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An Innovative Approach for City Bus Location with Route Navigation System using Android

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ABSTRACT

It is very important to reduce the passenger waiting time at city bus stops, when bus time tables are unknown to passengers. In order to reduce the waiting time, passengers would have to obtain live time tables for any City bus stop. To achieve this complicated task, we propose a new City Bus location and route navigation system using smart phones by using ICT (Information and Communication Technology). The system is able to easily retrieve information about bus locations by GPS. In addition the system also provides shortest walking route to the nearby bus stop. The system relays data about the current location of a City Bus to the Smartphone user (passenger). As such, even without knowing the entire time table, the system enables the users to get on a City Bus easily by showing the current location information of a Bus in real time. By using this system, we can expect an improvement of user convenience especially for Bus lines that have long operational intervals.

Key words: GPS, City bus, locations, Smartphone, Information and Communication Technology (ICT)

INTRODUCTION

The main aim of the paper is to reduce the waiting time of the passengers by providing them the live time tables of any city bus stop making use of ICT (information and communication technology). It is very important to reduce passenger waiting time at city bus stops, when city bus time tables are unknown by passengers. in order to accomplish that, we propose a city bus location and route navigation system by using smartphones. The system is able to easily retrieve information about bus locations by GPS, also providing users with the shortest walking route to the nearest bus stops.

In order to reduce waiting time at City Bus stops, passengers would have to obtain live time tables for any City bus stop. To achieve this complicated task, we propose a new City Bus location and route navigation system by using ICT (Information and Communication Technology). The system relays data about the current location of a City Bus to the Smartphone user (passenger). As such, even without knowing the entire time table, the system enables the users to get on a City Bus easily by showing the current location information of a Bus in real time. By using this system, we can expect an improvement of user convenience especially for Bus lines that have long operational intervals. For simplicity purpose, instead of getting the location data from the Bus directly, we install a Smartphone in the Bus. The system can then easily collect the City Bus location data by executing the application from the Smartphone in the City Bus. The application uploads data to the information collection server (Server 1), which stores collected information in a database. Information delivery server (Server 2) delivers the information to the user, so passengers can receive current Bus information by accessing a web page generated based on the stored information. Two applications have developed for proposed system; first application is designed to collect location data of the Bus and second application is displays location information to users.

The history of navigation is as old as human history, although early navigation was limited to following landmarks and memorizing routes. Historical records show that the earliest vehicle navigation dates back to the invention of the south-pointing carriage in China around 2600 B.C Well-known navigation devices that were extensively used in early navigation are the magnetic compass and the odometer. The 17th- century discovery of chronometer by John Harrison provided accurate local time at sea, which helped in solving the long-known problem of estimating longitudes [4].

The use of navigation devices in automobiles began in the early 20th century. Many modern-day automobiles are equipped with devices that are capable of determining the current location and then dynamically displaying and updating the current position on digital road maps. Over the centuries, various kinds of technologies have been tried for navigation. The discovery of global positioning systems (GPS) has changed the face of modern navigation forever. The positional accuracy of civilian GPS receivers has been improved to 10 meters. Sub meter accuracy can also be obtained through differential GPS. Navigation inside confined spaces such as buses, buildings, can be achieved through indoor location-sensing devices [1]. The ability to accurately determine the position of moving objects gave rise to new services known as location-based services. LBS use accurate and real-time positioning systems and GIS to determine the location of a moving object. The information generated by these systems is sensitive to the current position of the user and can be used to advise users about current conditions such as weather and traffic [2].

Many Countries are developing at a speed surpassing light but one thing that is hindering their development is corruption. Bribery is one of them you are constantly being looted of your money. Now that we have great advancement in technology, we should use it against corruption. As we are moving towards smart phones, they can be used as effective weapons. A simple Voice recognition system along with an effortless sound recorder in our phones can be an effective tool that can be used against people who ask for favours for your needs and their duties. This application can be used widely to curb bribe taking that is happening all around you with no extra costs levied by the victim [3-4]. Bitcoin is an experimental, decentralized digital currency that enables instant payments to anyone, anywhere in the world. Bitcoin uses peer-to-peer technology to operate with no central authority. Wallet is the place where Bitcoins are stored. Once Bitcoin wallet is installed on a computer or mobile phone, it will generate initial Bitcoin address and then the user can create an address for each transaction [5]

Hybrid Cloud offers small business customers the flexibility of a cloud-based solution with the security of a locally housed server. The customer's data is stored on the New Hybrid Cloud Server, and the New Hybrid Cloud Server is located at the customer's site, but is managed remotely. A style of computing where massively scalable (and elastic) IT-related capabilities are provided 'as a service' to external customers using Internet technologies. Automation of New Hybrid Cloud is essential to identify the defects and to rectify them early before the product is released. The traditional manual way of validation is time consuming as well as consumes man power. Automation of Hybrid Cloud helps in saving resources and also helps in porting New Hybrid Cloud on multiple platforms with varying architecture and features [6].

TECHNOLOGIES USED

The Java Platform

A platform is the hardware or software environment in which a program runs. The Java platform differs from most other platforms in that its a software-only platform that runs on top of other, hardware-based platforms. Most other platforms are described as a combination of hardware and operating system.

The Java platform has two components:

- The Java Virtual Machine(JVM)
- The Java Application Programming Interface(Java API)

The Java API is a large collection of ready-made software components that provide many useful capabilities, such as graphical user interface (GUI) widgets. The Java API is grouped into libraries (packages) of related components.

Java Server Pages (JSP)

Java Server Pages (JSP) technology enables Web developers and designers to rapidly develop and easily maintain, information-rich, dynamic Web pages that leverage existing business systems. As part of the Java technology family, JSP technology enables rapid development of Web-based applications that are platform independent

Global Positioning System (GPS)

The Global Positioning System (GPS), controlled by the US Department of Defence, uses a constellation of 24 satellites orbiting the earth. GPS determines the devices position by calculating differences in the times signals from different satellites take to reach the receiver. GPS signals are encoded, so the mobile device must be equipped with a GPS receiver. GPS is potentially the most accurate method (between 4 and 40 meters if the GPS receiver has a clear view of the sky), but it has some drawbacks: The extra hardware can be costly, consumes battery while in use, and requires some warm-up after a cold start to get an initial fix on visible satellites

Working of GPS

The principle behind GPS is the measurement of distance (or 'range') between the satellites and the receiver. The satellites tell us exactly where they are in their orbits by broadcasting data the receiver uses to compute their positions. It works something like this: If we know our exact distance from a satellite in space, we know we are somewhere on the surface of an imaginary sphere with a radius equal to the distance to the satellite radius.

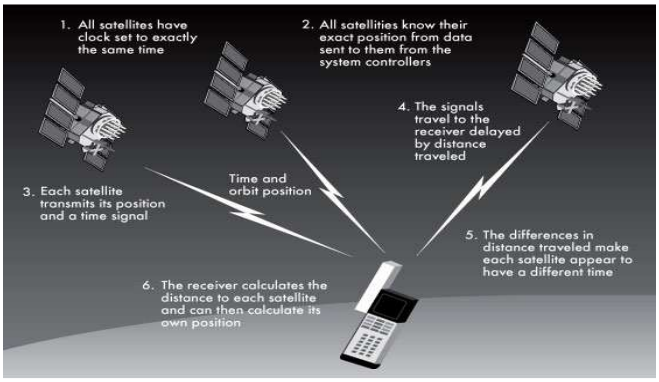

Fig. 1 Working of GPS

Fig. 2 Working of A-GPS

Working of A-GPS

An assisted GPS system [7] can address these problems by using data available from a network. A-GPS feature as stated by common mobile phone devices specification today is mostly the internet network-dependent one, the one that requires to connect to internet or ISP (or CNP, in the case of CP/mobile-phone device linked to Cellular Network Provider) data service to use the GPS-like feature. That is it is a mobile (Cell Phone/Smart Phone) device featured with A-GPS can work only when their internet link/connection to ISP/CNP - it is USELESS on areas with no coverage of internet link (or no BTS towers nearby, in the case on CNP service coverage area) to connect to those A-GPS servers (that usually provided by CNPs**).** The working of A-GPS is as shown in the figure

Google APIs (or Google AJAX APIs)

Google APIs are a set of JavaScript APIs developed by Google that allows interaction with Google Services and integration of rich, multimedia, search or feed-based Internet content into web applications. They extensively use AJAX scripting and can be easily loaded using Google Loader**.**

Google Maps

Google Maps has a wide array of APIs that lets us to embed the robust functionality and everyday usefulness of Google Maps into our own applications, and overlay our own data on top of them. Google introduced a Java application called Google Maps for Mobile, intended to run on any Java-based phone or mobile device. An internet connection is required to get maps and related information from Google Maps.

Android

Android is a comprehensive open source platform designed for mobile devices. It is Championed by Google and owned by Open Handset Alliance. The goal of the alliance is to 'accelerate innovation in mobile and offer consumers a richer, less expensive, and better mobile experience.' Android is the vehicle to do so. As such, Android is revolutionizing the mobile space. For the first time, it is a truly open Platform that separates the hardware from the software that runs on it. This allows for a much larger number of devices to run the same applications and creates a much richer ecosystem for developers and consumers.

Android is a comprehensive platform, which means it is a complete software stack for a mobile device. For developers, Android provides all the tools and frameworks for developing mobile applications quickly and easily. The Android SDK is all you need to start developing for Android; you dont even need a physical phone. For users, Android just works right out of the box. Additionally, users can customize their phone experience substantially. For manufacturers, it is the complete solution for running their devices. Other than some hardware-specific drivers, Android provides everything else to make their devices work. Android is an open source platform. The entire stack, from low-level Linux modules all the way to native libraries and from the application framework to complete applications, is totally open. Also, Android is licensed under business-friendly licenses (Apache/MIT) so that others can freely extend it and use it for variety of purposes. Even some third-party open source libraries that were brought into the Android stack were rewritten under new license terms. So, as a developer, you have access to the entire platform source code. This allows you to see how the guts of the Android operating system work. As manufacturer, you can easily port Android OS to your specific hardware. You can also add your own proprietary secret sauce, and you do not have to push it back to the development community if you dont want to. Theres no need to license Android. You can start using it and modifying it today, and there are no strings attached. More so, Android has many hooks at various levels of the platform, allowing anyone to extend it in unforeseen ways.

EXISTING SYSTEM

Many transportation organizations have proposed ITS (Intelligent Transport system) for the convenience of users to reduce waiting time of passengers.

Main Idea

The Global position system (GPS) mounted as part of the Vehicle Mounted Unit in the bus will receive the longitude and latitude coordinates from the Satellite. This information is then sent across to the Central Control station through the wireless communication link such as GSM / GPRS. The application at the Central control station on receiving the position inputs will update the display boards at the bus shelters and at the bus terminal platform display panel and the general display panel at the related bus terminals. They have used the following display boards for providing information to the users.

Display Boards at Bus Stops

KSRTC bus stops have 2 line/4 line LED display board which will display the Expected Time of Arrival (ETA) of the next bus on real time basis.

Display Boards at Bus Terminal

KSRTC has installed 10 line/16 line LCD display board which will display Expected Time of Departure (ETD) of various buses. These boards will be installed at City Bus Stand. Locations like Bangalore airport, Bangalore Railway Station, Bangalore Rural Bus Stand etc. will be having these display boards which will display ETD of buses passing through.

In Bus Display Boards

KSRTC/CMC will be installing LED Display Boards inside the bus. These display boards would be displaying Slogans, Real Time Traffic Messages from the Central Control Station and the Current and Next Bus Stops both in Kannada and English.

PROPOSED SYSTEM

In order to reduce waiting time at City Bus stops, passengers would have to obtain live time tables for any City bus stop to achieve this complicated task, we propose a new City Bus location and route navigation system by using ICT (Information and Communication Technology). The system relays data about the current location of a City Bus to the Smartphone user (passenger). As such, even without knowing the entire time table, the system enables the users to get on a City Bus easily by showing the current location information of a Bus in real time. By using this system, we can expect an improvement of user convenience especially for Bus lines that have long operational intervals.

For simplicity purpose, instead of getting the location data from the Bus directly, we install a Smartphone in the Bus. The application uploads data to the information collection server (Server 1), which stores collected information in a database. Information delivery server (Server 2) delivers the information to the user, so passengers can receive current Bus information by accessing a web page generated based on the stored information. We have developed two applications for our proposed system.

(i) First application is designed to collect location data of the Bus.
(ii) The second application displays location information to users.

The proposed system consists of 3 modules, namely (i) Admin module (ii) Driver module & (iii) Passenger module

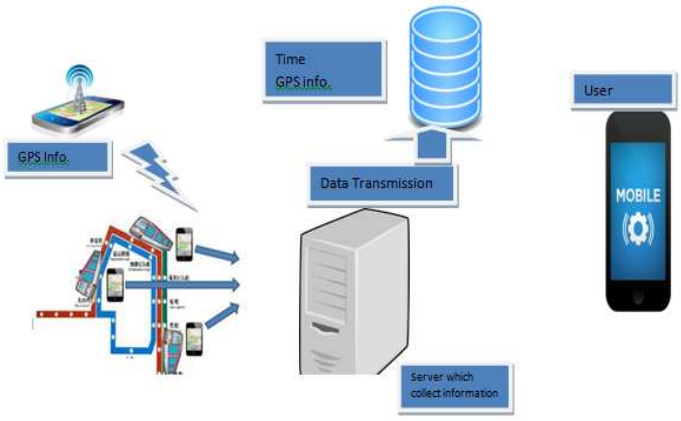

Fig. 3 Shows the architecture of proposed system

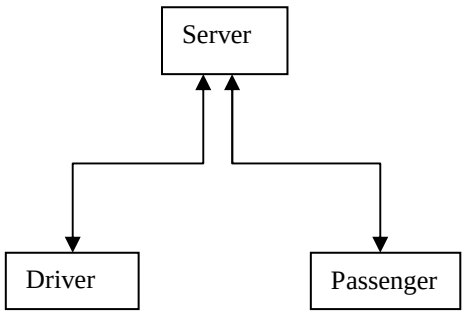

Fig. 4 Basic Functionalities of the system

Figure 4 shows the basic functionalities of the overall project. The Driver client side android application requests bus route information stored in the database maintained by Admin. The server processes the request and provides the bus route information which includes information about the bus stops to be traversed by the driver. This is displayed in the form of the buttons. The button click at a particular bus stop indicates successful arrival of driver to

the particular bus stop. This is updated on the server. The passenger requests for information such as nearby bus stops, Distance, Directions, Bus route information and approximate arrival time. This request is processed by the server and information is obtained.

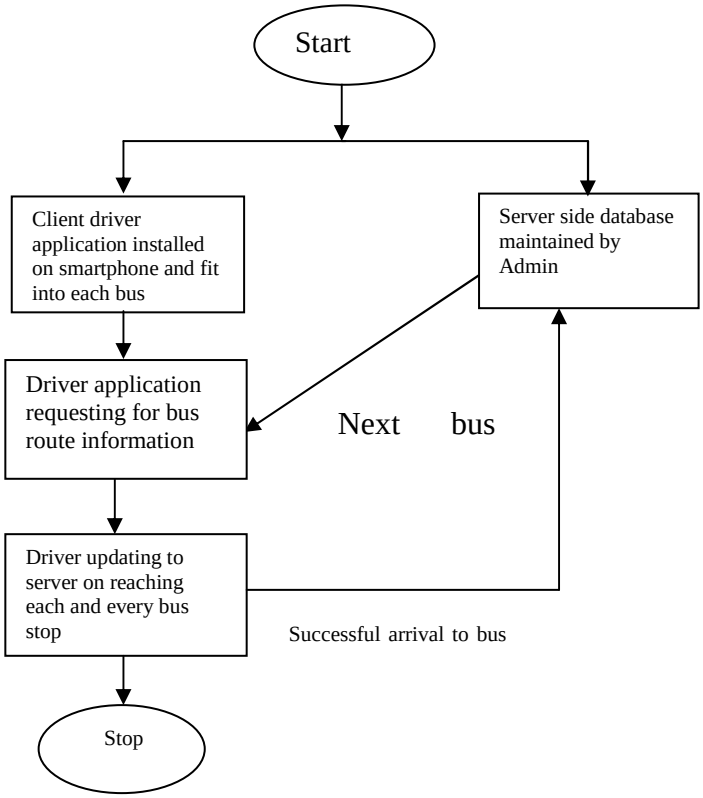

Fig. 5 Flow of admin module

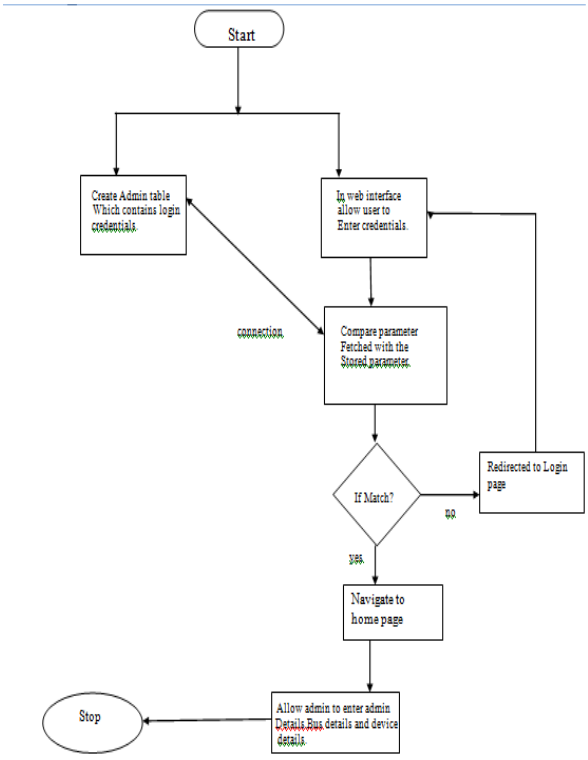

Fig. 6 Flow chart of the complete process

IMPLEMENTATION

Admin module

The whole system is controlled by Admin. Admin is responsible for adding bus stops, bus route information, set device IDs and to manage these information. In this module we create a web interface that includes all bus information. The main tasks performed by Admin are the following:

Admin authentication

It is necessary to authenticate admin. For this purpose we have saved username and password into the database. If the same username and password is provided at the Admin login page then we say Admin is authenticated. For this purpose we need web interface to communicate with the database. This is done using database interfaces.

Database interfaces

The JDBC Statement, Callable Statement and Prepared Statement interfaces define the methods and properties that enable us to send SQL or PL/SQL commands and receive data from our database. Table-1 given below describes usage of each database interface.

Table-1 Usage of Database Interfaces

Interfaces	Recommended Use
Statement	Use for general-purpose access to our database. Useful when we are using static SQL statements at runtime. The Statement interface cannot accept parameters.
Prepared Statement	Use when we plan to use the SQL statements many times. The Prepared Statement interface accepts input parameters at runtime.
Callable Statement	Use when we want to access database stored procedures. The Callable Statement interface can also accept runtime input parameters.

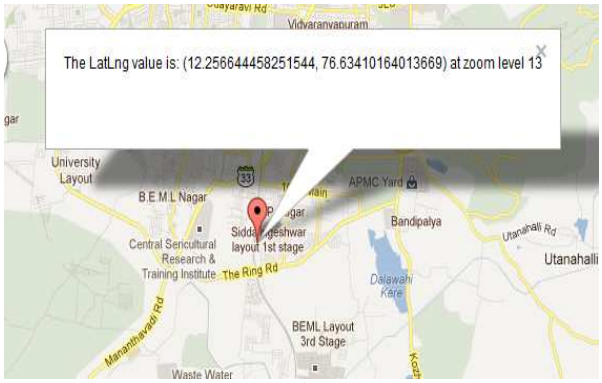

Fig. 7 Illustrates usage of the above Google APIs

Adding Bus Stops

Admin after navigating successfully to the home page can manage bus stops. Here he can add bus stops automatically by clicking on Google maps and providing radius which will add all the bus stops into database within the provided radius. Using Google APIs we retrieve information in JSON format which is the most widely used format by Google APIs. We parse the provided information into required bus stop information and finally add it to the database. Admin can also add bus stops manually. To add to database we use JDBC database interface.

Google Maps API

Google Maps has a wide array of APIs that lets us to embed the robust functionality and everyday usefulness of Google Maps into our own applications, and overlay our own data on top of them. Google introduced a Java application called Google Maps for Mobile, intended to run on any Java-based phone or mobile device. An internet connection is required Fig.7.

Adding Bus Route Information

Admin can add bus route information such as source, destination, and via routes which includes the names of bus stops between source and destination. We add bus route number and bus register number into the database. Admin is provided with a feature to search bus routes added either by giving bus route number or bus register number. It displays Google maps to view via routes which are displayed using markers. Admin can also view bus routes added.

Setting Device IDs

An android phone is fit into every bus. Each android phone has a unique IMEI number. The IMEI number is set along with bus register number and bus route number.

Bus Location

The current location of the bus can be retrieved by giving bus number. It displays the associated details such as bus registration number, device ID and also provides a Google map to view the location of the bus.

Driver Module

This is an android application loaded into the android phone fit into every bus. Driver at the source stop (starting) requests for bus route information from the server maintained by Admin. The server processes the request and provides the information. The information is converted into buttons. Upon reaching that particular bus stop the driver clicks on the button and the button will be disabled. The information is updated onto the server. The server to driver application connection is provided by using web services using SOAP protocol.

Passenger module

This is an android application loaded into android phone to be used by passenger. Passenger current location is retrieved and all the nearby bus stops are retrieved from server and displayed. A particular bus stop is selected. The shortest walking route is also provided. Passenger can also obtain bus route information. The approximate arrival time is also displayed. This is the main login screen for admin panel to proceed with the addition of bus details. Admin can add bus route information such as source, destination, and via routes which includes the names of bus stops between source and destination. The server processes the request and provides the information. The information is converted into buttons. Upon reaching that particular bus stop the driver clicks on the button and the button will be disabled. This is the screen in which the details of all the availablke buses will be displayed. User can easily monitor all the availability and go accordingly. This screen gives the information on all available bus stops byu which the user can map the near by routes easily and track the bus on time.

Fig. 8 Snapshot for admin login

Fig. 9 Adding bus stops manually

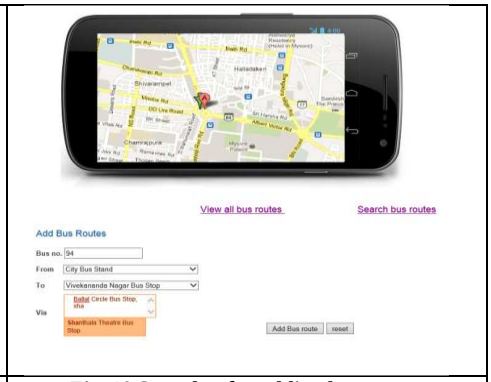

Fig. 10 Snapshot for adding bus routes

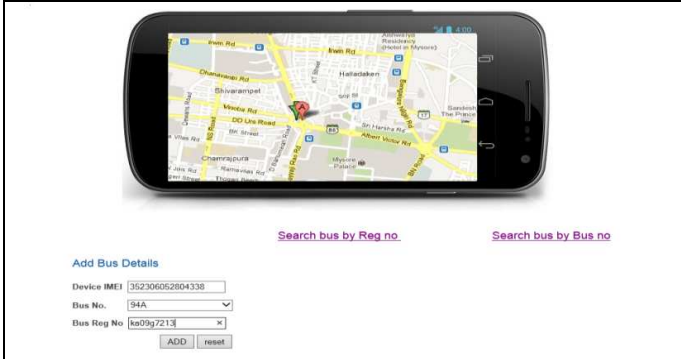

Fig. 11 Snapshot for adding bus details

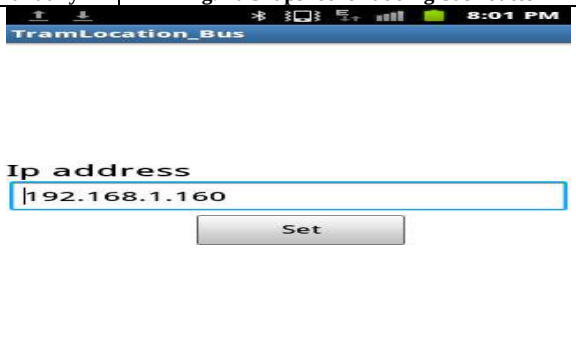

Fig. 12 Snapshot for setting IP address

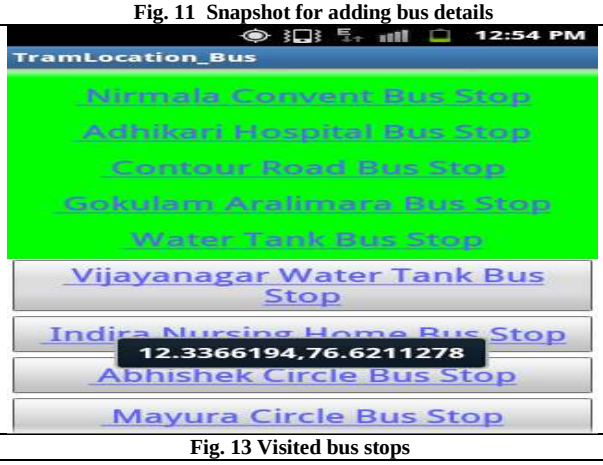

Fig. 13 Visited bus stops

Fig. 14 Passenger app prompting the user to select the bus routes

CONCLUSION

This paper provides passengers with information such as shortest walking route to the nearby bus stops, distance and direction to the nearby bus stops, available buses, bus routes and approximate arrival time of the buses. We develop a system that retrieves the bus location using GPS which accounts for accuracy in locating the current location of the bus. The advantages of the proposed system is that it provides real time updated information, reduces passenger waiting time, usage of android phones enables ease of usage and is user friendly and also the system has low implementation and maintenance cost.

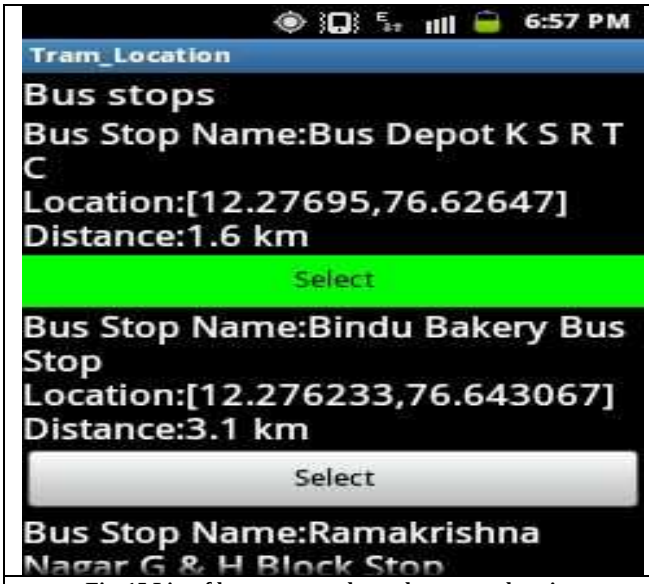

Fig. 15 List of bus stops nearby to the current location

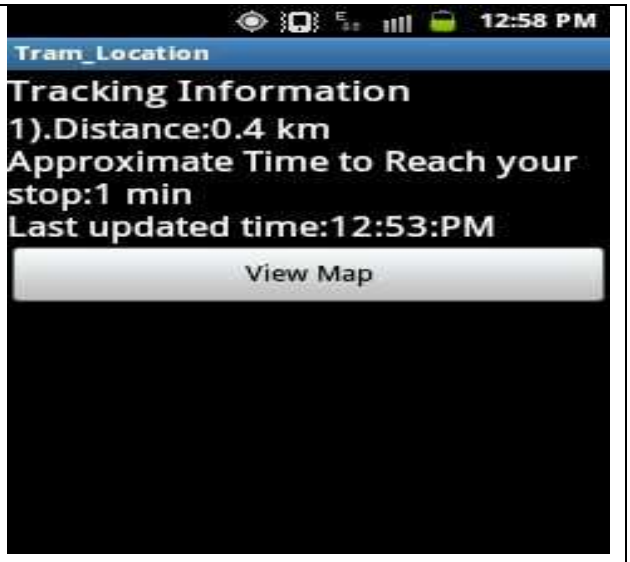

Fig. 16 Information about the nearest bus stop

Fig. 17 Depicting the direction to the nearest bus stop

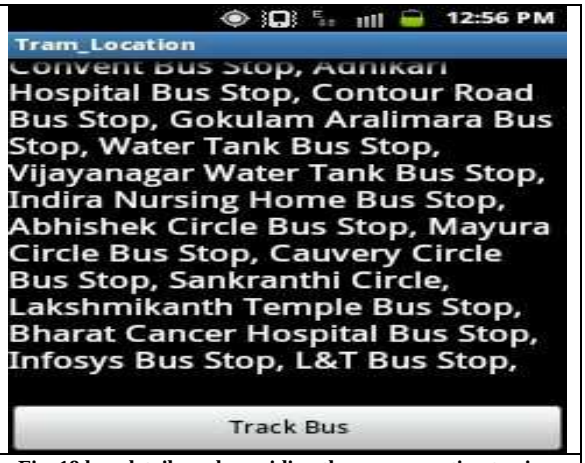

Fig. 18 bus details and providing the user an option to view the current location

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