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Design and Implementation of Location Tracking System for an Android Operating System

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ABSTRACT

In this study, a Location Tracking System (LTS) for an Android Operating System was designed and implemented using a wireless network. Wireless network provides location information from devices to service providers and send the results from the providers to devices. Probabilistic location algorithm was used to determine the nearest location of a user. Google map provides the location-based services; it gives coordinate of latitude and longitude. Latitude measures from south to north and longitude measures from west to east. Every position that is located east and north have a positive number, and everything west and south have a negative number. Real-Time Direction was used to determine the current location and position of user (person) at a given time; calculating the initial position of user and change in position. System was tested in RSU environment, showing the route and distance between two points. Proposed system performed better than Uddin location tracking system with more features (direction pointer, detection of nearest place and search). Java programming language was used to develop the system.

Keywords: Location, Tracking System, Android, Operating System, Design, Implementation

1. INTRODUCTION

As the global technology systems grow, one of the fundamental needs arose to curb challenges facing and threating national and global existence, tracking structure became an imperative technology to monitoring criminal tendencies. Tracking system has long been applied in some of the civilized countries in detecting movement of people and supply of commodity to destination of demand at every time of request place for such services. Varieties of tracking system are used for each specific task. Certainly tracking systems were confines to an event that happens with time, the pointer is regarded as time lag, thus, the time intervals were collected as data within the period when an item has moved from the source, items or commodity are secured with a security codes which are in different forms as such bar codes are often used for good differentiation and price.

In some famous organizations, tracking systems had become an important alternative for securing cars, office property, for reason of tracing a community and a building, global positioning systems (GPS) was introduced for easy identification of persons or item subject to how data is greatly revitalised. Bar-codes are secret code that needs a person to scan object for automatic documentation. Tracking system was programmed in discrete hardware and software system which offers separate application needs. Bar-code systems are isolated from Electronic Product Code (EPC) systems, and GPS systems are distinct from active Real Time Locating Systems (RTLS) for instance, a passive Radio-Frequency Identification (RFID) system would be utilized in a distribution center to scan the crates as they are stacked on a truck - at that point the truck itself is tracked on an alternate system utilizing GPS with its very own features and software (Lonestartracking, 2018).

Today lots of research is being done in the field of tracking the location, position of an object. The need to track location of place, position of an object can be done due to various reasons and so are the procedures. Various quantities of techniques have been created so as to satisfy this need. Technologies and software programming are additionally present yet it is out will so as to utilize which method for tackling the issue of area following. are also present but it is our will in order to use which way of solving the problem of location tracking. Tracking systems are costly prerequisite for discovering missing items or goods or price of items and tracking missing cars or using stronger and formidable software platform that handles global locations, this is needed to describe or to define the global community locations or in keeping with tracking principles. General Packet Radio Service (GPRS) tracking system in mixture with Global Positioning System (GPS) used for the detection of a particular location of a missing items or goods, whilst GPRS tracking system was used for the location of global village or vehicles (Junaid *et al.,* 2009).

This paper focuses on building location service application using Android by providing routes on device maps. The application uses geographical locations and its time report discover from the Global Positioning Satellite.

2. RELATED WORKS

Researchers have contested that Ubiquitous GPS Vehicle Tracking and Management System was imperative request to reduce car or vehicle snatching, with this in mind, they proposed the use of two kinds of customize applications, mobile and web application. Be that as it may they are likewise utilizing SMS portals in conveying message, where GPRS are transferring web information which are temperamental (Almomani *et al.*, 2011). Asim *et al*., (2015) proposed Position Tracking and Fuzzy Logic. The issue of tracking the situation of an item from remote spot is explained by applying the principles of fluffy rationale. The area of picture investigation and man-made reasoning was coordinated in order to follow the situation of the object and set results that are progressively exact. The object was distinguished and after that followed until it has surpassed the scope of a camera. Fluffy guidelines were made to achieve the objective. A video was first changed over into edges and after that utilizing strategy of foundation subtraction, the object recognised and afterward tracked which is an ideal arrangement just as exact.

Several attempts were dotted to improve on the implementation on real-time cost effective of people tracking system to reduce high level spending in tracking activities, efforts have improved that the combinational use of the general packet radio services and the global position system are made small, or portable to place mobility a priority. The projected interest had offers cost minimization in several tracking engagements (Essam, 2015). Researchers has considered factors that lead to loss of personal property and the keeping of individual, security, resolve to design and efficient secure tracking system that could be used for checking the situation of an individual and keeping to that the same time guarantees the secrecy, trustworthiness verification and freshness of the transmitted data. It considers mechanisms that opposed anti-spoofing on the acquired area data (Morais, 2015).

An effective contribution by renown researchers which states that mobile tracking is a better option to curb mobile restriction or total loss of items. The use of GPS, google mapping has increased the investigation on how to successfully actualize the application of an Android device or gadgets to give a conclusion on tracking a colleague's location at a critical point of view (Drew, 2012). Mahalingam *et al* (2014) proposed "Android cloud computing for vehicle tracking using GPS" which utilizes just cloud server to store vehicle location and tracking. Be that as it may, the actual framework does not consider power and cost optimization.

With the introduction of tracking systems in business and daily operations, tracking system has eminence in the sense that, it has reduced vehicles, goods and items misplacement around the globe, so many attempts were made to refreshly introduced better and more effective intelligent tracking system, researchers proposed SWTRACK, the proposed tracking system in best used for tracking vehicles location. Result indicates that the system has an efficient component view vehicle deviation (Oliveira et al, 2013). Some notable scholars agreed that tracking system must be efficient and capable of performing the targets, therefore many other techniques has been used in developing such system. In this present time the researchers have proposed "A secure tracking system that has a GPS – mobile phone component as a tracking tool, where java application was installed on the mobile phone and web portal whose mechanism was to monitor location and use geofencing, they use the GPS of the mobile phone to attain its location, this system required too much energy to perfect the required tasks. It is noted that the system is dedicated to tracing or tracking and securing inter-woofing communication locations (Bilsic & Alkar, 2011).

3. SYSTEM DESIGN

Architecture specifies the structure, views and action of a system. Figure 1 shows the component of location-based tracking service. A location-based service is based with respect to the land position of a cell phone. The location-based service could find an object in the Rivers State University location.

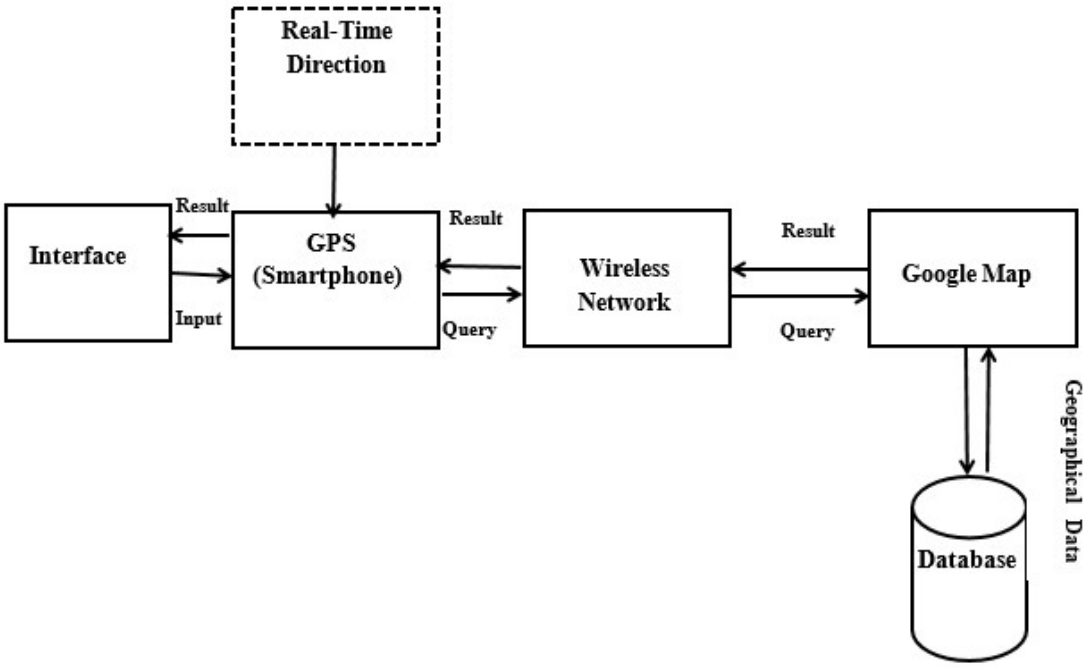

Figure 1: Architecture of Proposed System

3.1 Smart Phone

Smart Phone serves as GPS. Android smart phone uses its inbuilt GPS to fetch location. GPS is a route satellite framework that gives area and time data to anybody with a recipient. The GPS framework comprises of three portions: space section, control framework and user segment. The user segment includes the GPS receiver, which gets the sign from the GPS satellites and decide how far away it is from each satellite. The GPS receiver takes the data from the satellite and uses the technique for triangulation to decide a user's precise position.

3.2 Wireless Network

Relay on the query and location data from gadgets to service providers and send the outcomes from the suppliers to devices. Wireless network utilizes history based algorithm that is a progression of sequential sign strength, for location determination. Contingent upon whether the nearest neighbour algorithm or Bayesian algorithm is utilized to pick the in all likelihood neighbours, thus history-based algorithm is used in this study is probabilistic. The accompanying steps must be pursued to track any individual who is moving:

i. When the user is walking, real-time signal strength is to be gathered on periodic
ii. basis.
iii. Use the probabilistic algorithm to discover the most appropriate locations in the route, known as the nearest neighbour. Here K is a predefined parameter.
iv. In history vector of k closest neighbour, the segment of the most established k closest neighbour is erased and the segment of the newest k closest neighbour is to be added, with the goal that the depth of the history vector keeps h.
v. Then, ascertain the shortest route from the last evaluated location to the newest k closest neighbour in to the history vector. The separation between the two points is known as the physical distance.
vi. The end point of the shortest route is known as the current assessed location of the cell phone.
vii. The steps are to be repeated, until the user quits tracking procedure.

3.3 Real-Time Direction

To determine the current location and position of person at a given time.

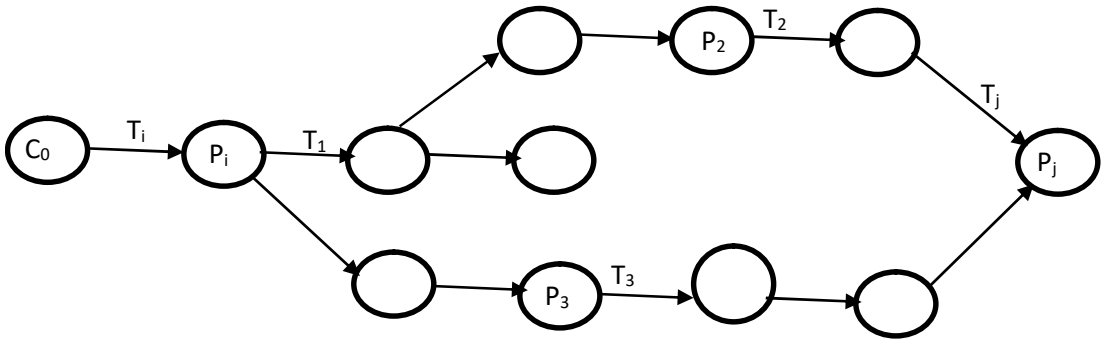

Figure 2: Network Graph Showing Real-Time Direction

C_o represent a person current location
(ti...tj) represent the transition

The position (P) of person can be determined in Figure 3

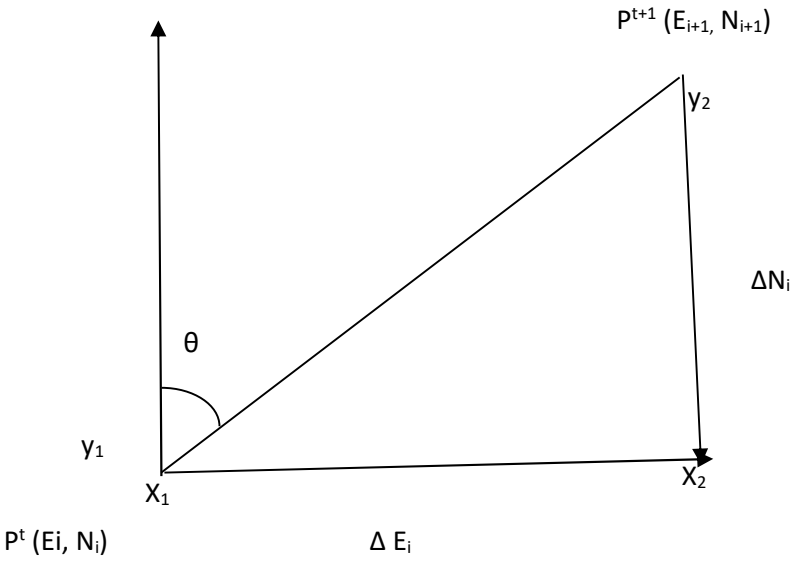

Figure 3: Current position of person

Assume Pt and Pt+1 represent to the individual position on a route at time t and t+1 separately. The underlying position of the individual at point Pt is known. From the direction of the route (for example θ) and position of the individual at Pt+1, the movement in easting and northing can be gotten as pursues:

$\Delta E_i = (p*1) \sin \theta$ (1)

$\Delta N_i = (p*1) \cos \theta$ (2)

So, the position of the person at point P^{t+1} can be calculated as follows:

$E_{i+1} = Ei + \Delta E_i$ (3)

$N_{i+1} = Ni + \Delta N_i$ (4)

Suppose a person location is found at point P with easting E_S and northing Ns. The (PE_S) and (PN_S) on the route can be gotten as follows:

$$PE_S = \frac{(X_2-X_1)[E_S(X_2-X_1)+N_S(Y_2-Y_1)]+(Y_2-Y_1)(X_1Y_2-X_2Y_1)}{(X_2-X_1)^2+(Y_2-Y_1)^2} \quad (5)$$

$$PN_S = \frac{(Y_2-Y_1)[E_S(X_2-X_1)+N_S(Y_2-Y_1)]-(X_2-X_1)(X_1Y_2-X_2Y_1)}{(X_2-X_1)^2+(Y_2-Y_1)^2} \quad (6)$$

Distance Among Two Points on the Earth:

Calculating the longitude and latitude: knowing start and end point of the cities, streets, or even smaller distances, as well as the geographical coordinates of each point. Consider measuring the distance between UST roundabout and

Convocation Arena, their respective coordinates would be as follows:

I. UST roundabout (latitude 4.805715N, longitude 6.987883E)
II. Convocation Arena (latitude 4.801466N, longitude 6.980991E)

For calculation purposes, southern latitudes can be expressed as negative numbers, as can western longitudes. Latitude and Longitude can be derived by applying the Haversian formulae:

$$a = sin^2\left(\frac{\Delta\varphi}{2}\right) + cos\varphi 1.cos\varphi 2.sin^2(\Delta\lambda/2) \quad (7)$$

$$c = 2 * atan2(\sqrt{a}, \sqrt{(1-a)}) \quad (8)$$

$$d = R * c \quad (9)$$

Where φ represent the latitude and λ represent longitude, '*a*' represent starting position, '*c*' represent endpoint position,'*d*' represent distance and 'R' represent radius.

3.4 Algorithm for Real-Time Direction

The algorithm utilizes the accompanying steps to relegate the route direction and determine persons' position at current location.

i. Find the nearest node from the principal GPS point (i.e., starting point) C0.
ii. Check whether the following point is an anomaly. In the event that not, at that point select all the street sections that go through the nearest node, generally accept this point as the initial point and go to step-1.
iii. Using (equation 2 and 3), pick the right route. These two points (i.e., beginning point and its next point) ought to be matched to this route.
iv. Determine the individual position on the right route for each one of the two points utilizing Equation 4 and 5.

4. DISCUSSION AND RESULTS

Before a location is tracked, longitude and latitude of a place must be obtained. The location tracking, tracks the name, longitude, latitude and address of a place and provide a route. The system could identify the current location of user, allow user to search nearby location and show real time direction of as user move from one point to another using real time direction pointer (blue object). Figure 4 shows the home page of a location tracking system; this consist of a tracking button that displays the current location of user, to get started user must press on tracking button (Red button) and user is prompted on the next action to take. Figure 5 illustrates the present location of user. Current location page consists of the location maker (red button), direction tracer (blue pointer) and route. Location maker points to the exact location of user, direction tracer move along with the user, showing the direction. The direction tracer fetches the next location. In Figure 6 the current location of user was at Central Administration Building Junction, in Rivers State University, user move towards Convocation Arena.

Figure 7 shows next location of user, currently at Faculty of Law. This indicates the roundabout of central library and farm junction, user took left route leading to Law and Science and arrived at Faculty of Law. Figure 8 shows the arrival of user at Faculty of Science car park, which was the endpoint of user. Figure 9 represents Nearby location of

user, detailing the places in a drop-down list. Experiment was conducted at Rivers State University. Starting point was UST roundabout with coordinate values at latitude 4.805715N and longitude 6.987883E, Central Admin building with latitude 4.800279N and longitude 6.983936E, Convocation Arena with latitude 4.801466N and longitude 6.980991E, Faculty of Law of with latitude 4.799157N and 6.978004E as shown in Table 1. To measure the distance between two points; Starting point (UST roundabout) to any of the faculty, we applied walking distance measurement. Distance was measured in 1 decimal point; unit symbol is in kilometre as shown in Table 2. Distance "From UST roundabout to Faculty of Law" is 1.6km. It very well may be accepted that a distance measurement is a straight line from a lot of point to another point.

Figure 4: Home Page

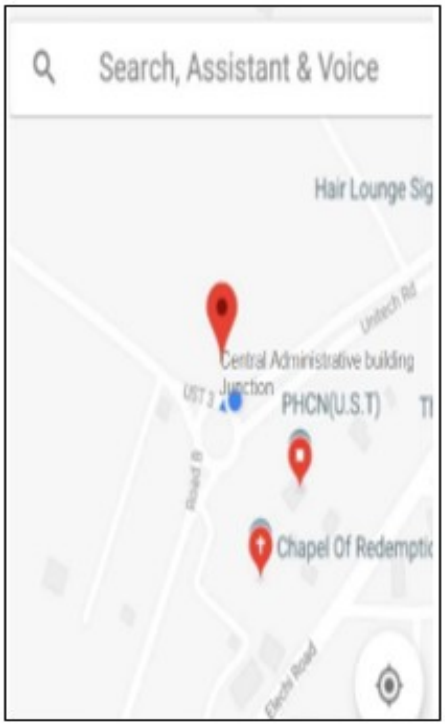

Figure 5: Current Location

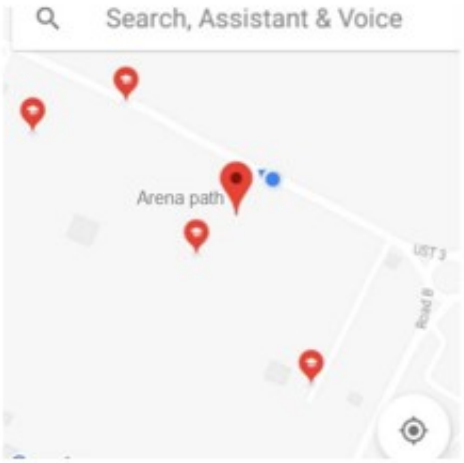

Figure 6: Arena Route

Figure 7: User Arrival at Faculty of Law

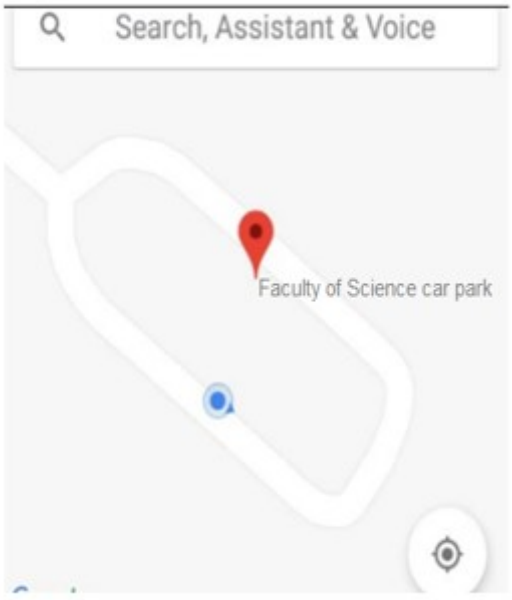

Figure 8: User Position at Faculty of Science Car Park

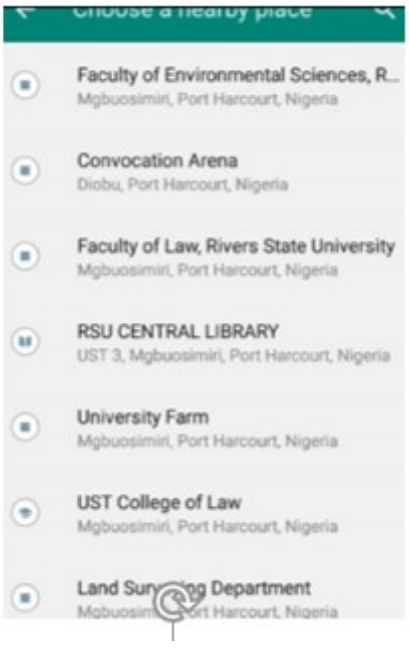

Figure 9: Search Result

Table 1: Longitude and Latitude

PLACE	LATITUDE (N)	LONGITUDE (E)
(INPUT)	(OUTPUT)	
UST roundabout	4.805715	6.987883
Central Admin building	4.800279	6.983936
Convocation Arena	4.801466	6.980991
Faculty of Law	4.799157	6.978004
Faculty of Science	4.797371	6.978722
Faculty of Engineering	4.797414	6.978528
Faculty of Environmental Science	4.799579	6.979011
Faculty of Management	4.8056965	6.9880235

Table 2: User Visited Route

The total visited path of a user and the distance covered

S|N	ONE POINT TO OTHER POINT (INPUT)		DISTANCE (KM) (WALKING) (OUTPUT)
1	From UST roundabout	To Convocation Arena	1.3
2	From UST roundabout	To Central Library	1.4
3	From UST roundabout	To Faculty of Law	1.6
4	From UST roundabout	To Faculty of Science	1.8
5	From UST roundabout	To Faculty of Engineering	1.9
6	From UST roundabout	To Faculty of Environmental Sciences	1.3
7	From UST roundabout	To Faculty of Management Sciences	1.0
8	From UST roundabout	To Faculty of Tech & Science	1.8
9	From UST roundabout	To F & G Hostel	1.7

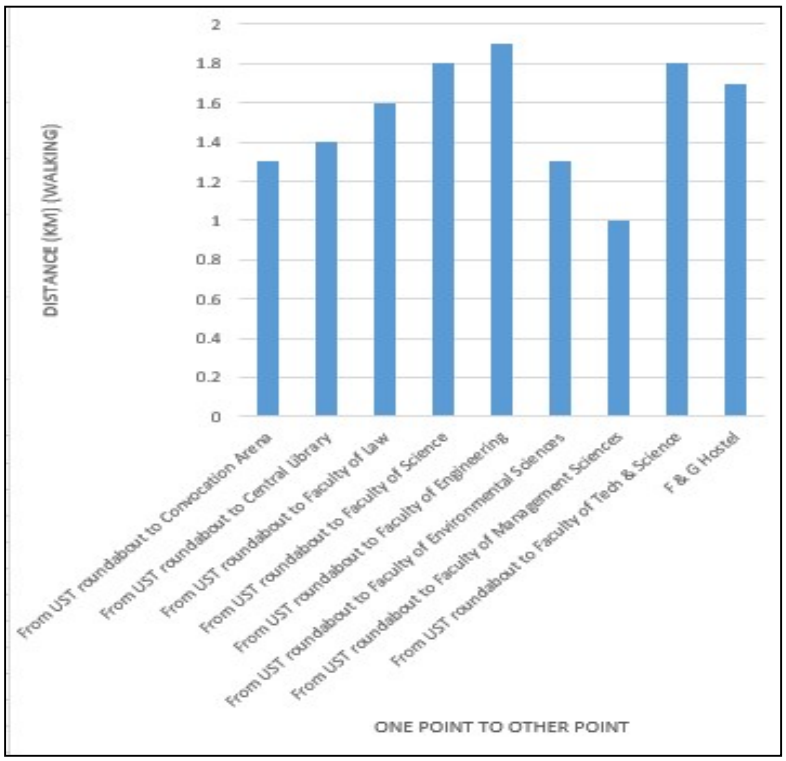

Figure 10: User Visited Route

Table 3: Comparison between the proposed system and another related system

S|N	NAME	SECURITY	ACCURATE PREDICTION	USABILITY	DIRECTION POINTER	DETECT NEAREST PLACE	SEARCH
1	Location tracking system (Uddin et al.,2013)	✓	✓	✓			
2	Proposed System	✓	✓	✓	✓	✓	✓

5. CONCLUSION

The inspiration of this research is to assemble an Android based application for giving a location track to the clients. By utilizing Android SDK and Eclipse IDE as the development environment the application is assembled remembering about the design principles and viability of the code. Location Tracker utilizes GPS features of the Android gadget to give a rich client experience to the travellers empowering them to fetch nearby place and locations visited, and direction pointer was implemented which points to the direction of the user. This application is very simple to display the users' routes and other details. The location tracking system developed has been applied to route in UST environment. User current location and user visited route was identified together with the latitude and longitude. Distance between two points was measured, real time direction tracer gave direction/position of user at any time.

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