GPS AND GSM BASED REAL TIME BUS MONITORING SYSTEM

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Abstract - The GPS and GSM based Real Time Bus Monitoring system deals with real time problem which many people face in their day to day life. Many times it so happens that people miss their desired bus even after spending a lot time at the bus stop. Sometimes people miss their first choice bus and end up wasting a lot of time at the bus stop. The bus stop for the next bus is few streets ahead and in reaching that destination, person misses this bus also. The proposed approach will overcome this problem. This approach will provide real time information on a mobile device. This will save time and lots of efforts of person to decide on the mode of transport.

Keywords:
GPS, Google maps, GSM

I. INTRODUCTION

The most important asset of man today is 'time'. It happens many a times that people wait in queues for a long time and ultimately miss out on their desired bus and the next choice bus arrives at a few streets away from their current location. If passengers had an easy way to see which bus is near to their location and approximate time it would take to reach the stop, in real-time, they could make a more accurate, informed decision of whether or not to wait at the stop. The GPS and GSM based Real Time Bus Monitoring system will provide pedestrians Convenience. Not only would the GPS and GSM based Real Time Bus Monitoring system be a new product for Best Transportation, it would also be an improvement to the transportation service already addressing the dissatisfaction with current wait times of the buses. If we have a mobile device that can provide bus arrival information with bus tracking based on the user's current location, and suggest alternative bus route to the same destination, it will definitely help the user to manage their time properly. Users can decide if they have to keep waiting at their bus stop or go across a few streets to wait for another bus instead. In case there is only one bus going from user's current location to their desired destination, then this application will show the approximate time the bus will take to reach the user's place. In this way the user does not have to unnecessarily stand at the bus stop. In addition, user can determine whether they have to run or walk to the bus stops when they are near to the potential bus stops.

Recent advances in automatic vehicle location (AVL) systems based on the global positioning system (GPS) have provided the transit industry and public transport enterprises with tools to monitor and control the operation of their vehicles and manage their fleets in an efficient and cost effective way [1].

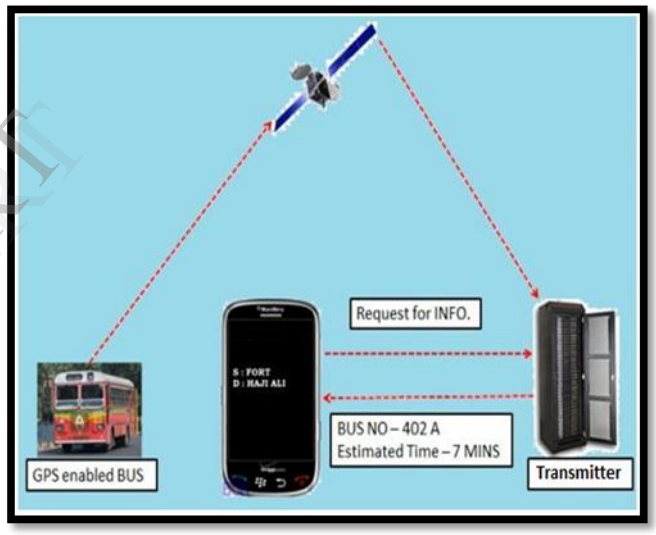

Figure 1: Structure of Real Time Information System

Instead of using expensive GPS device exclusively used for tracking purposes, this system aims at providing a GPS tracking solution providing all the existing and even more features than current tracking systems using the mobile technology. Following are the steps to achieve the process shown in fig 1 – (1) Develop a user-friendly travel time prediction application to predict the bus arrival time on the basis of global positioning system (GPS) data (2) To design a system that intelligently changes the arrival time prediction as per the traffic conditions (3) To provide the user with real time information about the current bus location, to provide or suggest 'optimal path' for the user, to provide user with miscellaneous facilities such get-off notification. Our objective is to provide an outlet to this combination of algorithms and programs; we aim to provide a robust and efficient software implementation of this application which will allow a user to simply enter either the bus number or their desired source and destination.

Subsequently the user is provided with various options to check the approximate arrival time or find alternate/optimal routes or even track a bus on their phone.

II. LITERATURE SURVEY

Existing Solutions:

In countries like Japan and Mauritius, GPS Tracking systems have gained importance in the last decade. In the metro cities of India like Mumbai, Delhi, Bangalore, Chennai, Kolkata etc. successful implementation of such a system is yet to be done. There are currently five major systems that people and businesses can use for tracking purposes.

The first system is provided by Island Communications Limited (Pioneer in GPS Technology in Mauritius) and is called Exact [2]. It is a device which when equipped with a SIM card can be used for vehicle or any other asset tracking.

Another existing GPS tracking system is the Garmin Nuvi 215/205 series, a device sold by Naveo GPS solutions in Mauritius. This device's main functionality is for navigation purposes since it comes with a detailed map of Mauritius. However for GPS tracking, there is the passive mode option which records all positions of the device and the user will need to load the tracks from the device to a computer which has the appropriate software to view the map. There is only recorded tracking which is possible on this system.

The third system is called Geo tab [3]. It is a system which consists of a small device which needs to be connected to the battery of a vehicle and the device will transmit data to a web based application through which an individual will be able to see the device live and also the past tracks of the device. There is the option of Geo fence which allows an individual to be alerted by email and SMS if in case the device leaves a particular zone.

One track is the fourth system identified and it is the GPS tracking solution outsourced by a Mauritian representative of Oner Alarm, a China based company. This system is mainly for vehicle tracking and it comes up with a GPS tracking device and a web based system with a server (which needs to be bought for all functionalities). Oner track provides live tracking, SMS/Email alerts, SOS Panic button, speeding alerts and the user can also request for its position via SMS. The last system identified, and perhaps the most popular in the past few months in Mumbai is BEST's Bus Tracking System [4].

In this system passengers are able to access the position, speed and expected arrival time of A/C buses by sending a code number, specific to each bus top, via SMS to 56060. This SMS reaches an intermediate server; the server stores the current information of all A/C buses currently on route and responds to the sender with details. It also uses a GSM module. But according to various articles in the leading English newspaper Hindustan Times, "BEST's new bus tracking system fails to impress city commuters. The launch of this new service is eyewash." The commuters complained that the code number is not displayed on most of the bus stop poles and shelters.

The Brihan Mumbai Electricity Supply and Transport (BEST) undertaking has a total of 6,000 bus shelters and bus stop poles spread across the city. Other passengers also found flaws in the online facility (www.bestpis.in) through which the details can be viewed, saying they could not register on the site. Also the people who sent the bus code as an SMS received a reply "no such bus stop exists". Sometimes because of heavy traffic, the server failed to even reply.

III. PROPOSED SYSTEM

Our aim is to create an application on a mobile device which provides information with bus arrival time prediction. The calculation of the prediction is done on the server side and then the processed data are retrieved and presented on the users' mobile device with the help of built-in Google Maps View display. This application includes the following general features:

- a GPS based system that can determine the distance of the users and the bus stops
- a timing device can tell when the bus should arrive to that bus stop
- a map interface can that shows the potential bus stops
- a bus route adviser can give choices to users
- a bus travelling timer
- a get off notification
- a real time map marker
- Occupancy inside the bus
- Driver name
- Bus number

The detailed descriptions about some feature are as follows:

A. Determination of the distance between users and bus stops

With the integrated GPS receiver, user's current location can be identified appropriately. User will send the message that will contain bus number, source name and destination name. According to the longitude and latitude we will determine the current position of the bus and based on that we will calculate how much time it will take to reach a particular spot.

B. Prediction of the bus arrival time

Details about the users' current status, such as location, time, are gathered and sent to the server for analysis. Arrival Prediction algorithms are applied and arrival times are then derived from the bus route schedules and the simulation set of data.

C. Google Maps Interface

A Google Maps based view will be displayed on the interface. It is the core of this application and basic map control functions are provided, such as zooming, panning and mode changing. Moreover, bus stops details are provided to users on the map.

D. Bus Travelling Timer

It is a timing function that can record the time taken for a particular trip of the user, which the data, such as actual bus arrival time, time taken between stops, can be viewed as a reference for future trips.

E. Design Details

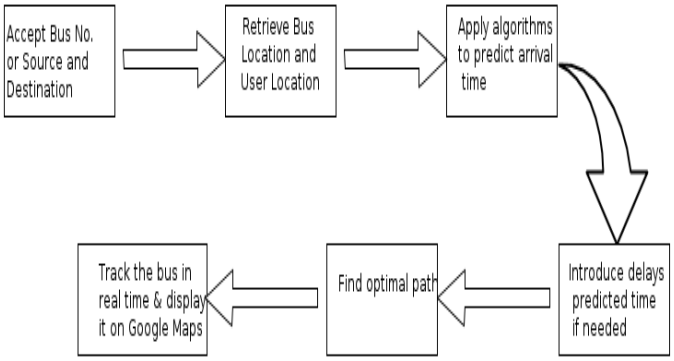

Figure 2: Overall flow of the system

A simple approach is shown in fig 2 which accepts bus number or source & destination. Retrieve bus location and user location. Apply algorithms to predict arrival time. Introduce delays in predicted time when needed. Find optimal path Track the bus in real time and track it on the map.The system is designed to run on the any Android operating system based smart phone or tablet which has a built-in GPS receiver and Google Maps View display. Hardware implementation will include incorporating a GPS device inside a bus; retrieving the latitude and longitude information from the GPS device; transmitting this information through a transmitter-trans-receiver combination; GPS receiver on the user's mobile phone receives the coordinates and proceeds to the software implementation. Software implementation will include designing the GUI for the application; using the latitude and longitude information of the current bus location and current user location and calculating the distance between them; displaying the arrival time of the bus; displaying the optimal or alternative paths; displaying real time tracking of the bus on Google Maps. Also, this technique will predict arrival time on the basis of the traffic conditions as accurate as possible.

With the help of predefined prediction algorithms, the system is made more efficient, as these functions are tried and tested on a much larger scale to improve their efficiency in intelligent prediction systems. Also, the algorithms are effective in terms of battery usage. The algorithms use minimum computing power of the mobile device.

The calculation of the prediction is done on the server side and then the processed data are retrieved and presented on the users' mobile device with the help of built-in Google Maps View display.

F. Algorithm to predict arrival time

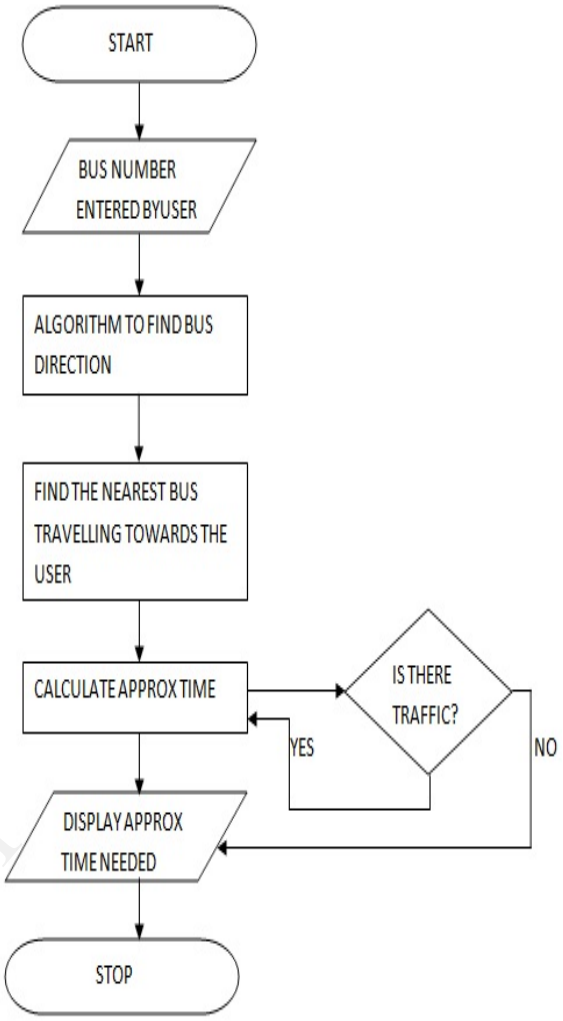

Figure 3: Algorithm for time and distance calculation

A simple approach is followed while calculating time and distance as shown in fig 3:

- Bus number entered by user
- Find nearest buses
- Find nearest bus travelling towards the user
- Calculate the approx time
- Check if there is traffic; if yes, then go back to step 5 and calculate the approx time required else go tostep7
- Display approx time on GUI

G. Overview of hardware components

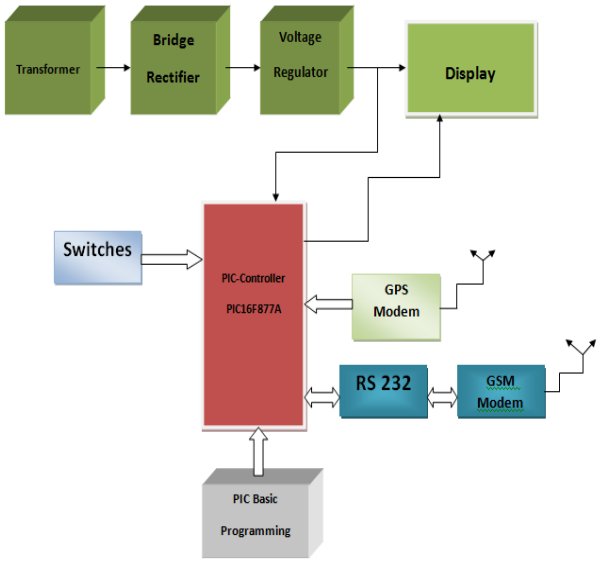

Figure 4: Hardware Block Diagram

As shown in fig 4, following are the hardware components:

Step down Transformer
This transformer will take 230V A.C. power supply and produce 12V A.C. power supply.

Full wave bridge Rectifier
It will take 12V A.C. input and provide 12V D.C. output. Its main task is to convert A.C. to D.C.

Voltage Regulator
The above circuit uses voltage regulator which converts 12V D.C. into 5V D.C. which is the requirement of our microcontroller.

A voltage regulator is a circuit that supplies a constant voltage regardless of changes in load current The regulator used for our system is IC7805, which is a three terminal voltage regulator .A heat sink is used, so that the heat produced by the regulator dissipating power has a larger area from which to radiate the heat into the air by holding the case temperature to a much lower value than would result without the heat sink. IC 7805 has an internal thermal overload protection and the internal short circuit current limiting device.

GSM modem
This GSM modem is a highly flexible plug and play GSM 900 operating frequency modem for direct and easy integration RS232, voltage range for the power supply and audio interface make this device perfect solution for system integrators and single user. Voice, Data/Fax, SMS, GPRS, integrated TCP/IP stack, RTC and other features like the GSM / GPRS. It has Built-in TCP/IP Protocol Built-in RTC in the module. AT Command based system it has the signalling speed of 85.6 kbps

Micro controller unit: PIC 16F877A

PIC16F877 is one of the most commonly used microcontrollers especially in automotive, industrial, appliances and consumer applications.

- Only 35 single-word instructions to learn
- All single-cycle instructions except for program branches, which are two-cycle
- Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory.
- Pin out compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers.

RS-232 Level Converters
Almost all digital devices which we use require either TTL or CMOS logic levels. Therefore the first step to connecting a device to the RS-232 port is to transform the RS-232 levels back into 0 and 5 Volts this is done by RS-232 Level Converters. Two common RS-232 Level Converters are the 1488 RS-232 Driver and the 1489 RS-232 Receiver. Each package contains 4 inverters of the one type, either Drivers or Receivers. The driver requires two supply rails, +7.5 to +15v and -7.5 to -15v.The advantages of these I.C's are they are cheap.

IV. CONCLUSION

In this paper, the details of GPS and GSM based Real Time Bus Monitoring system are stated. The GPS and GSM based Real Time Bus Monitoring system tracks the current location of all the buses and estimates their arrival time at different stops. Estimates are updated every time the bus sends an update. It gives the information to the passenger through the message. GPS and GSM based Real Time Bus Monitoring system will be of great help not only to the passengers but also to the vehicle drivers and administrators of the transport system. With the advent of GPS and the ubiquitous cellular network, real time vehicle tracking for better transport management has become possible.

Thus, the passenger will not only save a lot of time by receiving exact information about current position of the bus but will also receive information about the time it will take to reach a particular destination and occupancy of the bus.

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