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A Mobile Application for Bus Information System and Location Tracking using Client-Server Technology

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***Abstract*— Android is the latest and a rapid growing technology available for all the users or customers in todays market. An enormous increase in the end user acceptance has been experienced in the past few years. This project has been developed on the Bus Information System in Pune. This paper proposes an Android mobile phone application that gives information about buses, bus numbers as well as bus routes – both online and offline. Reason for Android platform - Android requires an open source development which is probably the most feasible and a present user friendly approach. This paper also deals with Location Based Services, which are used to track the current location of the bus as well as give an estimate remaining time for the tracked bus to reach its destination using the Client-Server technology. Also, it displays the required maps with the help of GPS.**

***Keywords*— GPS, LBS, Android plugins, Client-Server Technology**

I. INTRODUCTION

There are buses made available for passengers travelling distances, but not many passengers have complete information about these buses. Complete information namely the number of buses that go to the required destination, bus numbers, bus timings, the routes through which the bus would pass, time taken for the bus to reach, maps that would guide the passenger with his/her route and most importantly, track the current location of the bus and give the correct time for the bus to reach its bus stop.

The proposed system deals with overcoming the problems stated above. The system is an Android application that gives necessary information about all the buses travelling in Pune. This information overcomes the problems faced in the previously built application "Pune Bus Guide". The platform chosen for this kind of system is Android, reason being Android Operating System has come up on a very large scale and is owned by almost every second person. Also, Android is a user friendly platform, thereby enabling ease of access for all the users.

A number of applications made for the Android Operating System is increasing on a large scale ever since its advent. Android is an open source mobile software environment.

Brought up by Google, the operating system has been made Linux based and uses Java programming language. It has a virtual machine that is used to optimize memory usage as well as resources.

This application has been developed using IDE(Eclipse Integrated Development Environment) with ADT (Android Development Tools) and Android SDK(Software Development Kit).[3]

There are a number of constraints that need to be satisfied. A few of them may be stated as follows:

1. The users phone should be GPS connected.
2. The phone should not lag each time any route or bus number has been requested for.
3. The platform used must be Android only.
4. All the bus numbers must be stored in the database and retrieved whenever asked for.
5. The bus timings must match the real time bus arrival.
6. The bus locator must give the exact location details about the bus.
7. The time given for the bus to reach the bus stop much be almost accurate, irrespective of the traffic obtained.
8. The application must have information about all the routes in Pune.
9. The application must be user friendly enough for the user to understand it and operate it.
10. The application must be updated with the addition of new buses along with the bus numbers as well as the bus timings and new routes.
11. The location tracker must track the location of the passenger as well as the bus to give the estimated time, and then guide the passenger with the route to his/her destination.
12. The application must not need internet while displaying only the routes. It must be done in offline mode.
13. The Android versions must support the application.

A large number of applications were developed for this kind of purpose, but none of them worked due to inaccurate or incomplete information.

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The main goal of the proposed work is to improve the Bus system by adding the necessary additional features into the application, like accurate bus timings, correct bus numbers and moreover adding a GPS tracker into it. This study accepts input in the form of selection of the source and destination and selection of the bus travelling the distance to display the entire details about the routes and also track the location of the respective bus and give the map for the same.

The rest of the paper has been organized as: section II highlights the related work along with their downsides, section III discusses the proposed system to overcome those downsides, section IV gives the development environment of the system. Section V shows the results of the system followed by conclusion, future scope as well as references.

II. Related Work

The last two decades have seen growing interest in the development of Android based platform. Our review of this area shows that there have been only few approaches that provide automated tools for the functioning of the application:

1. An application has been implemented in Pune, named "Pune Bus Guide". This application gives the way to the destination correctly, but the number of drawbacks that it has is greater than the number of advantages.
   It does not show the passengers current location even if he/she is connected to the GPS.
   Also, this application has been proven useless as it does not display the bus numbers, so the passengers find it very hard to know the number and time of arrival of the respective buses.
   It does not have a real time bus tracking service or does not even generate maps for the users ease.
   This application has never been updated ever since its development.
   Moreover, this application has bugs which makes it all the more difficult for the user to use it.[5]
2. Another application that was implemented in Mumbai, named "M-Indicator – Mumbai" has drawbacks like:
   It displays matter which is the same as what is online.
   Its latest updates have given issues on every Android mobile supporting even the most recent device version. The "A to B" module of buses has given problems. Whenever an option for the source to destination is selected, the field still remains blank, i.e. no bus routes are displayed.[6]
3. The application built in Delhi named "Delhi Bus Navigator" has drawbacks like:
   The application works smoothly when offline, but works very badly when connected to the Internet.
   The application gives information about direct routes only. It does not give information about the alternate routes.
   This application has bugs due to which it lags all the time.
   Most of the time the application crashes when requested for specific bus routes.[7]
4. The application developed in Bengaluru named "Bangalore BMTC Info" has drawbacks like:
   The application is never in an updated condition.
   The application has fed in wrong routes on several buses and given no updates to fix them.
   After the minimization and restoration of the application, it cannot search anything.
   This application crashes almost always.
   The application is not user friendly with a complicated User Interface(UI).[8]
5. The application developed in Chennai named "Chennai Bus Route" has the following drawbacks:
   The application works fine, but the bus timings have not been mentioned.
   Not all bus stops are updated.
   The application does not display maps.[9]
6. The application built in Ahmedabad named "Ahmedabad BRTS" has the following drawbacks:
   This application has not been updated since the time of its development.
   Number of buses and routes are still the same. No changes made to them.[10]

These examples clearly state that all the bus applications implemented so far have faced serious problems, which have still not been fixed.

Currently, there is no framework application built in Pune to track the location of the bus.

Most of the earlier tools were developed considering only a few constraints. This led to exclusion of many important constraints which further caused problems while operating the application.

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This system deals with overcoming allthe problems faced the earlier applications and providing a bug-free, user friendly application.

The significance of our method is to resolve each of these above cited problems. The system takes basic information about the source and destination, selection of the bus, and displays the bus numbers along all the routes heading to the destination, generates maps as soon as the bus number is selected and most importantly tracks the location of the bus with the help of GPS and sends the location and the minimum time required for the bus(irrespective of the traffic) to arrive the bus stop.

III. PROPOSED SYSTEM

The application is a user friendly one, that anyone can access for free of cost. The basic idea for this project was to guide the bus travelers with the routes, all the possible stops that come on their way to the destination and moreover, display maps and track their locations and show the estimate remaining time required to reach. The aim is to overcome all the drawbacks faced in all the previous applications and generate fast and accurate results.

The proposed system has been divided into two modules as follows. Module 1 gives information about all the routes from the source to the destination and give maps for the same. Module 2 give information about all the buses along with the bus numbers that go through the selected stops, track the location of the selected bus and send this information to the passenger giving him/her the estimate time required for the bus to reach. This is done using the Client-Server technology.

i. Module 1 (Routes and Maps)

The first module depicts the process of selection of routes from source to destination and presents the respective map for the same. Every direct and indirect route would have a map for itself.

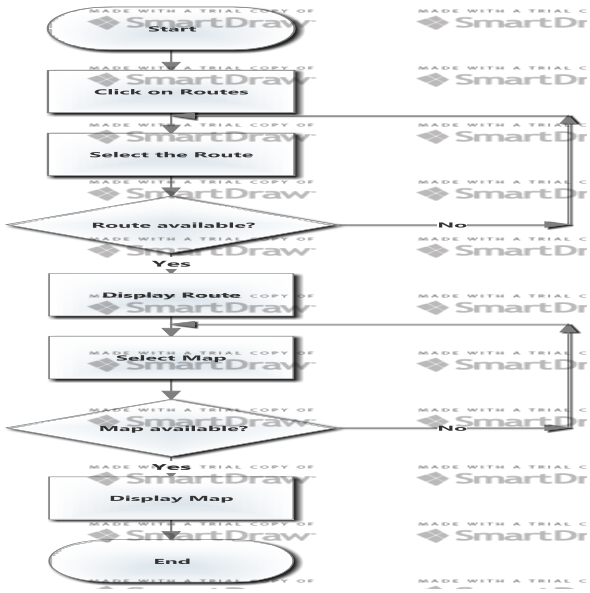

Fig. 1 Flowchart for Module 1

ii. Module 2 (Stops and Location Tracker)

The second module depicts the process of selection of the stops till where the passenger wants to travel. Passengers wanting to select stops can do so, irrespective of the routes. The Location Tracker is will detect the current location of the bus and send the location back to the passengers device. The Client-Server technology is used in this kind of system.

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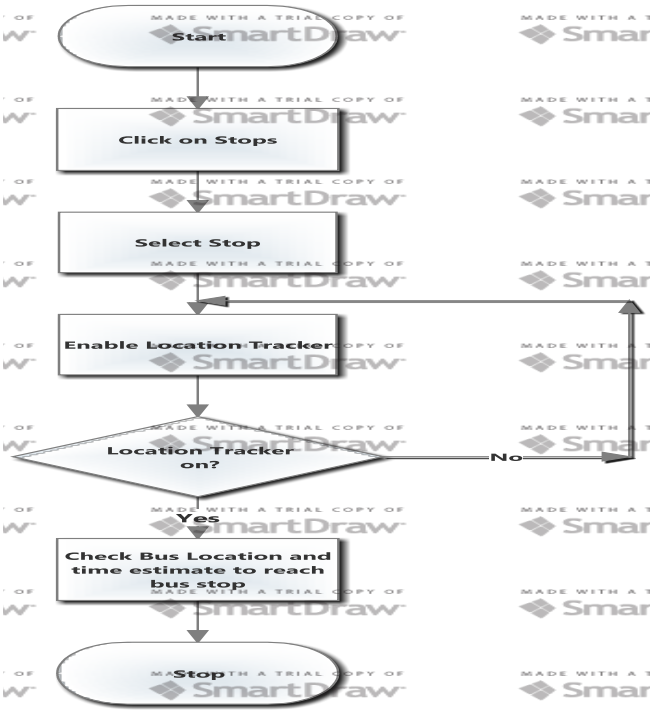

Fig. 2 Flowchart for Module 2

IV. DEVELOPMENT ENVIRONMENT

The proposed system requires Eclipse that is an open source software development environment. Eclipse consists of an Extensible plugin system and an IDE. The Android project has been developed in the Helios version of Eclipse, as it has plugins that are mainly used for Android.

i. Android SDK

Integrated Development Environment (IDE) is used in Android development in order to make it more straight forward and quick. It has been recommended for the developers because of its simplicity in working.

Android is basically a multitasking platform. To give an example, the application has one application for navigation, another application for games, and another messaging. These applications can work simultaneously because of this multitasking ability of the Android platform.

ii. ADT Plugin

ADT (Android Development Tools) is a plugin developed by Google. Its main purpose is for developing Android mobile applications in Eclipse. It makes it easy and convenient for all the Android developers working in Eclipse environment to quickly create Android projects and debug the programs whenever needed.

Text editor should not be used in the development of large applications having a large amount of code as the text editor cannot highlight wrong spellings.

iii. Android Emulator

Android emulator is a virtual mobile device which is included in every Android SDK which runs on the users computer. Android emulators are used to test Android applications, so there is no need of any physical device.

Android emulator supports Android Virtual Device (AVD) configuration, which in itself is an emulator containing specific Smartphone Operating System. Using AVD, one can easily test his applications.

Any application running on an emulator can use the services provided by the Android platform like play audio, store or retrieve data etc. But with these features comes a few limitations. Neither does it support Bluetooth , nor does it support SMS/MMS communication.[4]

A. Functionalities of the System

Below mentioned are the functionalities provided by the system:

- **Route Information**
- **Bus Information**
- **Stop Information**
- **Map Generation**
- **Location Tracking**

B. Database

The databases created in this application are created in SQLite. User passes a query to access the database. All the rows in the database that match this query are passed as a type of pointer(cursor) and then displayed to the user. The application maintains an Adapter class that handles calls that are made to the database.

The databases play an integral part of the system as all the bus information, stop information as well as routes are all stored in these databases.

C. Location Based Services

Location Based Service(LBS) is a widely used application in mobile data services which has led to the rapid development in wireless communication strategies as well as location positioning technologies. The travelers having the location-aware mobile phones can find out about the respective bus stops at any place.[1]

The LBS is a mobile application which depends on the location of a mobile phone. It is used as an IP service that uses geographic information in order to track the location of the bus.

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The bus is tracked and sent to the server and the server then forwards this tracked bus information to the client device which makes the user keep track of the bus location and get an estimate remaining time for the bus to reach his bus stop.[2]

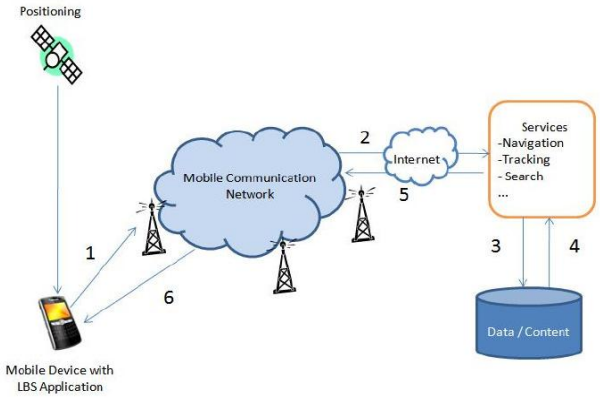

Fig 3. Location Based Service

D. System Requirements

- *Software Requirements:*

1)JDK 1.6

2)Android SDK 4.0

3)IDE :Eclipse Helios

4)Backend:MySQL SERVER 4.0

- *Hardware Requirements:*

1)Pentium 4,with 2 or 4 GB RAM

2)500 GB Harddisk

3)Net speed @Mbps

E. Client-Server Technology

The proposed system is based on the client-server technology, which consists of a client side part as well as a server side part. The limitations of both the parts have been considered during the development of the project. The bus traveler would enter his destination name in the application.

The application would forward a request to the server with the name of this destination, the server would look up for the place into the database and this piece of information would then be passed on to the client phone. [2]

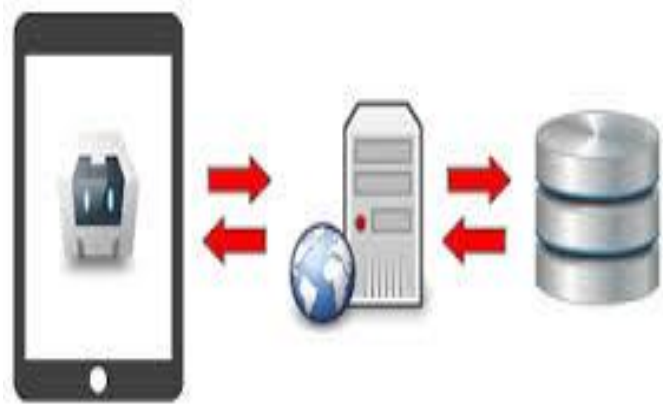

Fig 4. Client-Server Technology in Android

V. RESULTS

We have tested this system for appropriate outputs; the following section includes experimental section of these.

The system is given an input, i.e. the required selection is done and the information is displayed.

Screen shots of each selection have been displayed.

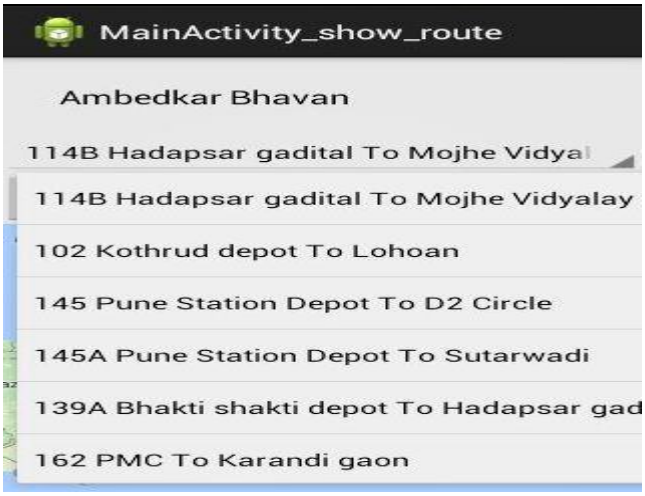

Fig. 5 Selection of Routes

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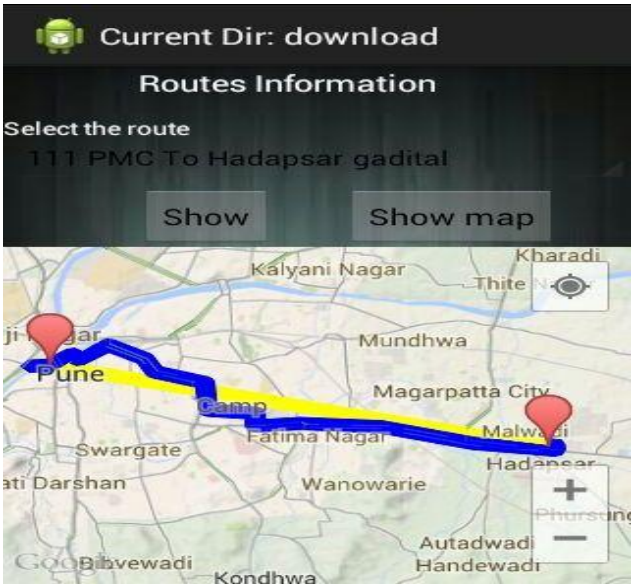

Fig. 6 Route information along with map

Fig. 7 Stop information

VI. Conclusion And Future Scope

The conclusions of this study suggest that knowledge of specific domain improves the results. This Project has been implemented on Android platform. Also, different attributes have been added to the project which will prove to be advantageous to the system. The requirements and specifications have been listed above. This project is implemented using Android and the SQL domain. Using the GPS system, the application will automatically display the maps and routes to the different locations and also track the bus location using client-server technology and forward it to the client device.

This project will be put up on the cloud platform, so that it will be accessible by every Android user. The application will prove beneficial for every bus traveler, or even tourists. Not just buses, but this application will be useful for every person travelling by any means of transport. The Location Tracker will give the exact location of the bus which will make it easy for the passengers to travel.

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