program. Rent a Car Firms Monitor the vehicle in agreement terms Street characterization.

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