Bus Tracking System Using Mobile Application

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ABSTRACT

In this fast life, everyone is in hurry to reach their destinations. In this case wait- ing for the buses is not reliable. People who rely on the public transport their major concern is to know the real time location of the bus for which they are waiting for and the time it will take to reach their bus stop. This information helps people in making better travelling decisions. This paper gives the major challenges in the public transport system and discuss various approaches to intelligently manage it. Current position of the bus is acquired by integrating GPS device on the bus and coordinates of the bus are sent by either GPRS service provided by GSM networks or SMS or RFID. GPS device is enabled on the tracking device and this information is sent to centralized control unit or directly at the bus stops using RF receivers. This system is further integrated with the historical average speeds of each segment. This is done to improve the accuracy by including the factors like volume of traffic, crossings in each segment, day and time of day. People can track information using LEDs at bus stops, SMS, web application or Android application. GPS coordinates of the bus when sent to the centralized server where various arrival time estimation algorithms are applied using historical speed pat- terns.

Keyword : - *Android; GPS, GSM, Position Grounded Services, Clustering, Artificial Neural Network.*

1. INTRODUCTION

BACKGROUND

Vehicle tracking systems were first implemented for the shipping industry because people wanted to know where each vehicle was at any given time. These days, however, with technology growing at a fast pace, automated vehicle tracking system is being used in a variety of ways to track and display vehicle locations in real-time.

However, bus transportation service has very poor transportation information system nowadays. Bus users do not know the exact arrival time for a bus, but only know the scheduled approximate arrival time. Bus transportation service does not have a proper system to track all buses position and the actual arrival time in every bus stop. These problems occur because current bus service system did not apply real time tracking technology to track on each buses on the road and also lack of a platform to update latest bus traffic information to bus users.

In order to solve these problems and enhance current bus service system, real time bus tracking system has to develop and implement. With real time bus tracking system, bus position data is connected real time and transmitted to a central server for processing and extracting transit information. The main technology used to develop this system is Global Positioning System (GPS). GPS technology able to receives the position of an object from space-based satellite navigation system through a GPS receiver.

For wireless data transmission, GSM and SMS technology are commonly used. The SMS technology through GSM network and GSM modem provide a user with vehicle location information. Instead of using SMS, the bus tracking system uses the smart phone application to track and monitor a bus location obtained from the in-vehicle tracking device.

The bus location is automatically placed on Google maps, which makes it easier for tracking a vehicle and provides users with more accurate vehicle location information.

The developed bus tracking system will be able to provide bus users a real time platform to check on updated bus traffic information, for example bus arrival or departure time. Besides, this system also reduces workload for bus management team

and provides an immediate platform to update latest and accurate bus traffic information to bus users.

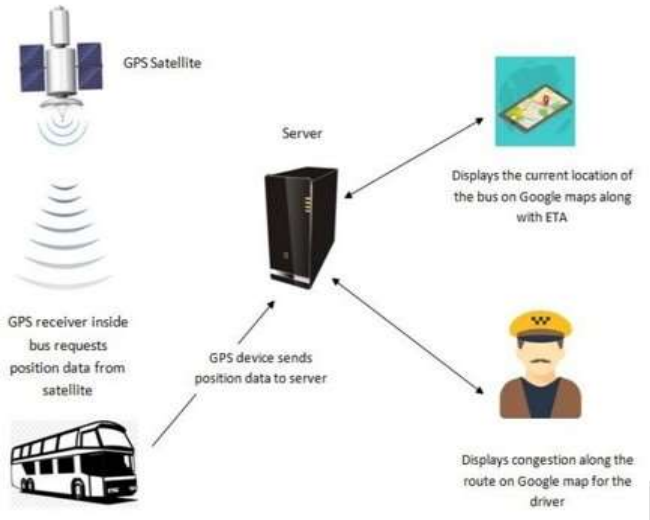


Figure 1.1: Bus Tracking System Architecture

ANDROID

Overview

Android is a mobile operating system (OS) currently developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smart- phones and tablets. Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to real-world actions, such as swiping, tap- ping and pinching, to manipulate on-screen objects, along with a virtual keyboard for text input. In addition to touchscreen devices, Google has further developed Android TV for televisions, Android Auto for cars, and Android Wear for wrist watches, each with a specialized user interface. Variants of Android are also used on notebooks, game consoles, digital cameras, and other electronics. Now we have phones which can even access GPS, GPRS, Wi-Fi, NFC and lot of other cool and advanced features which you cannot even imagine. So in this Mobile world of this complication, android is one of those operating system platforms which made it easy for manufacturers to design top class phones.
Stored and copied to a stream where the actual data is transferred. Due to its native characteristic, it runs in the background and waits for a possible transfer operation. They are called right after the related button is pressed. Services retrieve values from static class called Final-Values.java through intent's extended data. They mainly include Final Values .EXTRASGROUPOWNERADDRESSandAndroidOS.

As it is widely known, android is a Linux-based operating system led by Google. It is mostly developed for mobile devices to bring simplicity, functionality and efficiency to the market. Android is an open source project and it has a large number of developers writing applications. Developers write applications primarily in Java (Stephen Shank land, 2007) and applications can be downloaded mostly through official online store called Google Play. Currently there is 600,000 applications available on Google Play and so far 20 billion applications downloaded from this store (engaged, 2012).
Android runs on Linux with libraries and libraries written in C. Dan Merrill, Android Engineer in Google, explained that Android is not a specification, or a distri- bution in the traditional Linux sense. It's not a collection of replaceable components. Android is a chunk of software that you port to a device.
Android uses the Dalvik Virtual Machine to run Dalvik Executable code trans- lated from Java byte code. All standard API are defined in terms of classes, interfaces, methods and objects. In terms of hardware platform, ARM architecture is main plat- form for Android. However, there is also support for x86 architecture.

Architecture

Architecture Android runs on Linux under Dalvik VM. Dalvik has a just-in-time compiler where the byte code stored in memory is compiled to a machine code. Byte code can be defined as 'intermediate level'. JIT compiler

reads the byte code in many sections and compiles dynamically in order to run the program faster. Java performs checks on dependent portions of the code and thus the code is compiled only before it is executed. When it is compiled once, it is cached and set to be ready for later uses.

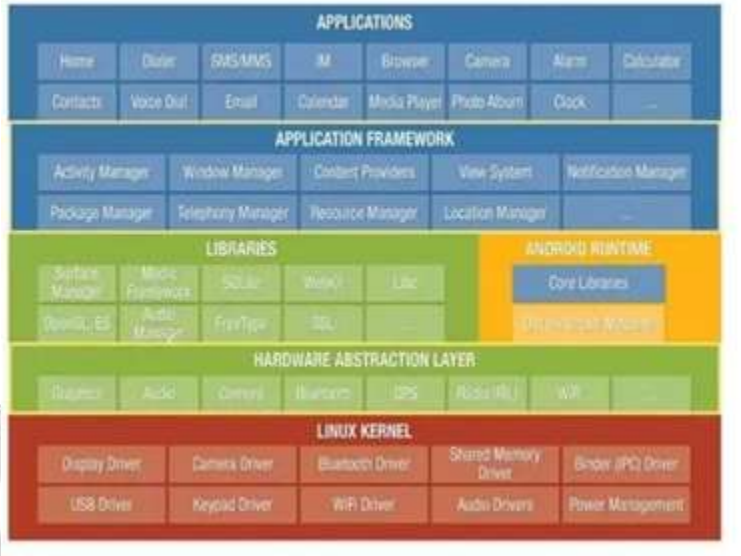


Figure 1.2: Android Architecture

Android Studio and Android SDK

Studio is the official IDE for Android app development, based on IntelliJ IDEA. On top of IntelliJ's powerful code editor and developer tools, Android Studio offers even more features that enhance your productivity when building Android apps, such as:A flexible Gradle-based build system. Build variants and multiple APK file generation. Code templates to help you build common app features. A rich layout editor with support for drag and drop theme editing. Lint tools to catch performance, usability, version compatibility, and other problems Code shrinking with ProGuard and resource shrinking with Gradle. Built-in support for Google Cloud Platform, making it easy to integrate Google Cloud Messaging and App Engine Android provides a custom plug-in for Android development called Android Development Tool (ADT). It is designed to build Android applications. It lets the developer to establish new Android projects, build and debug applications, and export APKs.

GPS Tracking unit

A GPS tracking unit is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. The recorded location data can be stored within the tracking unit, or it may be transmitted to a central location data base, or Internet-connected computer, using a cellular (GPRS or SMS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analyzing the track later, using GPS tracking software. Data tracking software is available for smartphones with GPS capability

GPS Architecture

A GPS tracker essentially contains a GPS module to receive the GPS signal and calculate the coordinates. For data loggers it contains large memory to store the co- ordinates, data pushers additionally contains the GSM/GPRS modem to transmit this information to a central computer either via SMS or via GPRS in form of IP packets
Fundamentals: The GPS concept is based on time and the known position of specialized satellites. The satellites carry very stable atomic clocks that are syn- chronized to each other and to ground clocks. Any drift from true time maintained on the ground is corrected daily. Likewise, the satellite locations are known with great precision. GPS receivers have clocks as well; however, they are not synchro- nized with true time, and are less stable. GPS

satellites continuously transmit their current time and position. A GPS receiver monitors multiple satellites and solves equations to determine the precise position of the receiver and its deviation

from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities (three position coordinates and clock deviation from satellite time).
Mobile Phones with GPS Capability: Due in part to regulations encouraging mo- bile phone tracking, including E911, the majority of GPS receivers are built into mobile telephones, with varying degrees of coverage and user accessibility. Com- mercial navigation software is available for most 21st- century smartphones as well as some Java-enabled phones that allow them to use an internal or external GPS receiver (in the latter case, connecting via serial or Bluetooth). Some phones using assisted GPS (A-GPS) function poorly when out of range of their carrier's cell towers. Others can navigate worldwide with satellite GPS signals as well as a dedicated portable GPS receiver does, upgrading their operation to A-GPS mode when in range. Still others have a hybrid positioning system that can use other signals when GPS signals are inadequate.
Mobile Messaging: Mobile messaging plays an essential role in LBS. Messaging, especially SMS, has been used in combination with various LBS applications, such as location-based mobile advertising. SMS is still the main technology carrying mobile advertising / marketing campaigns to mobile phones. A classic example of LBS applications using SMS is the delivery of mobile coupons or discounts to mobile subscribers who are near to advertising restaurants, cafes, movie theatres. The Singaporean mobile operator Mobile One carried out such an initiative in 2007 that involved many local marketers, what was reported to be a huge success in terms of subscriber acceptance.

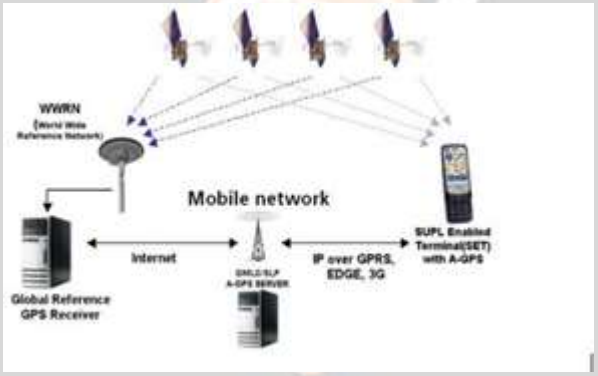


Figure 1.3: Architecture of GPS

MOTIVATION

Many cities have found that GPS tracking system not only improve the efficiency of city bus operation, but also encourage commuters to take the advantage of city bus system. Many city bus systems have discovered that GPS tracking system allows monitoring the location and arrival time of their bus actually increase the number of people using city buses for routine communing. 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.

2. LITERATURE SURVEY

The design of the navigation system was driven by a set of premises that distinguish it from other navigation solutions.
The service should be deployable on short term, and not in a far future.
Deployment cost for the service provider should be efficient.
Usage cost should be low considering currently common communication costs.
Service should be easily adaptable and extendable to a fast changing reality. Next to deployability under current conditions, another concern had a major influ-

ence in system design: user friendliness. The system should require as little interaction from the user as possible and little change of his habits. Furthermore, all interfaces be- tween user and navigation system should be carefully designed so that users unfamiliar with the system or with technology in general feel comfortable using it. Finally, being userfriendly also implies using technologies that most users are already familiar with, so that they do not have to acquire any new device or learn to handle one. A navigation sys- tem complying to these design requirements enhances the experience of users of a PTN in a cost effective way. Visitors and sporadic users are target user groups, as the system is especially helpful for people unfamiliar with the PTN. But also normal users would profit, being guided to destinations out of their current and known parts of the transport network, for example visiting a place for the first time in an area they do not usually use. In this way, the navigation system enhances the urban mobility experience and makes using the PTN more attractive to people unfamiliar with it. As with any application, it's important to consider the target audience. In this case, I can divide transit riders into new or infrequent riders, who aren't overly familiar with the local transit system, and frequent riders, who are familiar with it and use it every day. New or infrequent riders are less familiar with available routes and often need more trip-planning guid- ance, whereas frequent riders typically already know which sequence of stops and routes is the fastest to reach their destination, so they just want to know when the next bus is coming. The application presented in this article is targeted primarily at this second

group of frequent transit users. While static schedules and timetables are an important base for rider information, the reality is that transit vehicles do not always run on time. Traffic congestion, weather, accidents, and passenger incidents: there is any number of reasons why a transit vehicle might not meet its schedule. As such, many recent transit traveller information system improvements have focused on providing real-time arrival information.

EXISTING SYSTEM

There are many existing platforms and applications that are used to assist com- muters plan their travel uses mobile data for the connectivity and communication and GPS to get the real-time location of the bus (or other means of transport) relative to the commuter. There are solutions that offer a limited accuracy in metropolitan cities.
However, these solutions are not available to the other cities and also, they rely on historical data to provide information. The Intelligent Transport System (ITS)s based solutions can be studied to overcome these pitfall, would help the commuter to effectively utilize the public transport which includes lower waiting time. There are many implementations of Intelligent Transport System all around the world, each solu- tion designed to address a specific demographic region. There are existing solutions like tram TRACKER by Yarra Technologies in Melbourne, Australia and Google Maps is always there to cater the needs of the metropolitan computers.

PROBLEM STATEMENT

Possessing own transportation has become more common nowadays. The number of vehicles on the road keep on increasing and most of us are eager to own personal vehicle as we can go anywhere without limitation.
Undoubtedly, the existence of bus has reduced road traffic and taking bus is a good starting to inculcate the car-pooling value. Besides, it provides a low-cost trans- portation which means to the low-income family for traveling to another destination. However, things always don't come perfect.
The main drawback of traveling with bus is the inconsistent arrival time which may due to unforeseen circumstances. Even when we know the bus schedule well, there are number of reasons that bus as may not arrive as expected.
Traffic congestions
Heavy downpour

Bus breakdowns
It is particularly annoying when a person has urgent appointment, but we are late due to the time-consuming of bus trip.

PROPOSED SYSTEM

The real time tracking of bus can be done and this information is then given to remote user who wants to know the real time bus information. Our system provides the relevant information regarding
Real time location: Here the current location of the bus will be displayed.
Route details: The system will display the route details with stops name.
Driver's Contact Number: The system will display the driver's name with contact details.
Average waiting time and expected time to reach: The system will display the ETA(estimated time of arrival) on the Google maps between two stops.
Real time traffic to diverse route in case of heavy congestion: The system will display the traffic details for the driver in case of congestion.

OBJECTIVES

The objective of bus tracking system is,
The mobile phone industry is one of the fastest and most dynamic business sec- tors today. The need to communicate efficiently and instantaneously is always an undying necessity. The market sector and the ever-growing and demanding consumers always want to have more, and they want it better than ever. Having a mobile phone for us makes life easier.
Communication is always a part of daily life, and we cannot avoid it. The invention of mobile phone has gone tremendous leaps in innovation and new applications. Originally, it was intended to be a telephone that can be carried wirelessly at greater distances.
Advances in communications, upgrades in radio frequency and developments on the internet had given mobile phones more sophisticated but easy to use in appli- cations.
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.

3. SOFTWARE REQUIREMENT SPECIFICATION

FUNCTIONAL REQUIREMENTS

Functional requirements refer to the functionalities that must apply to a system.
The functional requirements of bus tracking system are stated below.

The system must be able to show information to user in real time.
The system must be able to process the position data received from bus positioning module, calculate the estimated time to user and display the position on maps.
The system must be able to show estimated arrival time for every bus in every bus stop.
The system must be able to allow user retrieve information from mobile device and computer.
The system must be able to show the traffic information on maps.

NON-FUNCTIONAL REQUIREMENTS

The system should provide the accurate estimated bus arrival time to user.
The system should reduce the paper work done by bus management team.
The system should be able to increase the efficiency and performance of bus service.
The system should reduce work done by bus management team by automated calculation of estimated bus arrival time and showing real time bus position to user.
The system should allow user to access information in anywhere with anytime

USER REQUIREMENTS

There are two main target users for the proposed system, bus user (student/staff) and bus management team. The requirement from different user is stated below.

Bus user:
Student/Staff is the main user of the proposed system because the main objective of bus tracking system is to provide estimated bus arrival time for student.
The student/staff must able to retrieve real time estimated bus arrival time for every bus stop. While waiting in bus stop, student able to access bus tracking system with mobile device instead of using computer to access.
This is the main purpose of bus tracking system in mobile application is developed. The system is provided real time bus tracking system with mapping feature, which mean student/staff able to view the bus position with a map.
With this mapping technique, student able to know where is a bus position based on the map in real time.

Bus Driver :
Bus driver is the second important user of this system. Bus driver is able to update bus status accordingly in order to inform bus users about immediate situation.

SYSTEM REQUIREMENTS

System Processor: Pentium P4
Mobile Processor: 1GHz or higher
Motherboard: Genuine Intel
Memory: 512 MB of RAM, 1GB recommended.
Display:1024x 768 or higher-resolution display with 16 bits colors of android mobile phone.

SOFTWARE REQUIREMENTS

Operating system: Windows XP or higher.
Technology Used: Android 4.1 or higher
IDE: Android Studio 3.0.1
Plug-in: ADT plug-in(Android Development Tool)
Language: Android, JAVA.

Actor:

Student
Faculty
Driver
Bus application

Use-case:

Get the bus location
Get the bus information
Get current location
Send location
Update location

Pre-condition:

GPS In bus should be working properly and should send the coordinates to the server

Post-condition:

Mobile application should receive location of bus from server

USE CASE DIAGRAM

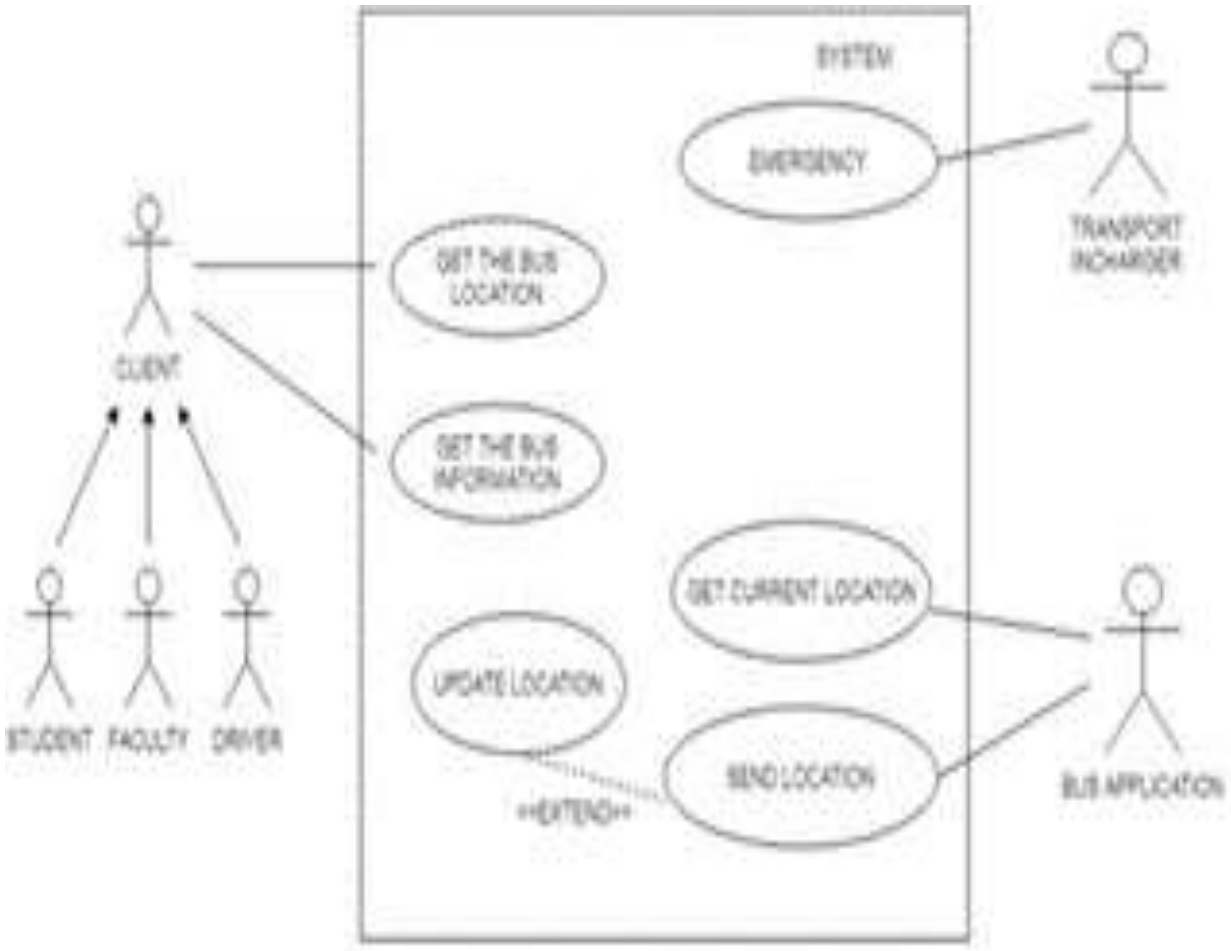


Figure 3.1: Use case diagram

4. DESIGN ANALYSIS

SYSTEM ARCHITECTURE

This chapter describes features, fragments, classes, architecture and the application itself by providing necessary information of major components. First, overall information is given along with project's components and classes. Subsequently, the architecture details of the application are discussed

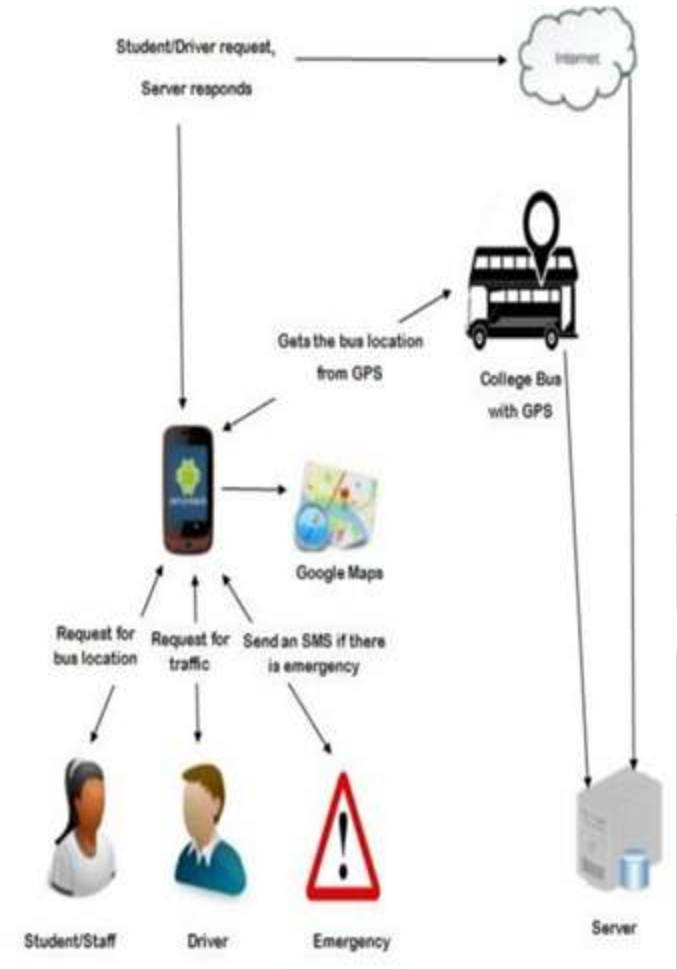


Figure 4.1: System architecture of bus tracking

ACTIVITY DIAGRAM

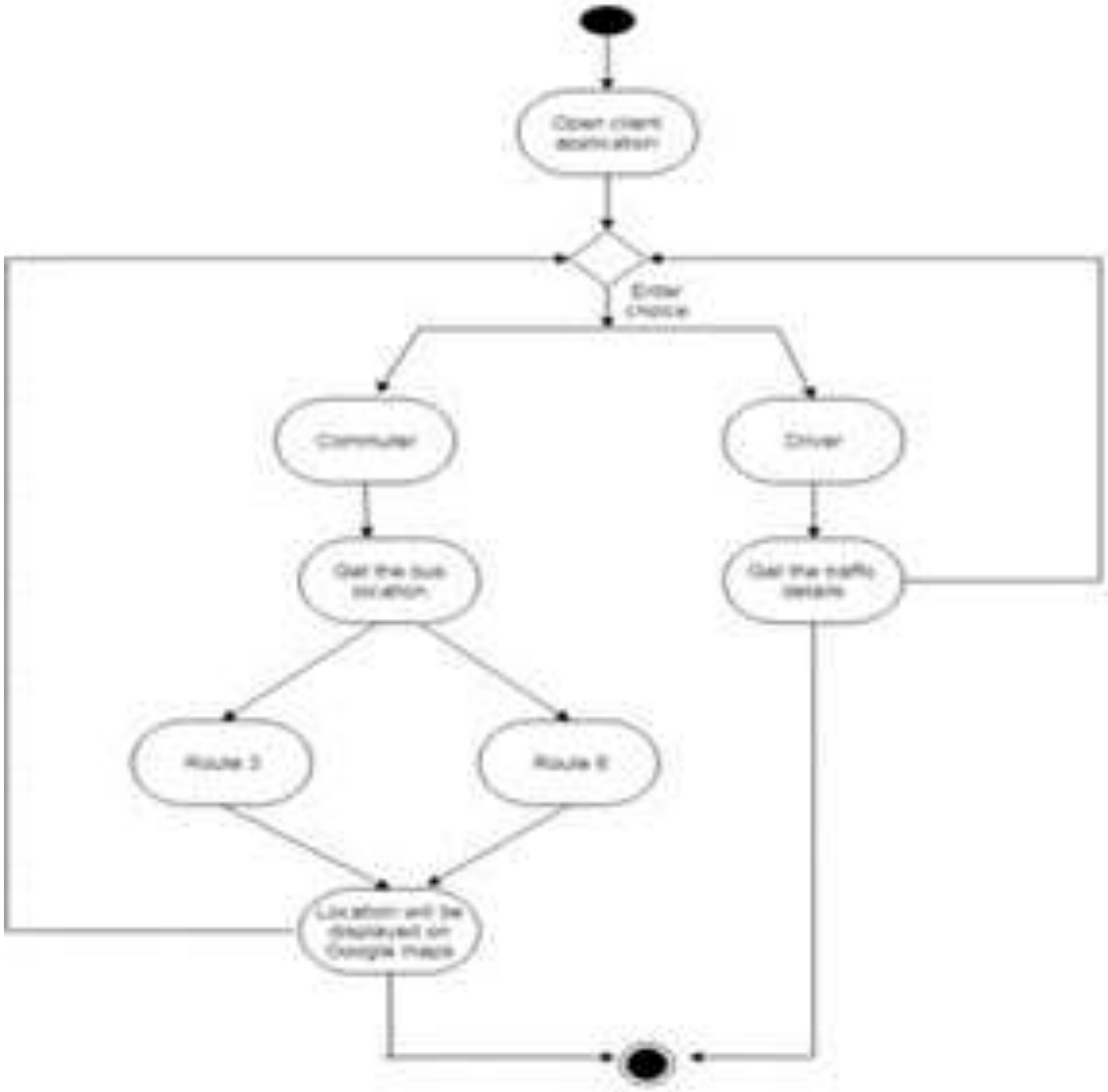


Figure 4.2: Data flow diagram

DATA FLOW DIAGRAM

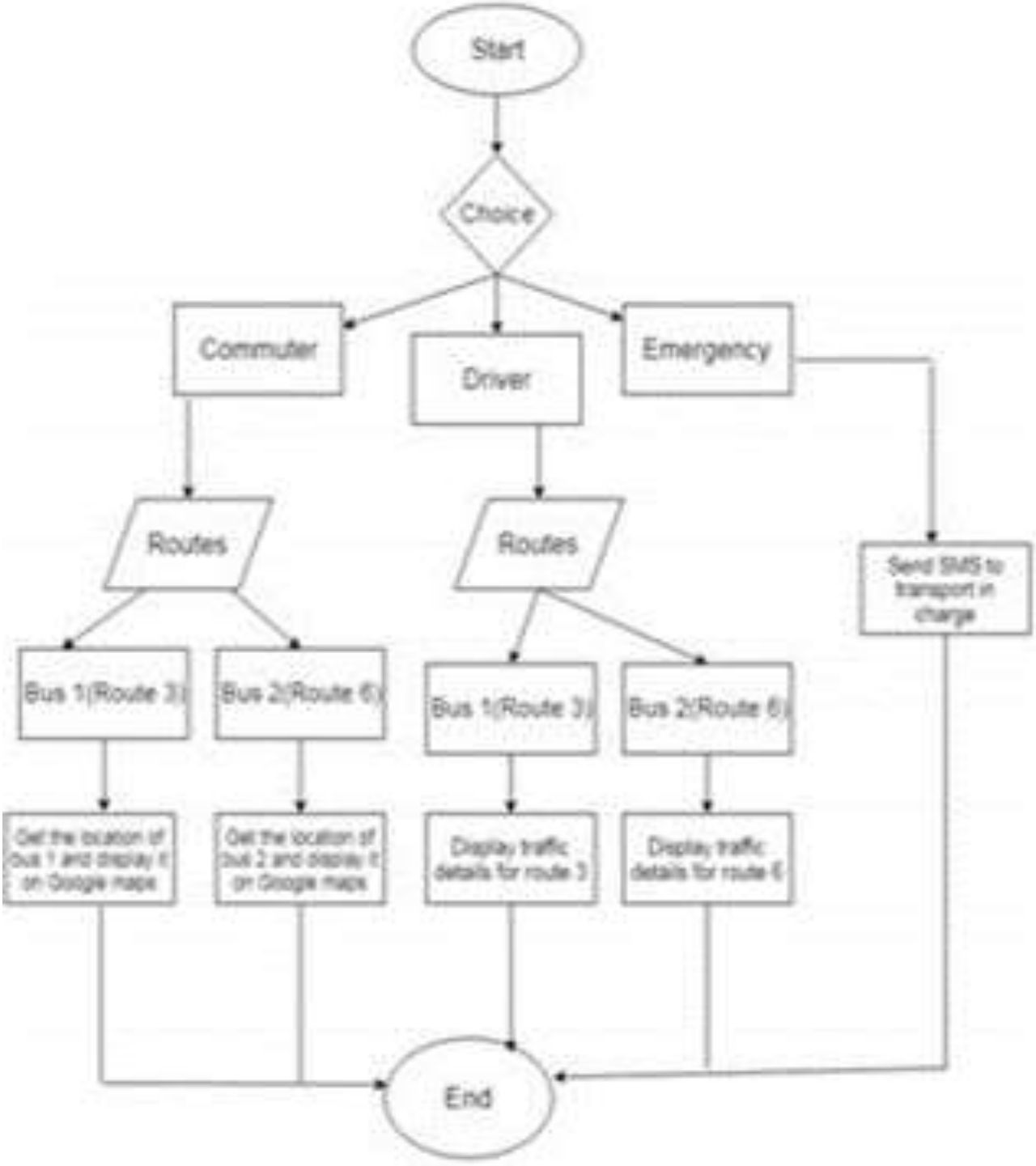


Figure 4.3: Activity diagram of bus tracking

5. IMPLEMENTATION

PLATFORM SELECTION

Android Studio

It is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development. The following features are provided in the current stable version:
Gradle-based build support
Android-specific refactoring and quick fixes
Lint tools to catch performance, usability, version compatibility and other prob- lems
ProGuard integration and app-signing capabilities
Template-based wizards to create common Android designs and components
A rich layout editor that allows users to drag-and-drop UI components, option to preview layouts on multiple screen configurations. Support for building Android Wear apps Built-in support for Google Cloud Platform, enabling integration with Firebase Cloud Messaging (Earlier 'Google Cloud Messaging') and Google App Engine. Android Virtual Device (Emulator) to run and debug apps in the Android studio. Android Studio supports all the same programming languages of IntelliJ, and PyCharm e.g. Python, and Kotlin and Android Studio 3.0 supports "Java 7 language features and a subset of Java 8 language features that vary by platform version." External projects back port some Java 9 features

PROGRAMMING LANGUAGE GIST JAVA

Android applications are developed using the Java language

Some of the Java's important core features are:
1.It's easy to learn and understand
2.It's designed to be platform-independent and secure, using virtual machines
3.It's object-oriented

Android relies heavily on these Java fundamentals.
The Android SDK includes many standard Java libraries (data structure libraries, math libraries, graphics libraries, networking libraries and everything else you could want) as well as special Android libraries that will help you develop awesome Android applications.

6 RESULTS

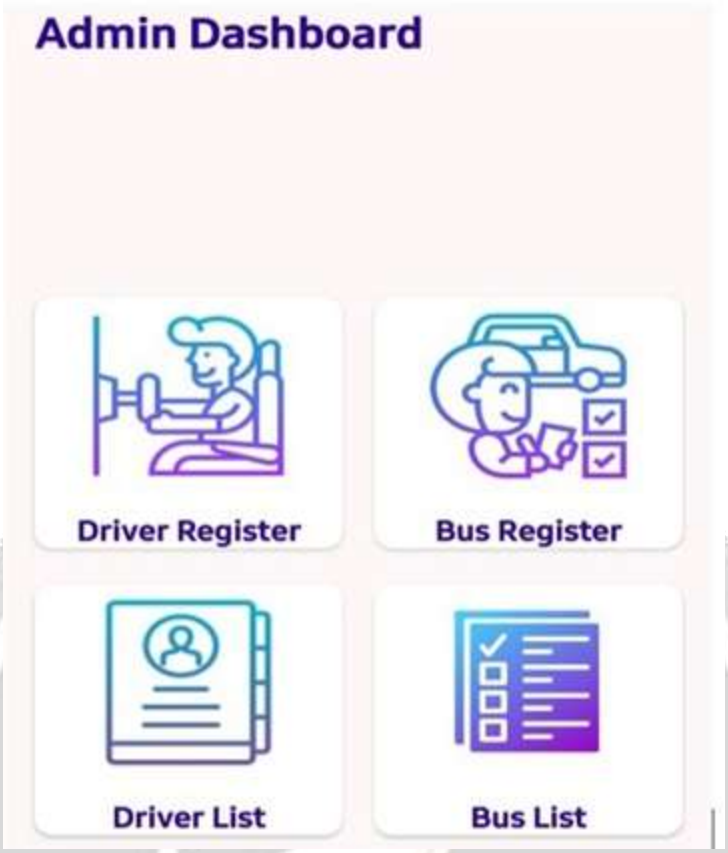
SCREENSHOTS

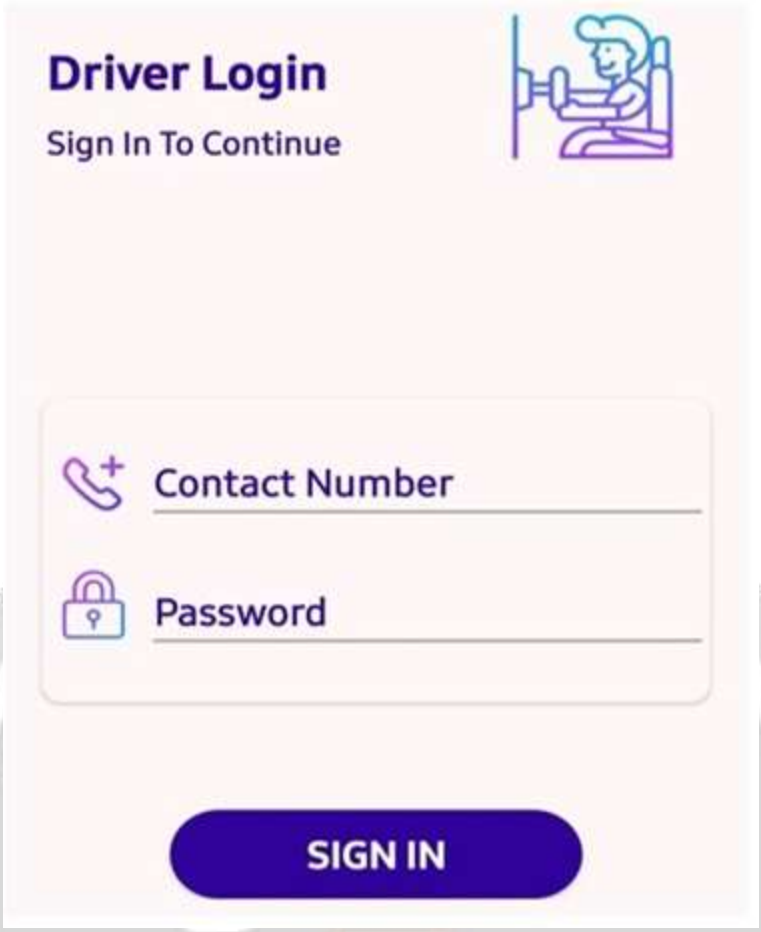
LOKNETE DR. BALASAHEB VIKHE PATIL
(PADMA BHUSHAN AWARDEE)
PRAVARA
RURAL EDUCATION
SOCIETY

SVITLINC

SVIT COLLEGE, Nashik


Login Dashboard
Admin
Student
Driver


Admin Dashboard
Driver Register
Bus Register
Driver List
Bus List



7. CONCLUSIONS

GPS Based Bus tracking System is an Application that has its client side on the Android platform. Application is free of cost and easy to install on device. The accuracy of this system relies on the GPS coordinates generated using satellites while reliability of the system depends on the GPRS facility. The system is effective where Internet is accessible. By including the concept of direction, the size of the database has reduced to half, thereby not exhausting the server and database with similar sets of data in different tables. The proposed system also predicts the average velocity of the bus using clustering and back propagation method. This increases the accuracy of the system as it also takes into account the traffic conditions during that day of week and time of the day.

8. ACKNOWLEDGEMENT

It gives us great pleasure in presenting the project report on **'ANALYSIS ON BUS TRACKING SYSTEM GPS ON SMARTPHONES'**.The satisfaction that accompanies to successful completion of any task would be complete without mention of people whose ceaseless cooperation made it possible,whose constant guidance and encouragement crown all efforts with success.

We would like to take this opportunity to thank my internal guide **Mr.Umakant D.Butkar** Sir,Head of Computer Engineering Department **Mr.Sharad M. Rokade** Sir and Principal .**G.B.Shinde** Sir for giving us all the help and guidance we needed.We are also thankful to all the staff members of the Computer Engineering Department, SVIT Chincholi, Nashik.We are really grateful to them for their kind support.

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