

# GPS-based Location Tracking System via Android Device

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**Abstract**— With recent technological advancement of modern science people are now expecting the information about the location of any object for tracking purposes. Presently, we want more location based services for being advanced and to save time and money also. GPS is a system which is already implemented and everyone can access it without any restriction. Having the facility of GPS to develop this system we need a GPS device to calculate the location from the information taken from GPS. Hence, we have chosen Android device to perform this calculations because Android mobile phone is cost effective and offers multidimensional purposes having some special built-in features like GPS service. Thus, this system is developed for location tracking of a group of people with a proximity alert system using various latest demanding tools and technology like Jason, Java, AVD, LAMP etc.

**Index Terms**— AVD, Android Device, GPS, Jason, LAMP, Location Tracking, Proximity Alert System

## 1 INTRODUCTION

The GPS, elaborated as Global Positioning System, is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense in 1973. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilians. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS [1]. GPS was invented by the U.S. Department of Defense (D.O.D) and Ivan Getting, at the cost of twelve billion taxpayer dollars. The Global Positioning System is a satellite navigational system, predominantly designed for navigation. GPS is now gaining prominence as a timing tool [2]. Eighteen satellites, six in each of three orbital planes spaced 120° apart, and their ground stations, formed the original GPS. GPS uses these "man-made stars" or satellites as reference points to calculate geographical positions, accurate to a matter of meters. In fact, with advanced forms of GPS, you can make measurements to better than a centimeter [3]. GPSs are very quickly becoming a standard in most new automobiles, and are even finding their way onto a variety of new cell phones. The mapping devices can come in handy under a variety of circumstances. If we are thinking about purchasing a GPS or a device that has a GPS built-in, here are some of the benefits of having one [3]. A GPS can help us to determine exactly where we are at any given moment. Not only can a GPS give us the name of the street we might be traveling on,

but many GPS systems can also give us the exact latitude and longitude of where you are located.

On the other hand, Android mobile platform is becoming more popular to the users for its multi-dimensional purposes. Thus, this proposed system namely "GPS-based Location Tracking System via Android Device" uses GPS and any mobile phones having an Android operating system to track the location of a person whenever necessary.

## 2 SIGNIFICANCE OF THE STUDY

### 2.1 Socio-economic Significance

In this study, the system will inspire the other researchers to develop more effective and efficient GPS-based location tracking system via Android device.

### 2.2 Technological Significance

In real life, we want the people to make more use of this one of the latest technologies.

### 2.3 Safety Features

If a person is lost, he/she can easily be tracked and brought back to a safe place by using this system

## 3 OBJECTIVES OF THE STUDY

### 3.1 General Objective

The general objective of the development of this system is to serve the people a more effective location based tracking facility.

### 3.2 Specific Objective

In real life, when a group of people are in a tour, it will be very helpful. The management of all participants is little tough because it is quite impossible to restrict the movement of all participants. But this system can help us to track where they are now and many more.

## **4 FUNCTIONS OF THE SYSTEM**

### **4.1 Smartphone User Function**

A Smartphone user using this application has two basic advantages. First one is whenever he/she is on a trip, he/she is able to record his/her footprints on a website that is monitored by the administrator. Well, you might be wondering that when you are not on a trip, then why would you install the application. The answer is that proximity alert system has been installed with this application. This salient feature allows the user to set alarm for different tasks on different locations.

### **4.2 Administrator Function**

The administrator function embedded in the GPS-Based Location Tracking System is to provide the functionality for monitoring the recorded footprints of each user individually on a computer screen. The application provides the administrator with the most recent location update.

## **5 GOALS OF THE SYSTEM**

### **5.1 Individual Task Management**

Often people are guilty of themselves that they move to a place to finish a job but returned from there without finishing it. To solve this problem, the proximity alert system helps you manage your tasks on a location based alarm system. If you have assigned a task in the application to a location, then whenever you are near to your place of interest, regardless of timing the application will issue you an alarm. Thus no task that is assigned to the phone once would be forgotten.

### **5.2 Safety Tool**

The application is very useful when you are on a trip. On a trip, one can easily be lost and become unable to find a way back to the base. This especially happens in forest areas. But if the GPS based tracking system is installed on your phone, you are leaving your footprints on a website which is monitored by someone who would be on the way when you really need someone to get you back to the base. So if there a problem occurs with the user, he can easily be found by the administrator simply by having a look at his last location. Thus the application provides you safety in an unknown area.

### **5.3 Administrative Capabilities**

Consider yourself as a guardian for a group of students that has gone on a trip. You are the person who has been assigned the job to look after the students and bring all of them back home safely. It is impossible for you to stay with each student individually. But if one of them is making a delay and no one is available there who can provide any sort of information about him, then it is a serious trouble for you. Well, GPS Based Location Tracking System is providing you the solution. Once each student gets registered on the network, you don't need to worry about their location. All you need to do is to switch on your PC and all the registered students will appear in one window with their most recent location update and recorded

footprints. Now it is much easier to track the students. Thus the application aims at helping you to manage your administrative tasks too.

### **5.4 Reliability**

The application is based on GPS location provider embedded on your Android Smartphone. GPS is a technology that is available 24/7. So you can rely on this application.

### **5.5 Ease of Access**

The application was developed to serve mass population. That is why the user interface of the application is kept simple.

## **6 FEASIBILITY CONSIDERATION**

Depending on the results of the initial investigation the survey is now expanded to a more detailed feasibility study for "GPS-based location tracking system via Android device."

### **6.1 Technical Feasibility**

To develop this application, a high speed internet connection, a database server, a web server and software are required. The current project is technically feasible as the application was successfully deployed on Android Emulator

### **6.2 Economical Feasibility**

The project is economically feasible as it only requires a mobile phone with Android operating system. The application is free to download once released into Android market. The users should be able to connect to internet through mobile phone and this would be the only cost incurred on the project.

### **6.3 Operational Feasibility**

It will need an internet connection to send the information to server. GPS is free. We need the server maintenance cost. This is the basic operational cost which tends to very low.

## **7 TOOLS AND TECHNOLOGY**

The basic tools and technology used for "GPS-based location tracking system via Android device" are illustrated below.

### **7.1 Scripting Language**

A client script is a program that is embedded in a Web page. The code is interpreted by a browser, which provides an interactive experience for an end user. Client scripts can be written in scripting languages such as VBScript or Jscript. Each element on a Web page is represented by an object that may have properties, events and methods. This is known as the Dynamic HTML Object Model. Client script can process events generated by these elements [4].

A server script is a program embedded in a Web page that is located on the server side. The code is interpreted by server software and it plays a key role in a dynamic Web application. The server script is never sent to a client machine directly; instead, it dynamically generates HTML and client script that are sent back to a browser. Server scripts can be written in scripting languages such as PHP [5].

## 7.2 Android Operating System

Android is a Linux-based operating system designed primarily for touchscreen mobile devices such as Smartphones and tablet computers. Initially developed by Android, Inc., which Google backed financially and later purchased in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliance: a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. The first Android-powered phone was sold in October 2008 [6]. Android is open source and Google releases the code under the Apache License. This open source code and permissive licensing allow the software to be freely modified and distributed by device manufacturers, wireless carriers and enthusiast developers. Additionally, Android has a large community of developers writing applications ("apps") that extend the functionality of the devices, written primarily in a customized version of the Java programming language.

## 7.3 Global Positioning System (GPS)

The basis of GPS is the process of "trilateration" from a group of satellites. To trilaterate, a GPS receiver measures distance using the travel time of radio signals. Distance is measured by calculating the amount of time it takes a radio signal from the satellite to make a one-way trip to the GPS Receiver. Trilateration is like triangulation, which uses a known distance and the measure of an angle to determine a point in geographical space. Trilateration uses two or more reference points and the distance from those points to the subject point to determine distance [7].

## 7.4 The Java Programming Language

The Java programming language is a high-level language. In the Java programming language, all source code is first written in plain text files ending with the .java extension. Those source files are then compiled into .class files by the javac compiler. A .class file does not contain code that is native to your processor; it instead contains bytecodes — the machine language of the Java Virtual Machine<sup>1</sup> (Java VM). The Java launcher tool then runs your application with an instance of the Java Virtual Machine [8].

## 7.5 The Java Platform

A platform is the hardware or software environment in which a program runs. We've already mentioned some of the most popular platforms like Microsoft Windows, Linux, Solaris OS, and Mac OS. Most platforms can be described as a combination of the operating system and underlying hardware. The Java platform differs from most other platforms in that it's a software-only platform that runs on top of other hardware-based platforms [8].

## 7.6 Android Virtual Device

An Android Virtual Device (AVD) is an emulator configuration that lets you model an actual device by defining hardware and software options to be emulated by the Android Emulator [9].

## 7.7 Web Server

LAMP is a solution stack of free, open source software. The acronym LAMP refers to the first letters of Linux (operating system), Apache HTTP Server, MySQL (database software, but now sometimes MariaDB) and PHP, Perl or Python, principal components to build a viable general purpose web server [10].

## 7.8 Programming Languages and Tools

Various latest demanding programming language and supporting tools used to develop the system are listed below:

- Java
- Jason
- PHP
- Javascript
- HTML
- CSS
- XML
- Database Query language

# 8 REQUIREMENT ANALYSIS

## 8.1 Bisection of the System

The GPS-based Location Tracking System via Android Device consists of the following two sections.

- User
- Admin

The facilities for the users are in below:

- Set his/her own password and user name
- Record his/her location data on a website
- Start and stop services any time he/she wants
- Set up proximity alerts based on location

A user using the application owns his own user name and password so that no other person can enter on the application and create confusion to the admin about the location of the user. The user enjoys safety in a dangerous place against being lost as he/she is leaving his/her footprints on a website that is being viewed by the admin. So if there any mis-communication occurs, the admin can get there soon to help him/her. Additionally, if the user wants to set an alarm system based on location, then the proximity alert system can help him/her. It allows a user to manage his/her tasks better. Every user who will be tracked must have the following capabilities:

- Operate a Smartphone with Android OS
- Must have a basic knowledge of English

The facilities for the admin are in below:

- Can add or delete a user whenever necessary
- Can have the access to the location and traveling path of each user

An admin can enjoy the peace of mind that he/she is able to track each one in his/her network. He/she can have a look at the path of each user that he/she has used to get to the last location that his/her device has uploaded to the site. So he/she is able to manage his/her task of ensuring safety.

A user with a PC wishing to track the Smartphone users must have the following capabilities:

- Operate a PC comfortably
- He/she must have a minimum knowledge about the world map

## 8.2 Project Development Requirements

As the project is based on usage of two devices, we have divided our project requirements in two parts. These are summarized in the following table.

Devices	A personal computer		Android Virtual Device
Hardware requirements	Processor	Pentium IV or higher	Android Virtual Device can be configured with Eclipse IDE. Need to have Android OS Google API version 2.2 or higher support .
	RAM	128 MB or higher	
	Disk space	128 MB	
Software requirements	Operating system	Windows – XP, Windows – 7, Linux or any other OS	

## 8.3 Application User Requirements

Smartphones with Android OS
Internet support
GPS support
Android OS version 2.2 or higher

# 9 SYSTEM DESIGN

## 9.1 Overview of System Design

The purpose of system design is to create a technical solution that serves both the user and the admin. The system should be designed in such a way that is very flexible to use for both the administrator and the user. The preparation of the environment needed to build the system, the testing of the system and the migration and the preparation of the data that will ultimately be used by the system are equally important. In addition to designing the technical solution, system design is the time to initiate focused planning efforts for both the testing and data preparation activates. The Location Based Tracking System is a real life problem solving application. Both the admin section and the user section are designed in such a way that both parties enjoy the facilities of the application.

## 9.2 Modular Design

The whole system is divided into two parts i.e. the user and the admin section. That is why, the modular design of the system is also divided into two modular diagrams.

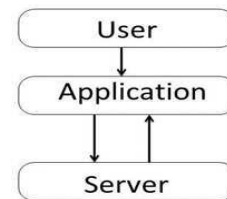


Fig. 1(a) Modular diagram for user

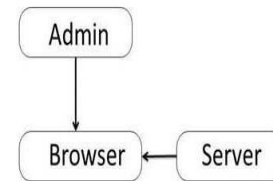


Fig. 1(b) Modular diagram for admin

## 9.3 Use-case Diagram

The use case diagram consists of the following criteria mentioned below.

- It should be the scenario that describes the interaction between a user and the system.
- It displays the relationship among actors and use cases.

There are two components in a use case diagram that helps understand the use case diagram. Those are,

- Actor
- Use-case

An actor in a use-case diagram represents a user using the system. On the other hand, a use-case represents the set of acts that a user might perform while using the system.

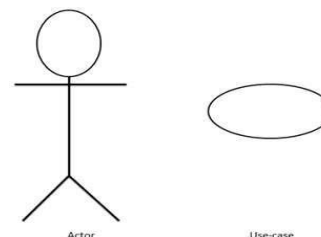


Fig. 2: Symbol of Actor and Use-case

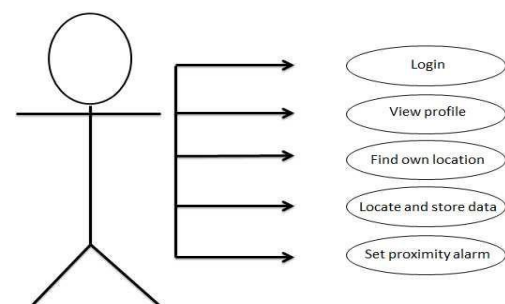


Fig. 3: Use-case diagram for user

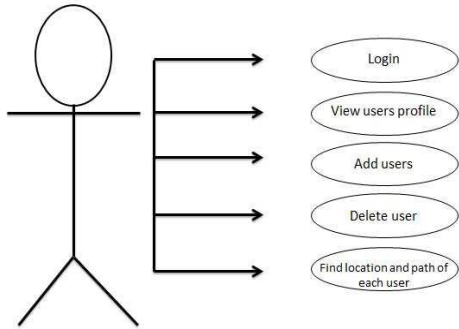


Fig. 4: Use-case diagram for admin

## 9.5 Schema Diagram Design of Data Storage

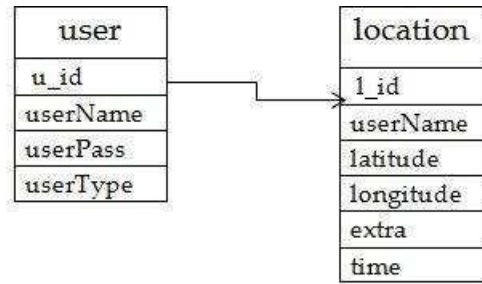


Fig. 7: Schema diagram

## 9.4 Data Flow Diagrams

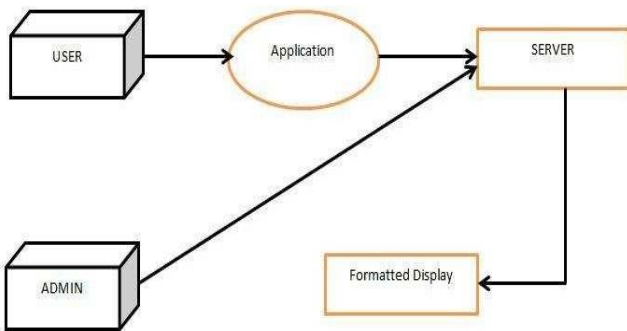


Fig. 5: Level-0 Data flow diagram

## 9.6 E-R Diagram Design Based on Schema Diagram

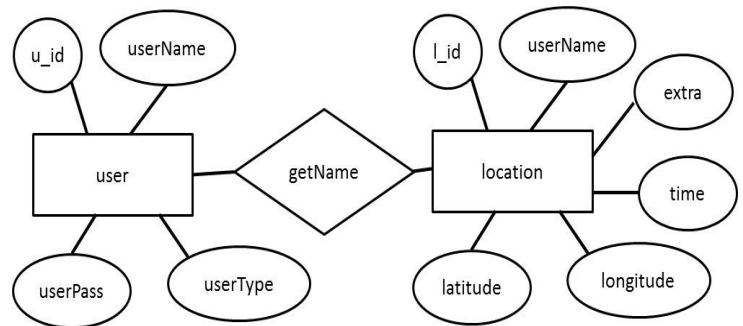


Fig. 8: E-R diagram

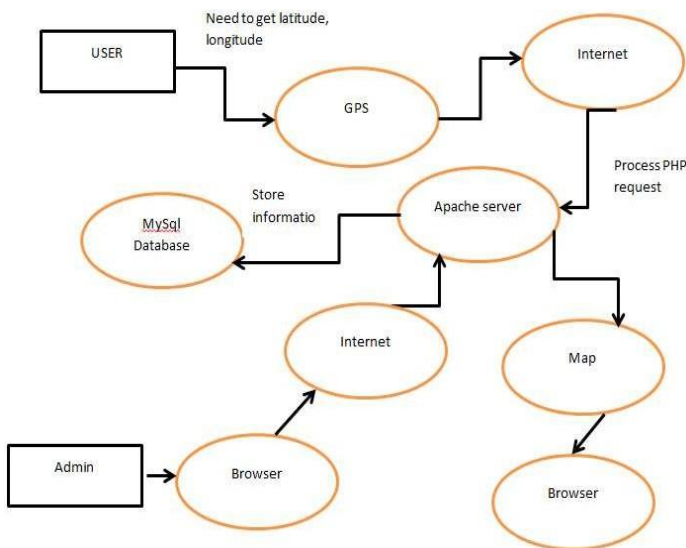


Fig. 6: Level-1 Data flow diagram

## 9.7 State Diagram Design

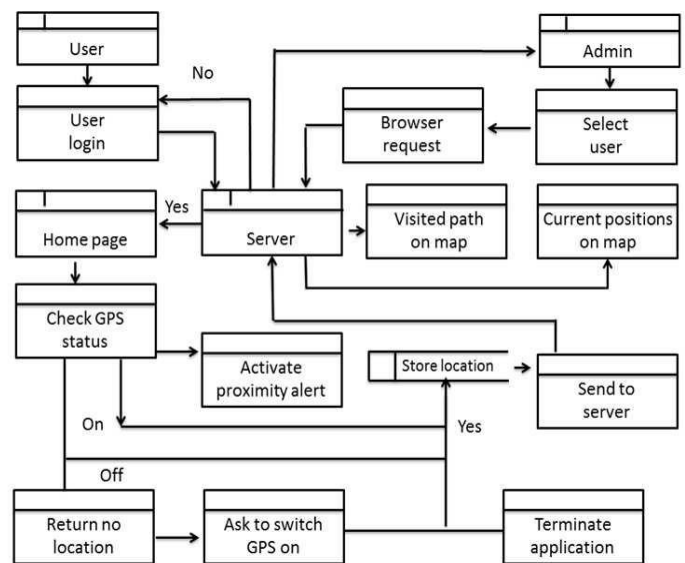


Fig. 9: State diagram

## 9.8 Snapshot from the Developed System

The simple user login form is in the following figure.



Fig. 10: User login

After successful login, the dashboard of the user is in Fig 11.



Fig. 11: Dashboard

The window showing the status of GPS is in Figure 12.

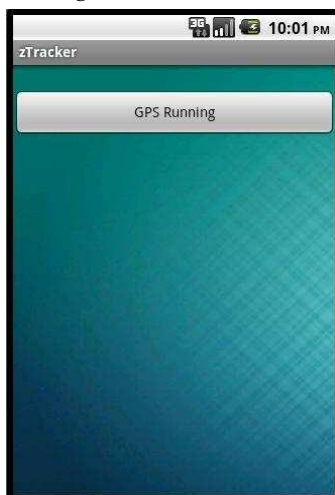


Fig. 12: Current Status of GPS

Here, the data is accessing and sending to the web server upon the availability of Internet connection. These are happening on background without any notification to the user. But, if there will be any incoming call to the mobile phone, then the data sending is stopped until the call has been disconnected.

## 9.9 User Location Marker

The locations of movement of the user are marked and passed to the server.

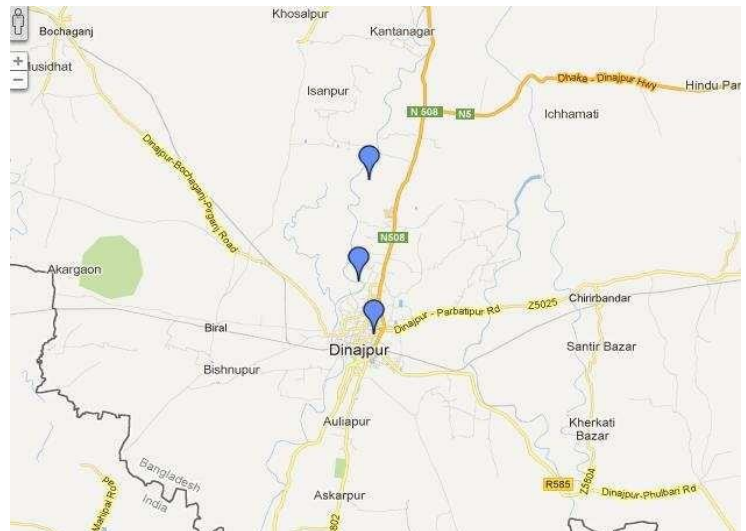


Fig. 13: User Location Marker

Here, the last positions of all registered users are shown. Three marked points shows three users are available to track.

## 9.10 User Visited Path

The visited path of a single user is shown in Figure 14.



Fig. 14: User Visited Path

Here, the total visited path of a user consisting of all available points in GPS is shown.

## 10 CONCLUSION

As the dedicated GPS devices are costly we have chosen android mobile phone as GPS device. Because all the android mobile phones have this built-in feature. GPS device will find out the current location from satellite. Depending on certain condition we will find the location again. Might after certain distance of location change we will count the location again. We will plot this location to map. At the same time we will connect with an external web server to send this information there. The web server will store the visiting path as a summation of some co-coordinating points. Actually, the web server is a restricted area. So we will have to use username and password to login that area. We can see the visiting path from the desktop or any other portable device.

Like other systems it is also not free from drawbacks. It will need the GPS service on from the time we want to track. It will mostly use the battery power of the mobile phone. For this reason our mobile phone can be automatically switched off for lack of power. We need to depend on Internet connection to store the information to the web server. If there is some problem with Internet connection or lack of necessary bandwidth, we may not be able to send the data correctly.

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