Predicting Bus Arrival Time with GPS on Android Application

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Abstract: *In order to facilitate the introduction of transmit tracking and arrival time prediction in smaller tranasit agencies, we search an Andriod-based system which we call Tracker. To use tracker, a transit agency should obtain smartphones, install an application, and place a phone or GPS in each transit vehicle. Our goal is to require no other input. This level of automation is possible due to a set of algorithms that use GPS traces collected from instrumented transit vehicles to decide routes served, find stops, and deduce schedules. The primary information to most city transport buses is arrival time. It often dishearten the passengers for excessively waiting long time at bus stops and makes them averse to take the public transport, travellers. To enable the passenger to track the vehicle or bus an electronic device is established in a vehicle is known as Vehicle tracking System. This paper suggest a bus arrival time prediction using GPS,GSM technology. It would work as theft protection system and inexpensive source of vehicle tracking. It is an system using GPS (Global Positioning System), GSM (Global System for Mobile Communication) and Microcontroller for tracking the travellers. The real time co-ordinates obtained from the GPS device will continually monitor a moving vehicle and report the position of the vehicle on request to passengers. The GPS/GSM unit is fix on the bus sends the data to the central monitoring system using the GSM module and show bus location name on the LCD. The status i.e Latitude and Longitude of a vehicle from distant place is sent by the GSM module to the Server and then the server calculates the ingress time of the bus and sends to the requested user through GSM module. A real-time vehicle tracking system uses a global positioning system (GPS) technology module to receive the location of the vehicle, to forward into microcontroller and to connect network by a general packet radio service (GPRS) technology for displaying a real time on the website or android map developed by Google Map which allows inspection of vehicles at all times. There are the GPS and GPRS modules, the GPS module will excavate the vehicles via the satellite, and will bring together all data and redirect it to the webapplication on student's device by a contoller. Here the system is handle by a bus in charge. It can notify students for several bus routes, timetables, bus location, etc. It also send notification to the students when data is updated. System also prevent to enter an unauthorized students in bus.*

Keywords: GPS, GSM, SBAS, WAAS

1. 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 travelling information and also help a person in order to belt down there swift with the final real time location [6].In many parts of the cosmos, public transport especially the bus sluice has been well developed. In order to reduce the fuel consumption, clubby 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 travelling 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 retarted to the class as they determine to wait for the bus instead of taking an alternate transportation.

The travellers can madean literal choice of whether or not to wait at a bus stop if they had an easy approach to see which bus is nearby to their location and an precise time it would take to attain the bus stop. A contrive of an embedded system which is used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM) is suggest in this paper. A combination of computer hardware and software, and perhaps additional mechanical part designed to perform a specific function is known as an Embedded System. An embedded system is software driven, real-time control system, microcontroller-based, reliable, human or network interactive, autonomous, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

In this paper, 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.[5]

Under the rubric of Advanced Public Transportation Systems (APTS), a number of projects have been implemented to improve distribution of pertinent information (departure time, vehicle delay, vehicle position) about a mass transit system directly to therider. This paper presents an algorithm developed in an APTS project whose primary objective was twofold: 1) development of real-time departure information displays for transit vehicles and 2) use of such displays to provide riders waiting at transit centers with useful information. This paper discusses the development of an algorithm to accurately predict arrival times of vehicles given both real-time data on a vehicles position and information about its path.[5]

2. Literature Survey

The bus companies generally provide bus timetables on the web. Such bus timetables only provide limited information (e.g., operating hours, time intervals,) which are not timely

updated according to instant traffic conditions. Although many commercial information providers offer the real time bus arrival prediction information, the service usually comes with prestigious cost. With a fleet of thousands of buses, the installment of in- vehicle GPS systems requires tens millions of dollars. The network infrastructure to deliver the these service raises the deployment cost even higher, which would eventually translate to increase expenditure of passengers.Participatory Sensing, user activity recognition and passenger Sensing provides a rich contextual information for applications of mobile such as location based

services and social networking services. Mobile devices consumes large amount of energy by continuously capturing this contex information. A new design framework for Gps Based bus arrival time predicting system is proposed in previous paper.

We present a new bus arrival time prediction system based on Gps based sensing. We interviewed bus passengers on acquiring the bus arrival time. Many passengers indicate that they want to instantly track the arrival time of the
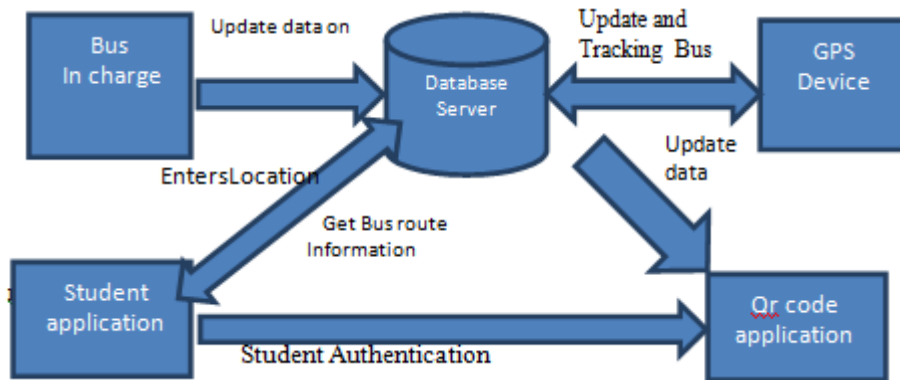

Figure 1: System Architecture

Buses and they are willing to contribute their location information on buses to help to establish a system to estimate the arrival time at various bus stops for the community. This motivates us to design a Gps based service to bridge those who want to know bus arrival time (querying users) by tracking the bus and able to share the instant bus route information .[1]

This type of vehicle tracking, which simply rking theports the locations of all active vehicles, is widely available today. While this is a useful service, its utility for transit applica-tions is somewhat diminished by a lack of sufficient navigation metadata: what route is each bus driving, and at what time will it arrive at my stop? State of the art systems provide this metadata by means of an in vehicle device which accepts driver input, such as the current route, as well as by estimating arrival times based on current vehicle location, past travel times, and the official route schedule.[4]

Manually collecting this information can be a time-consuming and complex task for many transit agencies. The authors have personal experience from working with four different transit agencies, which serve between 1,000 and 500,000 trips per day. Anecdotally, one such agency, despite an annual budget of $250M, lacks the resources to produce route shape files for their existing bus routes. As a conse-quence, their routes do not appear in Google Maps [8] and other trip planning services.

3. System Architecture and Overview

This system consists of four main components
1) **Smartphone** - installed in each bus or vehicle, which functions as a tracking device or an automatic vehicle location system.
2) **Back-end server**- which stores vehicle trajectories into schedules, route maps and prediction parameters,

3) **Online processing** - which uses the real-time location of a vehicle to predict arrival time.
4) **User interface** - allows a user to access current vehicle locations and predicted arrival times.

4. Modules

1. Module on Server Side
In server side module, used to stored data which is updated by the GPS installed inside bus. If any user can request to particular bus location or arrival time of the bus, then server can sent information to that particular user which are stored in his database. Figure 1. showing the system architecture

2. Module Inside the Bus
In inside bus module, GPS devices has installed in bus that device have minimum 12v battery backup. GPS device continuously collect the information and that information sent to server.

3. Module for Users (Android)
In user side module, each client have android application through that application client can send request to server for getting information about bus location and arrival time of bus where the user waiting at our bus stop.

5. Related Technology

1. GPS Technology
A highly integrated smart GPS module with a ceramic GPS patch antenna is G7020 GPS as shown in below fig 1. with 14 channel track engine and 51 channel acquisition engine the module is capable of of receiving signals from up to 65 GPS satellites and transferring them into the precise position and timing information that can be read over either UART port or RS232 serial port. Operable at 3.6V-6V, Cold start ≈ 29 seconds under clear Sky, Hot start ≈ 1 second under clear

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Sky. Capable of Satellite-Based Augmentation System (SBAS) (Wide Area Augmentation System (WAAS)/EGNOS (European Geostationary Navigation Overlay Service)) and Low power control of Integral LNA (Low Noise Amplifier)[3].

Figure 2: GPS Receiver

2. GSM Technology

SIM300 is a Tri-band GSM/GPRS engine that works on frequencies , DCS 1800 MHz, Personal Communication System (PCS) 1900 MHz and Enhanced GSM (EGSM) 900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. To get information in SIM card you can use AT Command. Both 3.0V and 1.8V SIM Cards are supported. An internal regulator in the module having nominal voltage 2.8V is used to power the SIM interface. All the pins will be reset to as outputs driving will be low.[3]

6. Algorithms

1. AVL (Automatic Vehicle Location)

Automatic vehicle location (AVL) is a computer based vehicle tracking system. The actual real time position of each vehicle is determined and relayed to a control center. AVL systems include computer -aided dispatch software, mobile data terminals, emergency alarms, and digital communications.

What is AVL technology?

AVL systems use satellite and land communications to display each vehicle's location, status, heading , speed on the computer's screen.

Tracking Systems

There are two types of tracking systems

1) Passive Tracking

It refers to stand-alone GPS Receivers, which stores data for further process Passive Tracking systems are limited to vehicle tracking only. It stores the location, time, velocity and heading data.

2) Real Time Tracking

It is based on mobile stand-alone terminals which combine GPS and GSM to transmit their position. The goal of the algorithm presented here is to accurately predict transit vehicle arrival times up to an hour in advance. Beyond the primary goals, there is an additional set of constraints on the algorithm that are imposed to facilitate implementation of the algorithm in real-world systems. These additional constraints are: 1) the uncertainty in the arrival-time must be quantified, 2) the output of the algorithm must be synchronous, and 3) lost or delayed data must be handled efficiently. Our prediction method is comprised of two sequential components, as shown in Figure 3. The first step is to estimate the current position of the bus. The second step is to use the position estimate to predict the arrival time. The position-estimation component is a tracking problem, and the travel-time prediction component is a statistical estimation problem.[7]
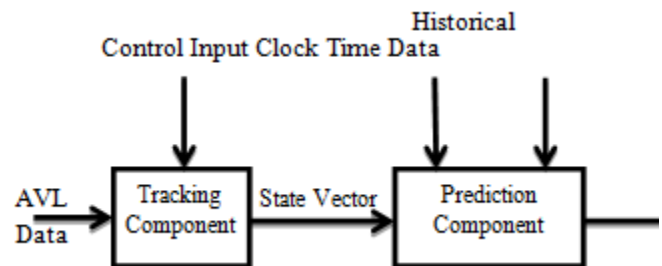

Figure 3: Diagram of prediction algoithm

2. Trilateration (Triangulation)

GPS Triangulation Algorithm also known as Trilateration. Trilateration is the process of determining absolute or relative locations of points by measurement of distances, using the geometry of circles, spheres or triangles. In addition to its interest as a geometric problem, trilateration does have practical applications in surveying and navigation, including Global Positioning Systems (GPS). In contrast to triangulation, it does not involve the measurement of angles. This process is used in getting the GPS co-ordinates.

7. Design and Implementation

We implement a prototype system on the Android platform with different types of mobile phones, and collect the real data over a 7-week period. We first present the experiment environment and methodology.[1] We test the performance of each system component individually to evaluate the design feasibility. We test the bus detection technique and route classification method . When we evaluate the whole system performance, i.e., the accuracy of arrival time predication , all the components are working together[2].

A design of an embedded system which is used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM) is proposed in this paper. For interfacing with various hardware peripherals is used. To continuously monitor a moving Vehicle and report the status of the Vehicle on demand an embedded unit is designed in the bus. For doing so hardware peripheral is interfaced serially to a GPS Receiver and GSM Modem.[3]

8. Conclusion

We present a GPS based bus arrival time prediction system. Primarily relying on inexpensive and widely available cellular signals, the proposed system provides cost-efficient solutions to the problem.This paper 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, whether you are travelling locally or in a foreign land and if

you think you are lost, you can use your GPS receiver to know your exact location.

9. Future Scope and Enhancement

Bus location and arrival time app in android can be used for research purposes by organizations or institutions to learn about what a person looks at most in a day. This can be used to provide information specific to those area to the particular customer on his/her next visit to the software.SMS can also be sent to the user in case of App upgradation or any news regarding bus services.

10. Acknowledgement

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