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Location Based Service For Information Publication Using GPS On Android-Based Mobile Phone

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***Abstract*-- The increasing development of mobile technology makes some technology capable to running on multiple mobile platforms. One of them is Location Based Service. Location Based Service is a service provided by the position of the user. One of the utilization of Location Based Service technology is a publication of public information. This information may include important information such as hotels, gas stations, ATMs, and Event. Location Based Service is very dependent on the user's position, therefore, the accuracy of component positioning should be accurate enough. By default configurations android GPS accuracy is not very good, needed tweaking to minimize errors in accuracy. To measure the accuracy shift used haversine formula. Haversine formula is a method to measure the distance between two points on the sphere based on its latitude and longitude. Based on test results without tweaking the maximum accuracy shift is 30 meters while with tweaking only 11 meters. Average accuracy shift without tweaking is 18 meters down to 8 meters using tweaking. Thus the process of tweaking can improve the accuracy of GPS.**

***Keywords* : Location Based Service, Android, GPS.**

I. INTRODUCTION

The development of mobile computing technology are rapidly and constantly evolving, much of the technology, methods, and new applications are introduced. One application that started a lot of public attention is LBS (LBS) [1]. LBS is a service that provides information based on the position of a device [2].

Mobile platform that can be used to implement the LBS technology is Android. Android is a mobile-based operating system developed by Google. Android is an open platform that anyone can develop anything in it. Android integrated with Google-Maps which provides tools for the development of LBS [1]. In contrast to previous studies conducted by Rizqi MachlizaPicture LBS use a custom map from personal photography and its service area range only inside the campus [3]. In this study the map service provider will use Google Maps and larger service area.

From that technologies LBS application created with advantage among others which is to create a new community. All community members can exchange information based on its location. This information contains information relating to the location, for example, information on hotels, rates, the available rest rooms, and other information about the event or in a place, for example the exhibition event, this information may include the date and duration of the exhibition. The LBS application expected to answer questions like: Where am I? What is going on here? where is the nearest gas station? How do I get there? simply by using a mobile device that provides such information.

II. BASIC THEORY

A. Definition of Location Based Service

LBS can be described as an application that relies on a particular location. The specific service of a location will be provided, in other words LBS is a service that provides information based on the position of a mobile device geographics location[2].

LBS has 2 main action :

1. Get user position .[2]
2. Provide Services based on the position [2]

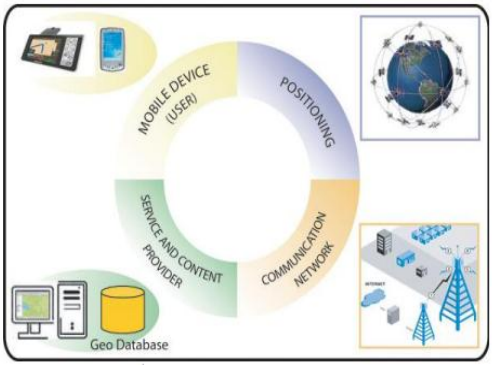
.

B. Location Based Service Component

In order to run well, LBS application need good infrastructure. The infrastructure including mobile

devices, applications, network communications, positioning components, and service server. [1,2]. Infrastructure of the LBS system can be seen in Figure 1.

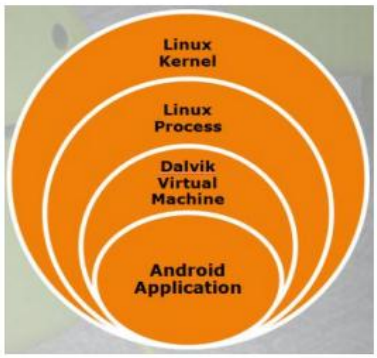
Figure 1. LBS Basic Component [2]



1. Android Mobile Device

Mobile device is a tool used by user to access LBS services.The device that will be used is a mobile phone with Android operating system. Android is a software used in mobile devices that includes an operating system, middleware and core applications. Android provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language, the Java code is compiled with the data and file the required resources and applications are incorporated by apt tools into Android package. The file is marked with the extension. Apk. It is this file that is distributed and installed as an application on a mobile device. Android architecture can be seen in Figure 2.

Figure 2. Android architecture [2]



2. Application

Application is a user interface for accessing LBS services. This software is usually created by the application provider. Downloaded and installed on the user's mobile device. A special application is usually made for a specific LBS services. Due to the shortage of mobile devices (small screens, limited processing power, and battery capacity), LBS applications should be light and battery saving.

3. Network Communication.

Network communication refers to the data communication from user to service provider, and returns the information back to the user. 3G network is the most widely used mobile devices. Mobile devices are usually controlled by the operator that provides the connection for mobile users and asking for payment for the transmission of data and voice.

4. Positioning Component

Positioning components typically required in the LBS to determine the location of the user's mobile device. Many LBS services now do not require manual input by the user location. But the location of a user obtained from positioning technologies such as satellite, and cellular networks.

5. Service Provider.

Service providers maintain the Server service which will provide different services to the users of LBS and are responsible for processing the user request and sends back the results to the user's request. The server calculates the position, route finding, or looking for specific information based on the user's position.

III. SYSTEM DESIGN

A. Server Side

The design includes the design of the webserver on the server and database information obtained from the user. Server that will be used is Debian Linux operating system. On the server will be installed Apache webserver that has PHP 5 component. Then the database will use mysql. PHPmyadmin used for database management..

1. Virtual Private Server

Virtual private server (VPS) is a virtual server that has its own public IP address that can be accessed from anywhere. IP address of the LBS system is 162.220.25.169. VPS used Linux operating system with debian distro version 6. VPS hosting the web server and database server.

2. Webserver

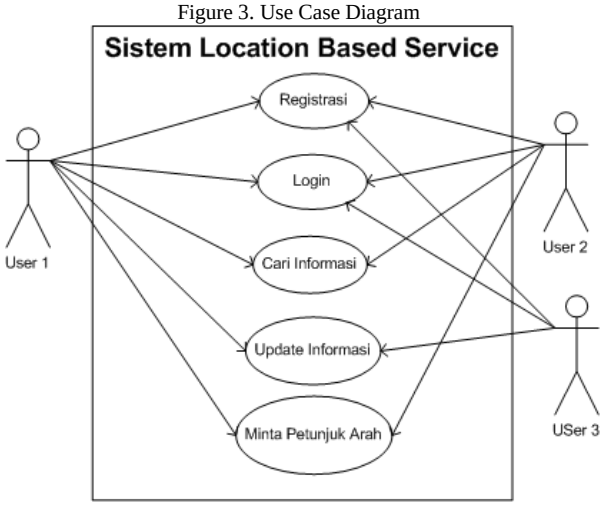
Webserver is a provider of a web service through HTTP or HTTPS protocol. Webserver system will be accessible through Location Based Service. Webserver to be used is already integrated with Apache PHP components.

There are four PHP script that will be used in the design of the LBS system :

- Register.php
- Login.php
- Update.php
- Cari,php

From the four scripts will form a Use Case diagram shown in Figure 3 below.

Figure 3. Use Case Diagram



3. Database Server

The data contains information obtained from users will be stored in the database. LBS system has one database which is contains two tables.User table is used for storing information about user and information table is used for storing information of a location service from user input. Field for the User Table can be seen in Table 1 below

TABLE I. User Database Table

Field	Type	Long
id	integer	11
uname	varchar	12
pass	varchar	8
email	varchar	60
nama	Varchar	60

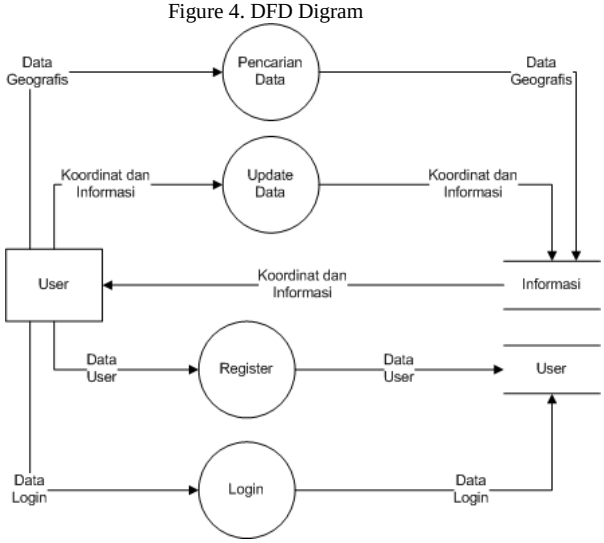
Field for Table information can be seen in Table 2 below.

TABLE II. Information Database Table

Field	Type	Long
id	integer	11
latitude	double	60
longitude	double	60
tipe	varchar	10
Info	varchar	300

Here is on figure 4 data flow diagram for the LBS system

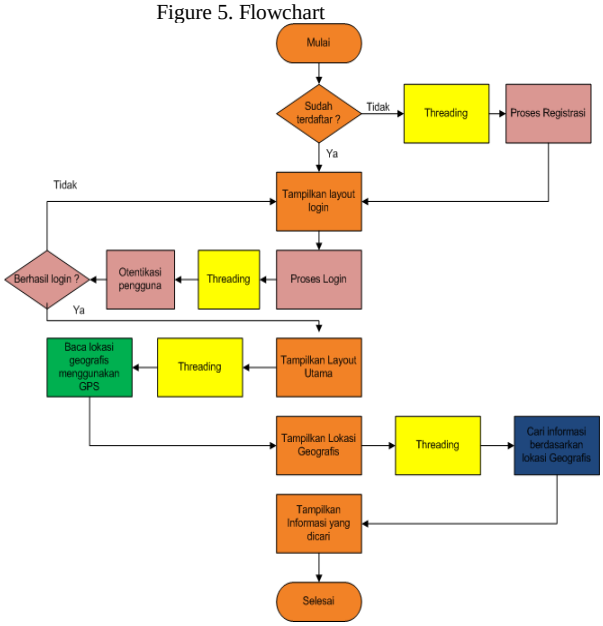
Figure 4. DFD Digram



B. Client Side

Client side designing the system for Location Based Service client. LBS system is written using the Java programming language. The design of software system plays an important role of Location Based Service. The algorithm will be translated into the Java language. The Flowchart can be seen in Figure 5 below.

Figure 5. Flowchart



C. Tweaking

The first step is tweaking android GPS configuration by editing the gps.conf file in the root directory / system / etc. Tweaking speed up the time it takes to lock the geographical position. Locking time duration will be used for benchmark and determining

duration request on the LBS system. By using benchmark duration on LBS system can reduce accuracy shifting because location request is done when GPS receiver is already lock Fix location.

IV. TESTING AND ANALYSIS

A. *GPS Accuracy*

The purpose of the LBS system is to provide the appropriate information based on the user's location. The user's location must be accurate in order to provide the right information. Therefore is necessary tests on components of the android GPS location provider.

1. Comparison of Coordinates

Comparison of these coordinates will compare the reading result with android GPS coordinates and current existing coordinates. Testing will take Prameswara monument location coordinates.

Capturing the value of the GPS using three mobile phones that are already installed android Location Based Service apps. The difference between the reading and the actual value will generate Error of measurement values. To determine the shifting distance of the coordinates can be determined by calculating the distance between the actual point to point GPS readings using the Haversine formula. Haversine formula is a method to calculate the distance between two points on a spherical plane based on its latitude and longitude [4]. Haversine formula is as follows :

$$d = 2r\ sin^{-1}\left(\sqrt{sin^2\left(\frac{\emptyset_2-\emptyset_1}{2}\right) + \cos(\emptyset_1)\cos(\emptyset_2)\ sin^2\left(\frac{\varphi_2-\varphi_1}{2}\right)}\right) \quad (1)$$

Description:

d = Distance between two points.

r = Constant radius of the earth is 6378.14 Km

$\emptyset_1$ = Latitude first point.

$\emptyset_2$ = Latitude second point.

φ_1 = Longitude first point.

φ_2 = Longitude second point.

From the above formula can be used for determining shifting point distance. The results of the calculations can be seen in Table 3 below.

TABLE III. Shifting Point

No	Handphone	The shift point (KM)(d)	The shift point (m)(d)
1	Lenovo A390	0,084499309	84,49930929
1	Samsung Galaxy Mini	0,00951388	9,513879959
3	Samsung S3 Mini	0,008378827	8,378826646

From the test results the farthest shifting point is Lenovo A390. It almost 85 meters. Because of that number 1 is not included in the analysis, too much deviation. For number 2 and number 3 deviation of its points between 8 meters to 9 meters. So the GPS reading for the monument Prameswara accurate to a radius of 8 to 9 meters. The results of sample calculations can be concluded that the accuracy of GPS android point ranged from 8 to 9 meters radius and varying kinds and types of mobile phone used.

2. Comparison of Native GPS

After compared with existing data and then proceed with comparisons using native GPS. Native GPS is an integrated GPS device. In this test it using GARMIN GPSMAP 76CSx and use mobile phone Lenovo A390. Testing is done by comparing the coordinates obtained using LBS system installed on android with native coordinates obtained using GPS. Samples taken are three existing gas station locations in Indralaya.

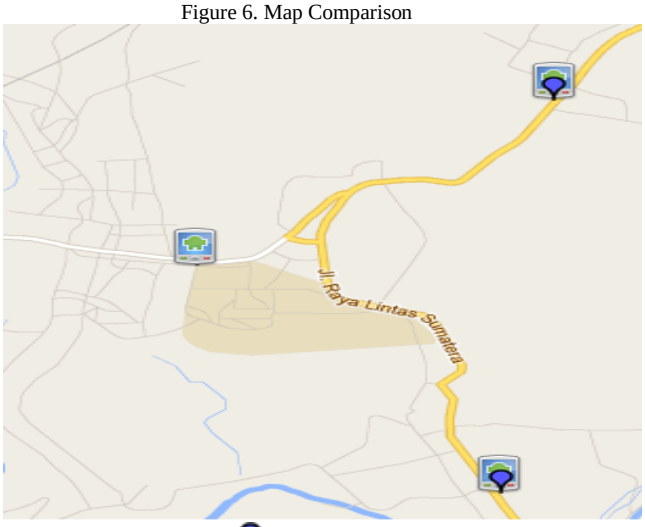
Here is a comparison Table of data obtained from native coordinates and GPS coordinates from GPS data.

TABLE IV. Shifting Point

No	Gas Station Code	The shift point (km)	The shift point (Meter)
1	24.306.137	0,017567062	17,56706152
2	24.306.100	0,013265173	13,26517338
3	24.306.26	0,01093047	10,93047039
	Average	0,013920902	13,92090176

From the above Table in mind the average displacement of point is about 14 meters. This shift is caused by differences in the receiving coordinates information of each device. To further facilitate the shift coordinate see used as a marker on Google Maps so that it can be seen how far the shift. Here is a picture comparison between native GPS coordinates readings with GPS android.

Figure 6. Map Comparison



Blue marker represent a point of pointing using GPS. Android marker represent a point of pointing using GPS in android phone.

Figure 7. SPBU 24.306.26

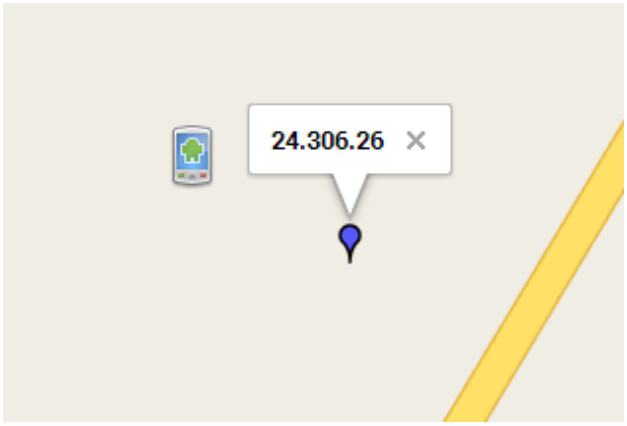


Figure 8. SPBU 24.306.137

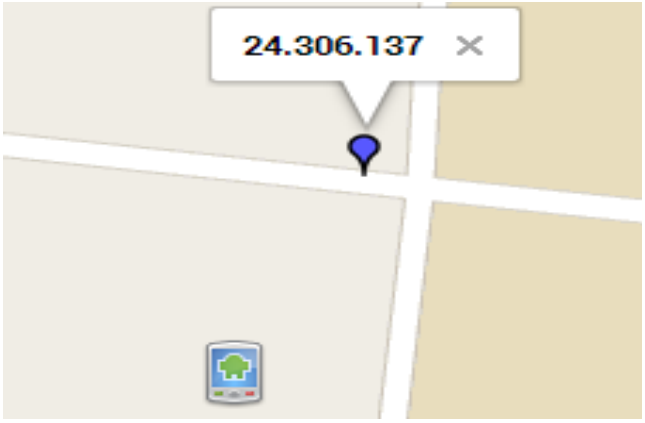
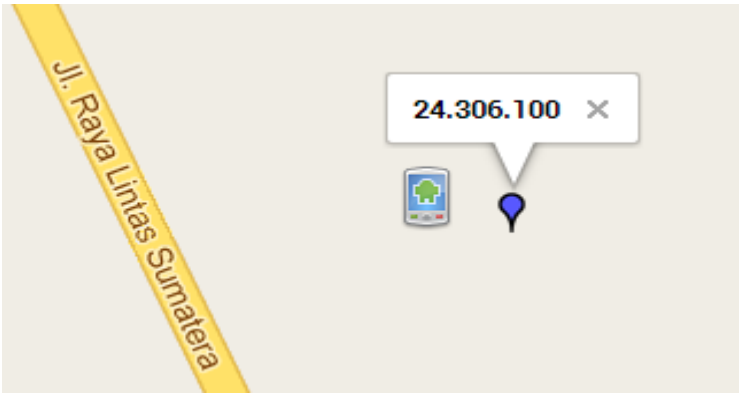


Figure 9. SPBU 24.306.100



From the map above the shifting point can be seen visually. For large areas such as gas stations shifting is not so significant because the shift is still in the area of the gas station itself but to a small area such as finding the location of an ATM needs to be improved in terms of accuracy of GPS in android
.

3. Location Verification

Based on the journal by T D'Roza and G Bilchev entitled An overview of location-based services can be seen from the accuracy of the GPS receiver that perform a coordinates data retrieval at the same location over and over again [2]. In this test the data collection is done each five times at intervals of 10 seconds based on Location Based Service lock time benchmark. Below is a Table of a database of information obtained from testing.

TABLE V. Accuracy shift of SPBU 24.306.137

No	Shifting Point (km)	Shifting point (m)	Error Latitude (%)	Error Longitude (%)
1	0	0	0	0
2	0,0303437	30,34375	0,0073191	0,00013225
3	0,0296331	29,63311	0,0032705	0,00023412
4	0,0130105	13,010519	0,0016093	0,00010033
5	0	0	0	0
Average	0,0182468	18,2468465	0,0024397	0,00009334

Based on the results of testing, the accuracy of the average data shifting is 18.2468465 meters or 0.0024397998% for latitude and 0.0000933445% for longitude.

B. Rectifying Error

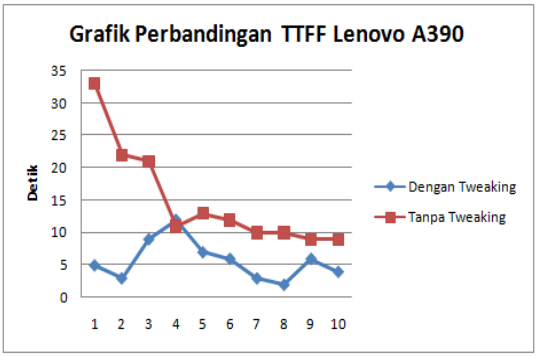
After tweaking on the phone and then testing whether tweaking successfully accelerate the locking time geographic location of the GPS. Tests were conducted at several locations and at random times in Indralaya area using the Lenovo A390 mobile phone

and use the GPS Test softtware. This software is able to calculate the time TTFF (Time To First Fix) at the GPS engine. TTFF is the length of time taken by GPS receiver to lock the GPS satellite signals and calculate position data calculation to obtain location information called Fix. Here is a comparison of before and after tweaking TTFF.

TABLE VI. TTFF Comparison

No	With Tweaking (Second)	Without Tweaking (Second)
1	5	33
2	3	22
3	9	21
4	12	11
5	7	13
6	6	12
7	3	10
8	2	10
9	6	9
10	4	9
Average	5,7	15

Figure 10. TTFF Comparison



From the above table the average displacement is 15 meters longer than the test results with tweaking. Thus tweaking process is deemed successful because it can reduce the duration required for locking the location in table 4, from 10 seconds to an average of 5.7 seconds compared without tweaking which is an average of 15 seconds versus 5.7 seconds. The average value is 5.7 seconds and the benchmark will be inserted into the coding system minimum_time of LBS as a parameter to determine the time to request geographical location.

After getting minimum_time parameter values and then proceed to test the accuracy of the shifting and compared with the results in Table 6. Tests will be conducted with the same test parameters as in Table 6 used mobile phones Lenovo A390 and take the location of gas stations Romi Herton but with varying pause time depending on the shifting. the system will record the new data when new position data obtained in a span of 50 seconds. 50 seconds is taken by testing the parameters in Table 5, which is 5 times the retrieval of data every 10 seconds. At this time of testing data collection is not set once every 10 seconds, but everytime new coordinate data received. The fewer the data obtained during the 50-second interval the better accuracy because the coordinates does not shift. The application was made separately to meet the needs of the test. This application will run a countdown timer for 50 seconds then record the coordinates of the data obtained and record how much shift is happened.

Here is a screenshot at the time of testing and test results table.

Figure 11. Shifting Test

TABLE VII. Shifting Position

No	Shifting point (km)	Shifting point (m)	Error Latitude(%)	Error Longitude (%)
1	0	0	0	0
2	0,0111160	11,11603	0,00005192	0,00009556
3	0,0044857	4,485702	0,00109015	0,00001911
4	0,0091520	9,152031	0,00243984	0,00002389
Ave-rage	0,0082512	8,251254	0,00089547	0,00003464

Figure 12. Shifting Error

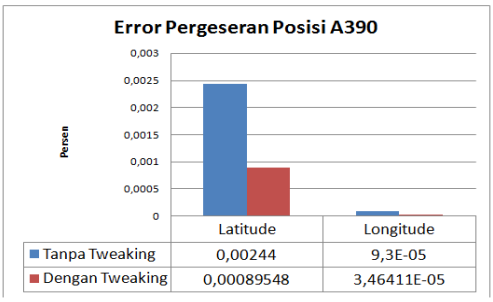


Figure 13. Average Position Shifting

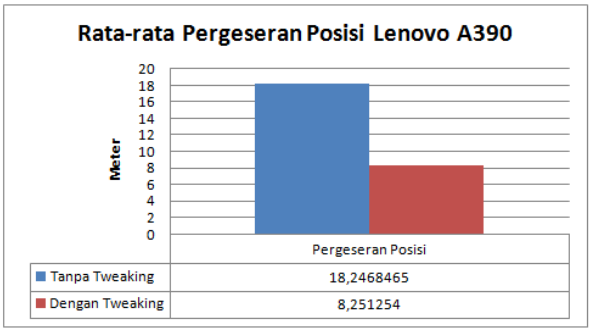
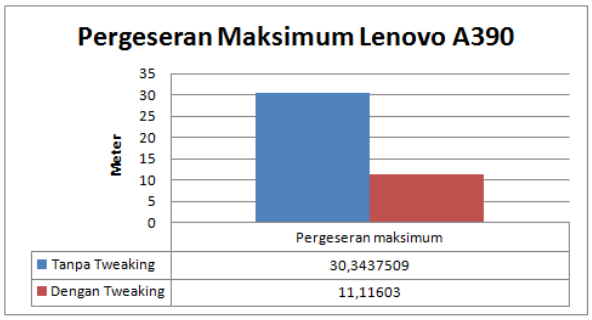


Figure 14. Maximum Shifting Point



C. *Testing Applications*

Application testing aims to test whether the application is running properly and in accordance with the design concept. Tests performed on the android emulator and on the real android phone. Here is a screenshot of testing using the emulator and testing on the mobile phone.

Figure 15. Testing on Emulator

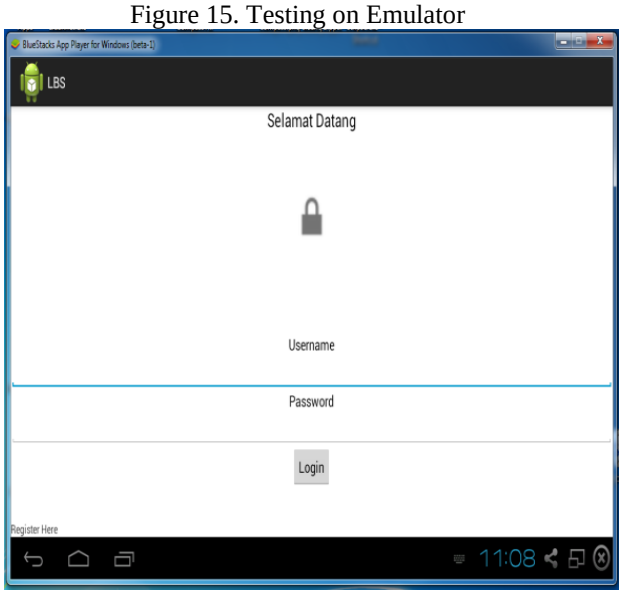
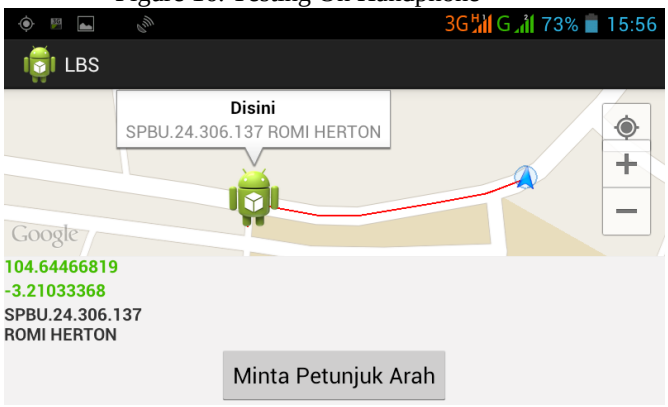


Figure 16. Testing On Handphone



Based on the test results can be proved that the application of the LBS system is correct, both in simulation and on a testing program directly.

V. Conclusion

LBS can be ported to smaller and portable device like mobile phone.

Android GPS can be used on the system to determine the coordinates of LBS users.

There is difference in the accuracy of the GPS readings used in Mobile The shifting point is about 18 meters.

The process of tweaking can improve the speed and accuracy of position locking. Before tweaking, the old locking FIX takes 15 seconds, after tweaking the old locking down to 5.7 seconds. For accuracy shifting is down from an average of 0.0024397998% to 0.0008954799% for latitude and 0.0000933445% to 0.0000346411% to longitude or from 18 meters to just 8 meters.

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