Real Time Bus Arrival Prediction System Using GPS

Shriram Kulkarni , Revati Deshmukh , Basavraj Devpuje , Nilam Kapare , Kumar Murari

Department Of Information Technology

Sinhgad Academy of Engineering

PUNE , INDIA

Abstract— When it comes to taking the public transportation, time and patience are of the essence. In other words, many people using public transport buses have experienced time loss because of waiting at the bus stops. We propose a real-time vehicle tracking system using a Global Positioning System (GPS) technology module to receive the location of the vehicle, to forward into microcontroller and to connect internet by a general packet radio service (GPRS) technology for displaying a real time on the website map developed by Google Map which allows inspection of vehicles at all times. There are the GPS and GPRS modules, the GPS module will locate the vehicles via the satellite, and the GPRS module will assemble all data and send it to the website by the microcontroller. The buses will be tracked live with real time coordinates with this system. There will also be an Android application which will give the real-time schedule of buses. Also, it can give quick and real time replay for inquiry, via the server. Also in the case of bus failure or breakdown, the notification will be sent to the system, with Bus location.

Keywords— RTBA, GPS, GSM, Android, Wireless .

I. INTRODUCTION

The transportation system provide as the heart in the economic and social growth of the country. Due to the fast rate of population in India there is a fast explode in vehicle which results in a burden on metropolitan traffic management. As the public transport has become an important part of the urban transportation advance in easily available technology Can be enforced which not only help the person who recalculate between a suburban and city to get the traveling information and also help a person in order to belt down there swift with the final real time location. In many parts of the cosmos, public transport especially the bus sluice has been well developed. In order to reduce the fuel consumption, car usage and comfort traffic congestion we can use the bus transport services. The passengers want to know the precise advent time of the bus, when traveling with the buses. The passengers become anxious while extremely waiting for a perennial time at the bus stop and make them indecisive to take buses. Most passengers are usually ripe to office and many of the students are restarted to the class as they determine to wait for the bus Instead of taking an alternate transportation. [1] In this system, our aim is to minimize the cost and complexity of content these services by creating Easy Tracker, an automatic system for transit tracking, processing, and advent time prediction. [2]

Travel duration in public transportation systems is a direct measure of their efficiency and usefulness. Travel time information is also important in planning operations, signal timing coordination and route assignments. Design and implementation of ITS tools depend on accurate predictions of travel durations by extrapolation of existing travel time data.[3] The main motto of this system is a real-time vehicle tracking using a Global Positioning System (GPS) technology module to receive the location of the vehicle. There will also be an android application which will give real time schedule of buses. [4] The main objective of this system is to develop an android application to provide real time bus arrival information. This system use real-time vehicle tracking using a Global Positioning System (GPS) technology module to receive the location of the vehicle. There will also be an android application which will give real time schedule of buses.[8] Also it can give quick and real time replay for inquiry, via server. Also in case of bus failure or breakdown, the notification will be sent to system, with Bus location.[4] [5]

II. RELATED WORK

" Predicting the Bus Arrival Time Using GPS and GSM Technology"-This paper proposes a bus arrival time prediction using GPS and GSM technology. It would also work as antitheft system and cheapest source of vehicle tracking. It is an embedded system using GPS (Global Positioning System), GSM (Global System for Mobile Communication) and Microcontroller for tracking the bus. The real time co-ordinates obtained from the GPS will continuously monitor a moving vehicle and report the status of the vehicle on request to passengers. The GPS/GSM unit is mounted on the bus sends the data to the central monitoring system microcontroller using the GSM module and displays bus location name on the LCD. The position i.e Latitude and Longitude of a vehicle from remote place is sent by the GSM module to the Server and then the server calculates the arrival time of the bus and sends to the requested user through GSM module .[1]

"Easy Tracker: Automatic Transit Tracking, Mapping, and Arrival Time Prediction Using Smartphones"-In order to facilitate the introduction of transit tracking and arrival time prediction in smaller transit agencies, we investigate an automatic, smartphone-based system which we call EasyTracker. To use EasyTracker, a transit agency must obtain smartphones, install an app, and place a phone in each transit vehicle. Our goal is to require no other input. [2]

"How Long to Wait? Predicting Bus Arrival Time With Mobile Phone Based Participatory Sensing"-In this paper, present a bus arrival time prediction system based 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. The proposed system solely relies on the collaborative effort of the participating users and is independent from the bus operating companies, so it can be easily adopted to support universal bus service systems without requesting support from particular bus operating companies. Instead of referring to GPS-enabled location information, we resort to more generally available and energy efficient sensing resources, including cell tower signals, movement statuses, audio recordings, etc., which bring less burden to the participatory party and encourage their participation. [3]

"Predicting Bus Arrival Time with Mobile Phone Based Participatory Sensing"-The system define on the base of users involving relies and collaborate efforts of passengers and it is not dependent from the operating companies of bus, so without support requesting from particular bus operating companies for supporting the universal bus service systems it can be adopted easily. [4]

"Predicting Bus Arrival Time on the Basis of Global Positioning System"-The results indicate that the proposed system is capable of achieving satisfactory accuracy in predicting bus arrival times and perfect performance in predicting travel direction.[5]

"An Algorithm for predicting the arrival time of mass transit vehicles using Automatic Vehicle location Data"-This Paper presents an algorithm for predicting the arrival time of transit vehicles using a combination of both AVL and historical data. And used the Kalmann Filter Framework.[6]

"GPS-GSM integration for enhancing public transportation management services"-This paper proposes and implement a soluation for enhancing public transportation management service based on GPS and GSM in Punjab. The System consists of 4 modules: Bus station module, IN-BUS module, BASE station module, BUS Stop module. Equipped with PC and GSM modem, BUS Station module sends initial information containing the Bus Number and license plate number to In-BUS module and BASE station module using SMS. The microcontroller based In-BUS module consisting mainly of a GPS receiver and GSM modem then starts transmitting its location and number of passengers to BASE station module. BASE module equipped with microcontroller unit and GSM modems integrated with PC to keep record of each Bus. Bus stop module is installed at every bus stop consists of GSM modem, memory unit and display.[7]

"Development of bus location system with smartphone and effect of providing regional information added on bus information"-In this paper, we have presented a smart bus tracking system. It is based on GPS, GSM, QR coding and Google's map technologies. Passengers with smart phones or mobile devices with the QR code readers scan QR codes placed at Bus Stop. After scanning QR codes, they are decoded via ZXing Library. The Passenger have to present at the Bus Stop to scan the QR code and then the user will get the information about the current location of bus. [8]

III. SYSTEM MODEL

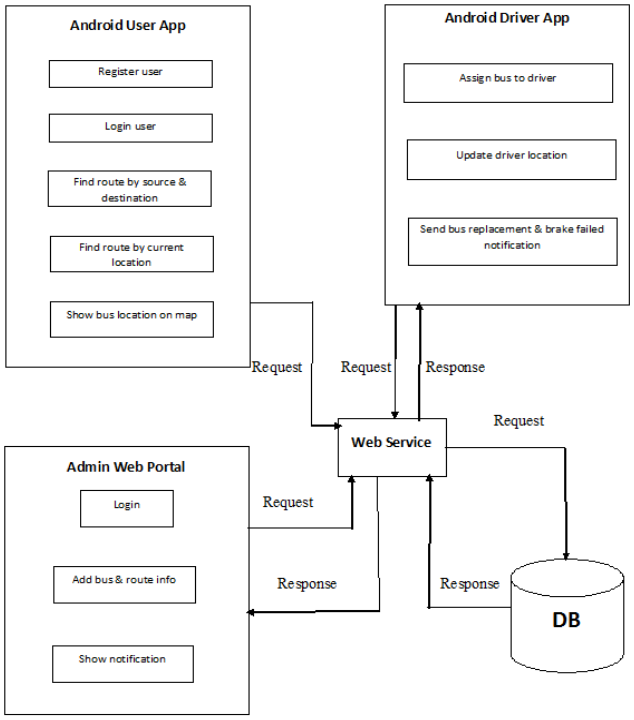

Fig.1. System Model

A. Description

- **JAVA:**

Java has been tested, refined, extended, and proven by a dedicated community of Java developers, architects and enthusiasts. Java is designed to enable development of portable, high-performance applications for the widest range of computing platforms possible. By making applications available across heterogeneous environments, businesses can provide more services and boost end-user productivity, communication, and collaboration— and dramatically reduce the cost of ownership of both enterprise and consumer applications.

The original and reference implementation Java compilers, virtual machines, and class libraries were originally released by Sun under proprietary licenses. As of May 2007, in compliance with the specifications of the Java Community Process, Sun re-licensed most of its Java technologies under the GNU General Public License. Others have also developed alternative implementations of these Sun technologies, such as the GNU Compiler for Java (byte code compiler), GNU Class path (standard libraries), and Iced Tea-Web (browser plug in for applets).

- **Dot Net:**

NET Framework is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large class known as Framework Class Library(FCL) and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment (as contrasted to hardware environment) known as Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling.

- **MySQL:**

MySQL is the most popular Open Source Relational SQL Database Management System. MySQL is one of the best RDBMS being used for developing various web-based software applications. MySQL is developed, marketed and supported by MySQL AB, which is a Swedish company. MySQL is the most popular Open Source Relational SQL Database Management System.

MYSQL Enterprise edition includes the most comprehensive set of advanced features & management tools for MYSQL. MYSQL is the world's most popular open source database. Whether you are a fast-growing web property, technology ISV or large enterprise, MYSQL can cost-effectively help you deliver high performance, scalable database applications. MYSQL is popular choice of database for used in web application & is a central component of widely used LAMP open source web application software stack. MYSQL Query Analyzer: To optimize performance by visualizing query activity and fixing problem SQL code.

- **SQLite:**

SQLite is a relational database management system contained in a small (~350 KiB) C programming library. In contrast to other database management systems, SQLite is not a separate process that is accessed from the client application, but an integral part of it. SQLite is ACID-compliant and implements most of the SQL standard, using a dynamically and weakly typed SQL syntax that does not guarantee the domain integrity. SQLite is a popular choice as embedded database for local/client storage in application software such as web browsers. It is arguably the most widely deployed database engine, as it is used today by several widespread browsers, operating systems, and embedded systems, among others. OS like Android, Web browsers like Mozilla etc. SQLite has many bindings to programming languages.

- **GPS:**

Global Positioning System was developed by the United States' Department of Defense. It uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The GPS satellites are maintained by the United States Air Force. GPS is often used by civilians as a navigation system. On the ground, any GPS receiver contains a computer that "triangulates" its own position by getting bearings from at least three satellites. The result is provided in the form of a geographic position- longitude and latitude- to, for most receivers, within an accuracy of 10 to 100 meters. Software applications can then use those coordinates to provide driving or walking instructions. Getting a lock on by the GPS receivers on the ground usually takes some time especially where the receiver is in a moving vehicle or in dense urban areas. The initial time needed for a GPS lock is usually dependent on how the GPS receiver starts. There are three types of start- hot, warm and cold. [7]

B. Model Perspective

The main perspective of this system is to develop an android application to provide real time bus arrival information. This system use real-time vehicle tracking using a Global Positioning System (GPS) technology module to receive the location of the vehicle. There will also be an android application which will give real time schedule of buses.[3] Also it can give quick and real time replay for enquiry, via server. Also in case of bus failure or breakdown, the notification will be sent to system, with Bus location.

C. Product Function

In this system two android application are developed such as user application and driver application.[8]

◆ **User App :**

- Log in- User log in on system.
- Register -User register on app.
- Find Route-Find Route by providing Source and destination.
- Find Route-Find Route by providing current location.
- MAP- Show Bus Location on Map.

◆ **Driver App :**

- Driver Select bus assigned.
- Driver location is continuously updated on server using GPS to get Current Location.
- Driver able to send notification to Admin for Bus replacement and break failed.

◆ **Admin Panel :**

- Admin is able to add bus, route info.

D. Experimental Setup

Android device with GPS enabled will be placed in a car or bike with internet provision, the driver application will be installed on the device.
To restrict any other application and features on device, the device will be rooted and only driver application would be installed on device.
Web API will be hosted on a dedicated server with static ip mapped to a domain name.

a. Configuration required for server is as follows

- 4GB of RAM
- 2.4GHz 4 core Intel Xeon processor
- 250GB of Disk space
- At least one static IP

b. Software installation required on server

- Dot Net framework 4.5 or above
- Internet information services(IIS) 7 or above
- MS SQL Server 2008 or above
- Management Studio

c. Hardware Recquirements :

Android Phone

LCD/LED Panel

E. Steps to calculate real-time arrival of bus

1. Query Google for Distance between each bus stop that fall on the current route
2. Get the real time traffic information when the bus starts travelling
3. Calculate the travelled distance by the bus.
4. Calculate the remaining distance and divide the travel time in the same ratio and calculate the remaining arrival time to next stop
5. Once the arrival time for next bus stop is calculated, calculate the arrival time to other bus stops
6. Calculate arrival time to destination by adding all bus stops arrival time.

F. Advantages

- Easy Identification of nearest bus stop.
- Actual and real-time arrival of bus.
- Exact arrival of destination.
- Location and time based ads.
- Location based places of interests.
- Automatic reporting of breakdown vehicles.

G. Disadvantages

Internet is recquire all the time.

IV. Mathematical Model

S={s, e, X, Y, T, f_{main}, NDD, DD, Success, Failure}

• **S (System)** = Is our proposed system which includes following tuple.
• **s (initial state at time T)** = GUI of search engine. The GUI provides space to enter a query/input for user.
• **X (input to system):-** Input Query. The user has to first enter the query. The query may be ambiguous or not. The query also represents what user wants to search.
• **Y (output of system):-** List of URLs with Snippets. User has to enter a query into search engine then search engine generates a result which contains relevant and irrelevant URL's and their snippets.
• **T (No. of steps to be performed)s:-**These are the total number of steps required to process a query and generates results.
• **f_{main} (main algorithm):-** It contains Process P. Process P contains Input ,Output and subordinates functions. It shows how the query will be processed into different modules and how the results are generated.
• **DD (deterministic data):-** It contains Database data. Here we have considered MySQL, SQLite which contains number of queries. Such queries are user for showing results. Hence, SQLite is our DD.
• **NDD (non-deterministic data) :-** No. of input queries. In our system, user can enter numbers of queries so that we cannot judge how many queries user enters into single session. Hence, Number of Input queries are our NDD.
• **Memory shared :-** SQLite. SQLite will store information like User Authentication, Performing Operations like Find Route by providing Source and destination, Find Route by Providing current location, show Bus Location on Map. Since it is the only memory shared in our system, we have included it in the MYSQL.

• **CPU_{count} :-** 1. In our system, we require 1 CPU for server.
• **Success** = successfully recommended best system as per user's interest
• **Failure** = If application will not send the notification to user it will fail.

A. Subordinate functions:

S={s, e, X, Y, f_{main}, NDD, DD, Success, Failure}
Where
s= Start State
e= End State
X={Set Of Inputs}
= {x1,x2,x3,x4}
Where ,
x1= Log in Details, Register details
x2= Source and destination
x3= Current location Latitude and longitude
x4= Bus info

Y={Set of Outputs}
= {y1,y2,y3,y4,y5}

Where ,
y1= Find list of bus on Route with arrival time
y2= Update Bus Location
y3= Add Bus with info
y4= Send notification to Admin panel about bus replacement and bus breakdown
y5= Show current location of Bus on Map

f_{main} = {Set of procedure}
= {f1,f2,f3,f4,f5,f6,f7,f8,f9}

Where ,
f1= Take x1,x2 Input
f2= Give y1,y2,y3 Output
f3= Take x3 input
f4= Give y4 output
f5= Take x4 input
f6= Give y5 output

B. State Transition Diagram

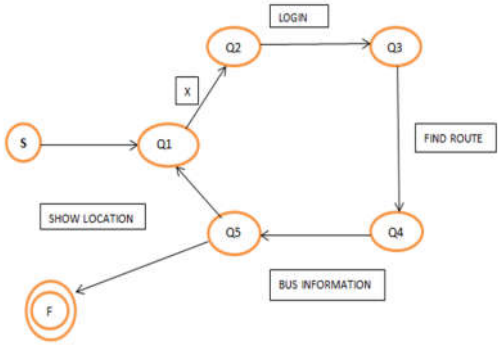

Fig.2. State Transition Diagram

Where,
s=input state
x=query
q1= Log in Details, Register details & Source and destination
q2= Find list of bus on Route with arrival time, Update Bus Location, Add Bus with info
q3= Current location Latitude and longitude & Bus info
q4= Send notification to Admin panel about bus replacement and bus breakdown and then Show current location of Bus on Map.

a. Explanation

- The q1 state accept the ambiguous query 'x' from the state 's' which is our initial state .
- The q2 state is meant for capturing Source and destination of User, which stores the query x which is accept in state q1. The query stores in state q2 based on map of Current location Latitude and longitude and send to state q3.

- The q3 state will Send notification to Admin panel and display final result

CONCLUSION

In this project,the Real Time Bus Arrival System is developed. Primarily relying on inexpensive and widely available cellular signals, the proposed system provides cost efficient solutions to the problem. This system proposes the bus tracking and predicts the bus arrival time with a proposed system in it. This system is turn on and uses i.e. self-calibrating and works anywhere on earth and does not require a laboratory or artificial environment. Having a GPS is truly an advantage you can determine your location.

REFERENCES

[1] Sudhakar K N, Rashmi K,"Predicting the bus arrival time using GPS and GSM Technology". IJSR, May 2015

[2] James Biagioni, Tomas Gerlich, "Easy Tracker: Automatic Transit Tracking, Mapping, and Arrival Time Prediction Using Smartphones".

[3] Pengfei Zhou, Yuanqing Zheng and Mo Li, "How Long to Wait? Predicting Bus Arrival Time With Mobile Phone Based Participatory Sensing" ,IEEE, June 2014.

[4] Suvarna C. Pawar, Aishwarya R. Alavekar, Vibhavari S.Patil, Shivani M.Sasane, Ritesh V. Rananavare, Kekade Mandar.
"Predicting Bus Arrival Time with Mobile Phone Based Participatory Sensing"

[5] Data Dihua Sun, Hong Luo, Liping Fu, Weining Liu, Xiaoyong Liao, and Min Zhao. "Predicting Bus Arrival Time on the Basis of Global Positioning System"

[6] Z. Wall, D. J. Dailey,"An Algorithm for Predicting the Arrival Time of Mass Transit Vehicles Using Automatic Vehicle Location Data".

[7] Farooq, U., Haq, T., Amar, M., Asad, M.S., Iqbal, A., 2010. "Gps-gsm integration for enhancing public transportation management services."

[8] Sakata, A., Matsumoto, Y., Suzuki, H., 2013."Development of bus location system with smartphone and effect of providing regional information added on bus information.