

Local Transport Tracker and Reminder System

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Abstract

The bus arrival time is major information to nearly all city transport travelers. Extremely long waiting time at bus stops depresses the travelers and makes them unenthusiastic to take buses. Here, we propose a bus arrival time forecasting and reminder system depending on bus passengers' participatory sensing. With commodity mobile phones, the bus passengers' surrounding environmental context is effectively collected and utilized to estimate the bus traveling routes and predict bus arrival time at various bus stops.

This system exclusively relies on the mutual effort of the contributed users and is independent of the bus operating companies, so it can be easily adapted to support universal bus service systems without any support from bus operating companies. Instead of referring to GPS-enabled location information, we resort to more generally available and energy efficient sensing resources, including Wi-Fi signals, movement statuses, etc., which bring less burden to the participatory party and encourage their participation. We develop a prototype system with different types of Wi-Fi-based access points (AP) and comprehensively experiment with the buses as well as Pune public buses.

Keywords: *Bus Routing, Bus Tracking, Google Maps, Wi-Fi, Access Points (AP), Wi-Fi signals, signal based Voronoi diagram (SVD).*

INTRODUCTION

Transport is one of the important infrastructures of any country. The main problem with transportation is the ambiguity of waiting time due to traffic jams and any other problems live abnormal conditioning. The securities of private and public vehicles are a major disquiet. Again metropolitan living environment is becoming more complex; the road situation is becoming inferior because of heavy traffic and complex road structures. Today in public transport like buses or trains, no of vehicles and their frequencies also have increased. And all people have difficulty to make follow up of these vehicles.

Nowadays, most bus operating companies have been providing their station lists and timetables on the web generously accessible for travelers. But, the bus timetables, which are typically not timely updated we can get very limited information. For example, the schedule of a bus may be delayed due to many unpredictable factors (traffic conditions, bad weather situation, etc) [1]. When traveling by bus, travelers usually want to know the accurate arrival time of the bus.

The current system only provides real-time location of their vehicles on the map and

but there is no provision to track the speed of the vehicle or mapping the traffic route for the location of the vehicle. Today road conditions are becoming worse because of heavy traffic and an increase in traffic accidents. So vehicles are generally not running on time and passengers miss buses and public transport utility vehicles. Hence, there is an urgent need to develop a real-time bus arrival time prediction algorithms that can provide more accurate information under nowadays conditions. GPS [1][7][10] is mostly used for vehicle tracking system[8][10][11][12] to ensures safety while traveling.

Here we present a bus arrival time prediction system based on bus passengers' participatory sensing. The system mainly depends on the collaborative effort of the participating users. Instead of referring to GPS-enabled location information we are using different types of Wi-Fi-based access points (AP) signal based Voronoi diagram (SVD) to track the bus location based on their scanned AP-list points. The system provides buses current location along with time and speed is constantly updated to the server.

PROPOSED SYSTEM

Here we propose a Local Transport Tracker and Reminder System by using the Wi-Fi signal based Voronoi diagram (SVD).

Here first admin plot all the Wi-Fi Access Point list and download the entire travel route from the website of the travel company. According to this downloaded route, admin can map the AP-list. Wi-Fi signal based Voronoi diagram (SVD) is created after route mapping that gives the real-time bus position. Buse's current

location along with time and speed is constantly updated to the server to get arrival time of bus for a particular bus stop. Below figure shows the architecture of the proposed system.

The systems working exclusively depends on the mutual effort of the contributed users and is independent of the bus operating companies, so it can be easily adapted to support universal bus service systems devoid of requesting support from particular bus operating companies.

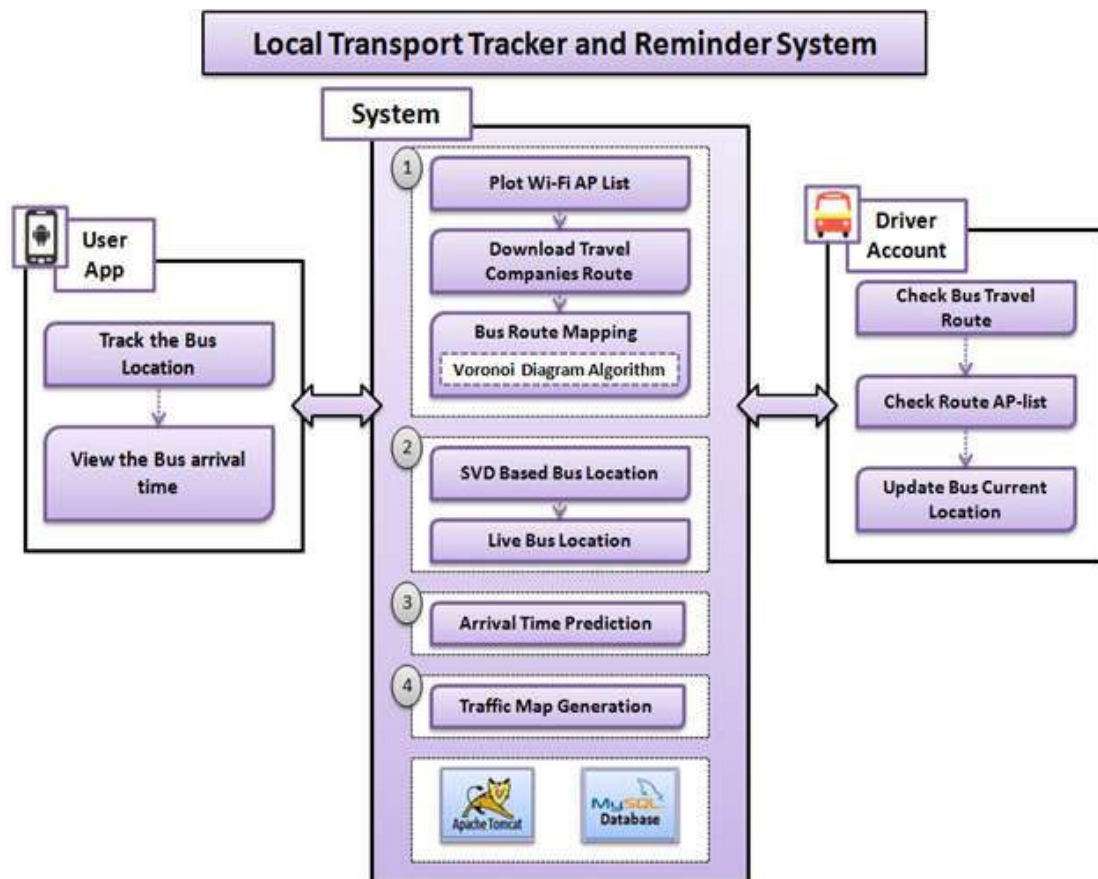


Figure:-1

1. Plot WI-Fi AP-list:

Here Admin can plot the AP-list with their corresponding GPS coordinators like address, latitude, and longitude. Also, they can add the Wi-Fi details like MAC address, SSID. The AP-list consists of ap1 (rss1), ap2 (rss2), ap3(rss3).etc.

2. Download Travel Companies Travel Route:

Admin needs to download every travel route from the website of the travel company. Every company has an _x pre-defining route from the source to destination place along with their stops. The travel route consists of r1, r2, r3, r4.... etc.

3. Mapping Route to AP-list:

According to the downloaded travel route, admin can map the AP-list. Firstly, the admin needs to check the travel route and the AP-list details and then map the AP points to the route.

For eg.

r1= ap1 (rss1), ap2 (rss2), ap3 (rss3)

r2=ap3 (rss1), ap4 (rss2), ap5 (rss3)

After Mapping the route to AP-list system can draw the voronoi diagram.

- The routes wise APs are joined to form triangles. Perpendiculars are drawn
- On the middle point of each edge of the Voronoi diagram.
- The intersection point within the triangle is marked.
- All the intersection points are joined to form a convex polygon shaped graph.
- The access point within that polygon will be nearest all the points around it. This is used to getting the bus current location according to their nearest AP point.
- For eg. See the following Voronoi diagram

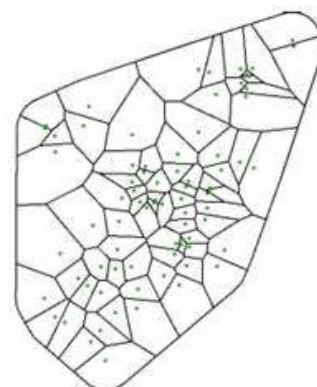


Figure:-2

4. SVD Based Bus Location:

After the route mapping the Wi-Fi signal based voronoi diagram (SVD) is created.

This gives the real-time bus position. The user can track the bus location based on their scanned AP-list points. Buses current location along with time and speed is constantly updated to server. This in turn updates the arrival time of bus on further stops.

For eg.

If a bus is traveled at route r1 mentioned by Access Points AP1, AP2, AP3 having equal RSS (Received Signal Strength) then user may be at the common point Containing AP1, Ap2 and AP3

Live Bus Location:

By using Signal Voronoi Diagram (SVD) system can get the live bus location.

5. Arrival Time Prediction:

Based on bus current location and speed system can predict the bus arrival time at the user location on their route. The user can see the predicted arrival time of bus.

6. Traffic Map Generation:

The system can analyze the travel time on each road segment and generate the traffic map. If any traffic anomalies occur then it report to the user.

A. System Flow

Figure 2 gives the detail flow of proposed system.

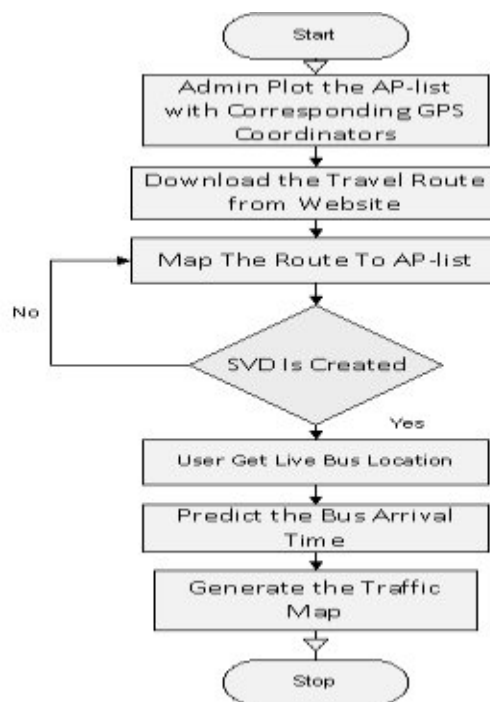


Figure 2: System Flow

ALGORITHM USED

A. Voronoi Diagram Algorithm

Voronoi diagram is nothing but partitioning of a plane with n points into convex polygons such that each polygon contains exactly one generating point and every point in a given polygon is closer to its generating point than to any other. A Voronoi diagram is sometimes also known as a Dirichlet tessellation. The cells are called Voronoi polygons.

The Voronoi diagram is draw with the help of following steps.

Step 1: The input points are called sites, labeled here A, B, C, etc.

Step 2: The next step is to connect the sites to all of their nearest neighbors without making a line that crosses another. This is known technically as the Delauney Triangulation, and it's maybe the most difficult part.

Step 3: To find and mark the center point of every line on the Delauney triangle.

Step 4: To draw the perpendicular bisector for each Delauney line. This is where careful accuracy, in finding the center points, and in drawing a tight 90 degree angle, pays off.

Step 5: To retrace the outline of each Voronoi cell from the perpendicular bisectors. There will be one cell for every site, and at the end, each cell is just the set of all surface area points that are closer to its site than any of the other sites.

EXPERIMENTAL RESULTS

A. Project Screenshots

For the use of the system user or driver have to login first to the system with valid credentials

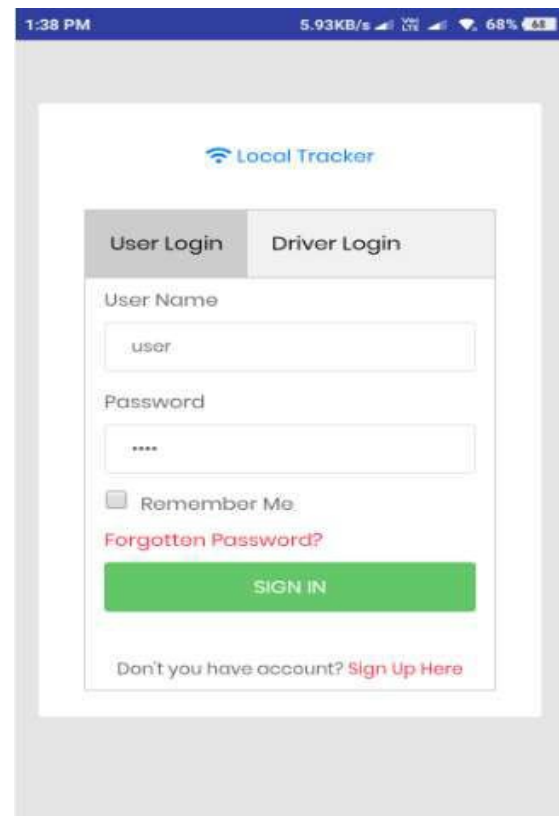


Figure 2: Login Page

Admin can Plot Wi-Fi AP-list.

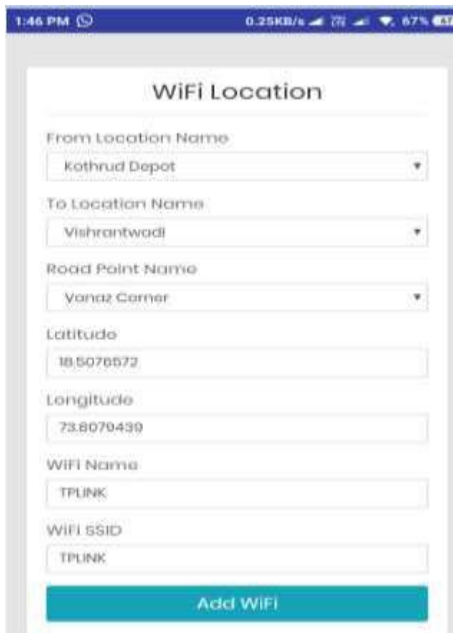


Figure 3: Add WiFi Location

The app gives the tracking of live position of bus and shows it on Google Map.

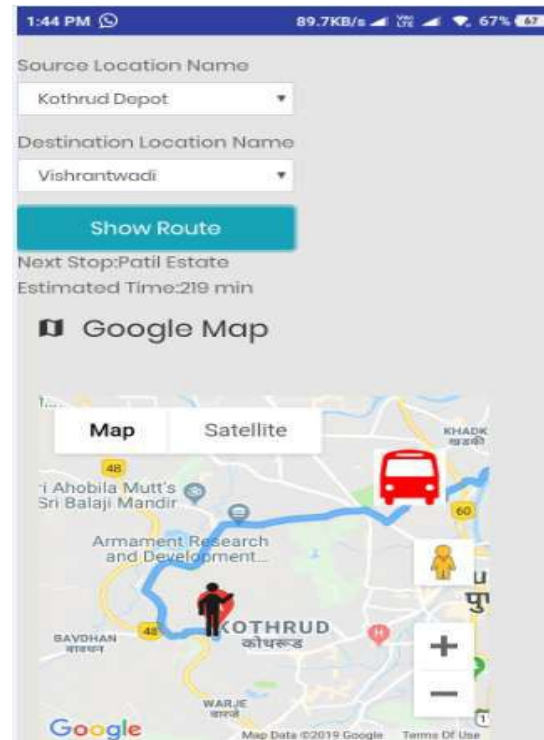


Figure 5: User Location and Bus Location

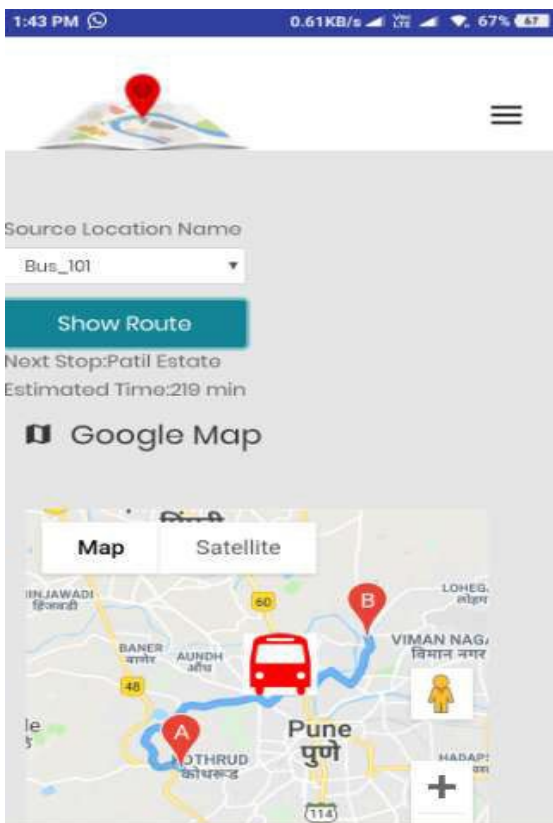


Figure 4: Show Bus on Driver app

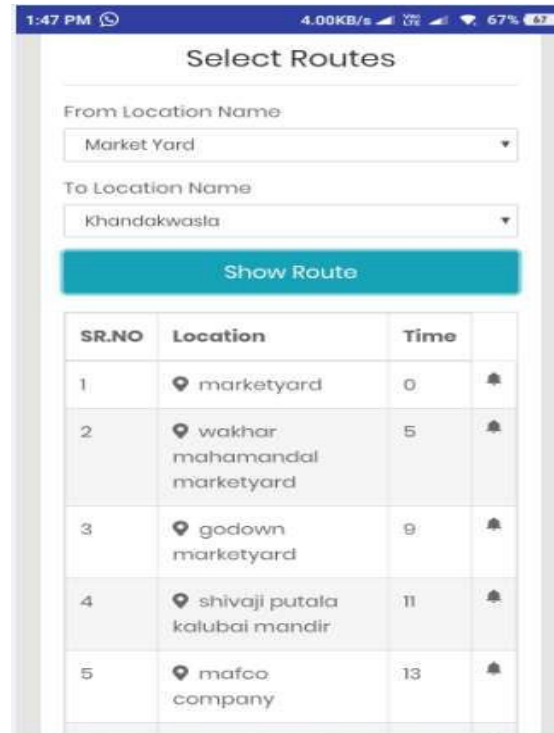


Figure 6: View Route

RESULTS

We compared our proposed method i. e. signal based voronoi diagram (SVD) with existing GPS based method. Figure 7 shows the comparison graph for these two methods in terms of Latitude and Longitude. Table shows the Latitude and Longitude values getting from the two different methods (Table 1)

The table shows that the traditional GPS-based solutions work poorly in urban areas due to urban canyon where tool named Signal Voronoi Diagram (SVD) can to track an urban bus based on the surrounding WiFi information more accurately. The proposed method is energy-friendly and does not suffer from urban canyons as compared with the GPS based methods. Below graph shows the same.

Table I: Latitude and Longitude Values

Actual Latitude	Actual Longitude	Latti (SVD)	Latti(GPS Based Method)	Longi (GPS Based Method)	Longi(SVD)
22.46085	91.97192	91.97192	91.775	22.4608	22.46085
22.46942	91.9693	91.9693	91.9289	22.46939	22.46942
22.45648	91.95745	91.95745	91.808	22.45645	22.45648
22.45141	91.94554	91.94554	91.94558	22.45149	22.45141
22.46332	91.94324	91.94324	91.94321	22.46335	22.46332

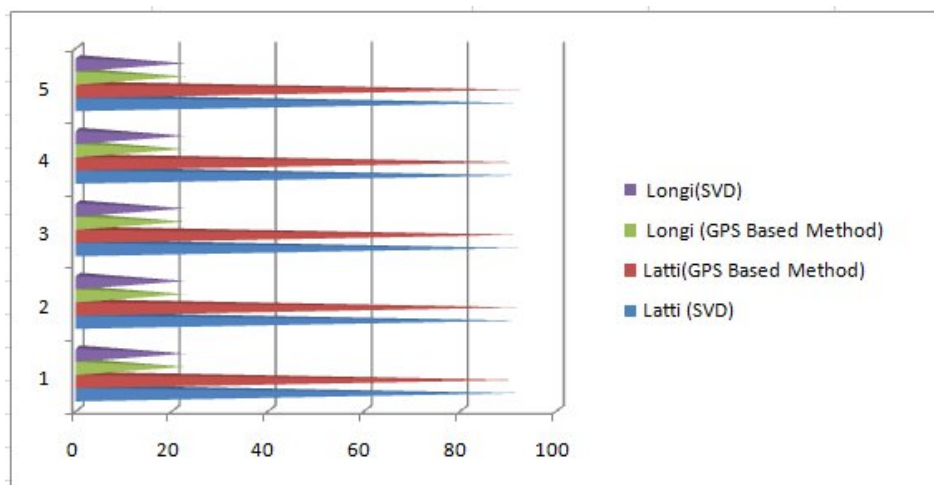


Figure 7: Plot for Latitude and Longitude Values

CONCLUSION

We are giving a system which will help to track the bus location and view the bus arrival time prediction on particular bus stops. Here instead of using GPS for tracking, we are using Wi-Fi signal based on Voronoi diagram (SVD) to track the bus location based on their scanned AP-list points. The real-time bus tracking is done along with the arrival time prediction at the user location on their route. The system analyzes the travel time on each road segment and generates the traffic map which will help the user to report to the user in case any traffic anomaly occurs.

Such a system should be able to satisfy users, who want to track a bus, by providing its position in real time. The system is an advancement and automation of the current system of public transports. Thus, the implementation of this system would undoubtedly lead to better public transportation.

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