Determining Real Arrival Time of the Vehicle Considering Environmental Conditions using Historical Data

Tushar Bhimrao Meshram, Sujata Deshmukh

1 Department of Computer Engineering, Lokamanya Tilak College of Engineering, Navi Mumbai, India.
2 Department of Computer Engineering, Fr. Conceicao Rodrigues College of Engineering, Bandra, Mumbai, India.

Abstract

Public transport system faces many problems like delays in India. Technology based solution like Vehicle tracking system, is used to estimate the real arrival time of the vehicle. This paper presents a technique for determining real arriving time of the vehicle using location of particular vehicle, location of user and by considering all Environmental conditions which a vehicle faces during its travel to the road paths. In this system each bus is provided with the GPS enabled device which locates the location of the bus, and the user can access the application using mobile device which detects the location of user. This system estimates the real arrival time of user selected bus by considering delay by environmental conditions using Kalman filter. This system also provides the delay information from predefined time table of the buses. This will allow the user to manage its time by considering the real time of bus Arrival from users location.

Keywords: Vehicle tracking, Global Positioning System, Arrival time of the vehicle.

I. INTRODUCTION

Time Management is a very important to increase personal productivity in this digital era. Largest population of the world, are using public transportations daily to reach to their destinations. These people completely rely on public transports to reach to their destination being unaware about delay and arrival time of particular bus to the user’s location. If the vehicle is on time they will reach on time otherwise they could switch to other transport system to reach to their destination on time or could do other important work mean while. So there is need of efficient public transport system. Use Digital and mobile technology in public transport system can improve efficiency, reliability, accessibility of the system. But utilization of technology in public transport system can add value to passenger information by providing arrival information, Route information, fare information, suggestions to alternate route and many more location based information services [1,9,17].

Vehicle tracking system collects the real time data about vehicle location with the use GPS or other technology for locating the vehicle [5]. So this system is an application of vehicle tracking system to estimate the real time of public transport system by considering environment condition of a route.

II. LITERATURE REVIEW

The aim this section is, to get acquainted with topic by considering the research work done by earlier researchers. This section provides different technologies and algorithms used by earlier authors which provided motivation to the current system. Ibrahim and Mohammed Bouhorma [2013], determined the Velocity of the GPS device is by considering the last two points between which device has travelled and time taken to travel that distance[1]. This work provided motivation to use the concept of considering the last two points of the GPS device for calculating its velocity. Pankaj Verma and J.S Bhatia [2013], tracked and monitored of the GPS device using the GSM cellular network and Google maps[3]. This work has given a concept of using Google map as a mean to monitor the vehicle location instead of just getting the SMS about longitude and latitude information. Pranay Dhole and Sumit Hirve [ 2013], developed application using J2ME for considering the safety of women by using location based services, it sends an alert message to another user when women cross a particular given radius which she does not usually do[]. This gives a general idea about mobile device which can also be used to locate a vehicle using mobile device. M. Zaki et. Al [2013], predicted the arrival time of bus using neural network and Klaman filter. Kalman Filter is a technique that uses a series of observations to get the desired required results. Here the weighted average of the observation is evaluated to get the estimated arrival time of the vehicle [16]. This work motivated to use the Kalman filter for current system. By considering above literature, research gap is identified. Further problem statement and objectives are finalized. Next section provides the objectives of the research.

III. OBJECTIVISE AND PROBLEM DEFINITION

The main objective of this system is to develop a mobile based application to estimate the real arrival time of public transport system. The main objective is subdivided into following sub objectives:

• To find the user location with respect to time.
• To find location of a specified public transport vehicle with respect to time.
• To find the speed of bus from starting point to current location.
• To find the speed of public transport vehicles travelled to the same path from which request is generated.
• Estimate the speed using Kalman filter and delay calculation if any.

IV. ARCHITECTURE OF THE SYSTEM

To achieve the objectives of system, each vehicle is facilitated with the GPS [15, 20] enabled mobile devices and users are provided with an application using mobile phone [6, 12] by which system can get the current information’s of their desired bus. Each bus will send all its information to the central server i.e. its current location, time. The server stores the each and every bus information like location and time from source to destination. Further it will process the required information after the query is submitted by user to estimate the time of particular vehicle using algorithms. This system works on the basis of Kalman filter algorithm and delay estimation algorithms. Kalman filter is used to determined the exact arrival time of the vehicle to the users desired location using the concept of Kalman filter[16] technique in which historic data of the buses i.e. its speed, and the time it has taken to travel a particular path and clock time at which bus was at a particular stop. All these data helps to get the exact arrival time of the vehicle. Another algorithm is used to find the delay time of the bus at the particular bus stop, in what exact clock time it will reach to the particular bus stop. Both these algorithms are processed at the central server and send the user query information to the server. To find the location using GPS enabled device is based on the concept of Trilateration.

To locate an GPS[1][3] devices minimum three satellites are required and each satellite forms an radius of its reach and through these radius creates a sphere, the location at which sphere of each satellites collides is the actual locations of the GPS devices. In the above figure the location at which all point joins here it is Denver is the actual location of the GPS[4][7][14] device. Using this technique of trilateration tracking or locating of the vehicle is also carried out.

V. SYSTEM WORKING

The Figure 2, shows the actual working of the proposed system, here U represents the user and its location, B represents the location of the bus, d is the distance between users and the bus, B1 and B2 represents the buses which were travelled earlier along the path between B and U, Lsb represents the bus stops which was last travelled by the bus B and the d1 is the distance between bus stop Lsb and the bus B.
The System working is based on two Algorithms -

A. Algorithm for Estimated Arrival time

1. Get the user location U
2. Get the Bus location B
3. Calculate the Distance between B and U i.e. d
4. Calculate Speed Sr of the bus Considering previous stop travel
5. Get the historical data of the buses B1, B2. travel along same path (considering only certain time data)
6. Calculate the predicted speed Sp of the bus travel along the path B and U using historical data
7. Using Sp and d calculate the Estimated time to reach by the bus from B to U

Ex. Sr = 2km/10min = 12km/hr

This algorithm finds the Estimated Arrival time of the bus at the users source of travel, the steps are as follows:-
1. Get the Location of the user U using coordinates given by the satellites.
2. Get the Location of the Vehicle/Bus B using coordinates given by the satellites.
3. Using step 1 and step 2, calculate the Distance d (let d=5km) between user U and the current position of the Vehicle/Bus B.
   Suppose that B and U are at their particular position is at 3:00 PM.
4. To find out the Current speed Sr of the required bus B we have considered the distance d1 (let d1=2km) between the B and the last bus stop Lsb through which B has travelled and the time tr (let tr=10min) it has taken to travel that distance d1.
   Ex. Sr = 2km/10min = 12km/hr
5. To find out the Speed at which bus will travel from its current position B to the user U can be calculated by getting the historical data means. Speed of the buses B1 and B2 travelled along that path earlier and that to be considering for a interval of particular time period let say last 30 minutes, and take the average of the speed of the buses.
   Sa = ((d1/t1) + (d1/t2)......(d1/tn))/n
6. Then calculate the predicted speed Sp of the required bus B along the required path by considering equations (1) and (2).
   \[ Sp = \frac{Sr + Sa}{2} \] (3)
   Sp = 11.6 km/hr
7. If no Bus has passed between B and U in the given time period then calculate the predicated speed Sp using step 1) and equation (1).
8. Then Calculate the Estimated time required to travel between distance of B and U i.e. d.
   \[ ETR = \frac{Sp}{d} \] (4)
   ETR = 25min 40sec

B. Algorithm for the Delay and real arrival clock time

This algorithm allow us to find out the actual delay time and the actual real clock time of the bus B arrival at the users source stop U, this algorithm works as follow.

1. Get the Current Location of the Selected bus B and the time at which the location is determined assumed as Ct = 3:00 PM from algorithm 1.
2. Determine the predefined time Tpr (Let Tpr be equal to 2:40 PM) of the required bus at the bus stop Lsb at which bus has travelled last.
3. Determine the Actual time Tar (Let Tar be equal to 2:48 PM) at which bus B has reached to that stop Lsb.
4. Delay by the bus to that particular stop Lbs.
Delay (D1) = Actual Bus time (Tar) - Predefined time (Tpr) ..............(1)
Ex. D1 = 2:48 - 2:40 = 8 Minutes

5) Determining the Estimated time to travel Between Current location B and the required bus stop U considering environmental condition and dynamic data using Algorithm 1
   i.e. ETR............................(2)

6) Determine Regular Clock time of the bus at the required stop U using predefined data
   i.e. Tpr1 (let it be 03:20:00 PM) .........................(3)

7) Using (1) (2) and (3) determined the new time at which bus will arrive at the required stop
   New Time of Arrival (NT) = D1 + Ct + ETR ............(4)
   Ex. NT = 00:08:00 + 03:00:00 + 00:25:40 = 03:33:40 PM

8) Delay in time from Regular time i.e. how much late the bus
   is
   D2 = NT - Tpr1 ............................ (5)
   Ex. D2 = 03:33:40 - 03:20:00 = 00:13:40 min

VI. SCREENSHOTS

This section provides the screen shots of system.

Fig. 6. Source and Destination of Journey Selection

Fig. 7. Activity showing if Direct Bus is not available between required source and destination then use Route Map to find the routes for connecting buses

Fig. 8. Activity showing Different Routes of Buses

Fig. 9. Buses for Required Source and Destination
VII. CONCLUSION

This system determines the real arrival time of public transport vehicle from the user location. It provides the distance, current speed, estimated arrival time and delay from predefined time. This information helps the users to manage their time accordingly looking at the situations of the bus real timing. Further web based user interface is provided with link for the users who don’t have mobile device but users have to provide location.

REFERENCES


