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Energy Efficient Location Tracking System Using Smartphone Sensors

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ABSTRACT

Wireless location finding the key technologies for wireless sensor networks.GPS is the technology used but it can be used for the outdoor location. Indoor locations include buildings like supermarkets, big malls,parking,and locations under thesame roof. In that areas, the accuracy of the GPS location is greatly reduced. So to find out the correct location for indoor environment we use the RSSI (Received Signal Strength Indicator)based trilateral localization algorithm. Algorithm has become the conventional localization algorithm in the wireless sensor networks. With the development of the wireless sensor networks and the smart devices the WI-FI access points are also increasing. The mobile smart device detects minimum three known WI-FI hotspots positions. And using the values from the WI-FI routers it calculates the current location of the mobile device. In this paper we have proposed system so that we can find out the exact location of the mobile device in the environment and can navigate to the destination using the navigation function and also can beable to low consumption of the mobile battery for the tracking purpose.

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I. INTRODUCTION

The communications is currently the major driving force of the development of indoor location services for wide range of applications such as those in commercial, agriculture, medical, and the military uses. Many wireless technologies can be used for indoor positioning applications. Some systems make use of an existing wireless network infrastructure. Wireless Sensor Networks (WSNs) due to the advantages in term of low power consumption, light weight as well as low cost. Existing indoor localization systems are classified into the 3 types based on the structure of serviceareas. These include the indoor localization systems for 2-Dservice areas, 3-D service areas, and multi-story building. Most of existing systems are designed for usages in 2-D areas where the position of target object is defined by a coordinate. The second type of the indoor positioning system considers a 3-D space in a small service area, such as in a room. Compared with outdoor localization, the difficulty of indoor localization lies in that indoor maps pay more consciousness to small areas, largescale, high precision and display of the internal elements. Existing wireless localization algorithms require either special hardware support or complex computing, which consuming valuable battery resources, especially comes to smart phones or sensors. The contribution of this paper is that it suggest a new algorithm which increases the indoor localization accuracy not containing any additional hardware support or enlarge the computational complexity.

II. LITERATURE SURVEY

The system contains design and implementation of a high-accuracy global positioningsolution based on GPS and human mobility captured by mobile phones. It proposesa prototype system,namedGloCal, and conduct inclusive experimentsin both crowded urban and spacious suburban area. GloCal is an effective and lightweightaugmentation to global positioning. GloCal uses merely mobile phones andrequire no infrastructure or additional reference Information. The results show that GloCal can achieve 30 percent improvementon average error with respect to GPS.[1] The feature points in the frames are found and then classified as belonging to foregroundor background features. This paper makes three major contributions:- It hasgood performance for a moving camera without additional sensors. It works well fortracking overlapping objects and objects whose scale changes.[2]It presents MapCraft, a novel, robust and responsive technique that is extremelycomputationally efficient and does not require training in different sites.Indoor trackingand navigation is a fundamental need for pervasive and context-aware Smartphoneapplications. Itis very lightweight. It can be running in under 10 ms on a Smartphone.[3]

III. PROPOSED SYSTEM

In the indoor environment with each WIFI routers there are some attributes. Inour system we will be using the strength that is the level and the frequency for thecalculation of the distance of the mobile from the WIFI routers. But as we are dealingwith the accurate location finding and also less consumption of the battery wetake the assistance from the mobile sensors. The smart mobile has the number of thesensors embedded within it. But for our system we use the accelerometer and theorientation sensors. We calculate the distance value to plot the mobile device locationand to check whether the user is moving to check speed and the path change wetake the sensor values.

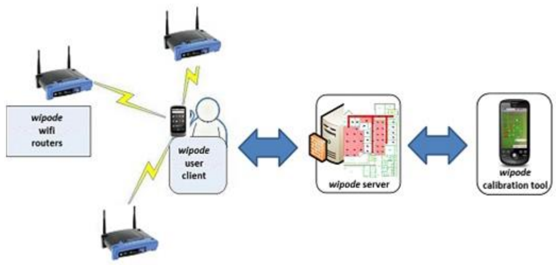


Figure 1: General Architecture

This is the general architectural diagram of the system. The system has one webapplication and one application running on the smart mobile. The smart mobile userfirst download the map of the indoor environment for which he wants to enable thenavigation with login in to the system. The user gets the map on the smart mobile. With the search function user can search for the desired position and can enable thenavigation to reach to the destination. The system takes the assistance from the mobilesensors also for the low battery consumption and for the more accurate locationof the smart mobile in indoor location.In the environment we can't guess the user behavior the user might be at one positionor he can take the turns the speed variation all these behavior can be pointedout using the accelerometer and the orientation sensors. These sensors sends thelocation samples to the server and those are plotted on the map and the trajectory is made.

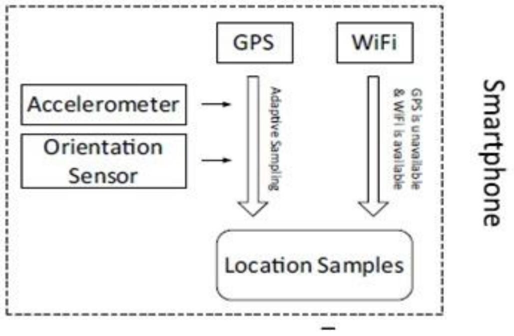


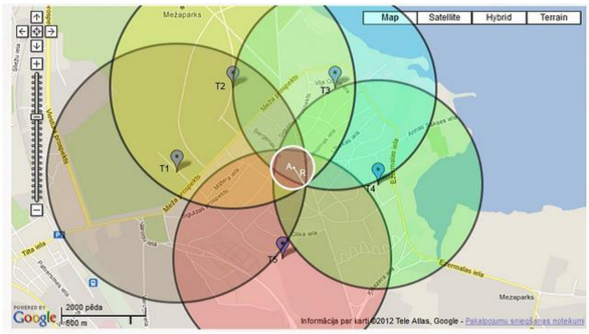
Figure 4.2: Sensors Data

The mobile sensors and the WIFI routers can be user for the indoor localization because of the accuracy and the consumption of the less mobile battery

IV.ALGORITHMS

- **Triangulation Algorithm**

Triangulation offers a way to discover yourself in space. This technique was used bythe Cartographers in the 1600s to compute things like the height of the cliff, whichwould be too impractical to measure directly. After the triangulation method evolvedinto an early navigation system when Dutch MathematicianWillebrord Snell discoveredthree points can be used to locate a point on to the map. While triangulationmethod uses angles for locating the points, whereas trilateration uses lateral distances.If we know positions of three points P1, P2, and P3, as well as our distancefrom each of the points, r1, r2, and r3; we can look at the overlapping circles formedto estimate where we are relative to the three points. The technique can be extendedto 3D, finding the intersecting region of spheres surrounding the points



- **Mathematical Model**

Free-space path loss is proportional to the square of the distance between thetransmitter and receiver, and also proportional to the square of the frequency of theradio signal.

The equation for FSPL is

FSBL(db) = 10log10((4)2df)= 20 log10 4 df = 20 log10 (d) + 20 log10 (f) + 4 = 20 log10 (d) + 20 log10 (f)147.55

Where the units are as before For typical radio applications it is common to findf measured in units of MHz and d in Kmsin which the FSPL equation becomes

FSPL(dB) = 20 log 10(d) + 20 log 10(f) + 32:45

For d, f in meters and kilohertz, respectively, the constant becomes -87.55 Ford,f in meters and megahertz, respectively, the constant becomes. -27.55 For d,f inkilometers and megahertz, respectively, the constant becomes 32.45

- **Haversine Formula**

1. The haversine formula is an equation important in navigation, giving greatcircle
2. distances between two points on a sphere from their longitudes and latitudes.
3. It is a special case of a more general formula in spherical trigonometry, the lawof haversines, relating the sides and angles of spherical triangles.

For any two points on a sphere, the haversine of the central angle between them is given by

$$\operatorname{haversin}\left(\frac{d}{r}\right) = \operatorname{haversin}(\phi_2 - \phi_1) + \cos(\phi_1)\cos(\phi_2)\operatorname{haversin}(\lambda_2 - \lambda_1)$$

where

- *haversin* is the haversine function:

$$\operatorname{haversin}(\theta) = \sin^2\left(\frac{\theta}{2}\right) = \frac{1-\cos(\theta)}{2}$$

- d is the distance between the two points (along a great circle of the sphere; see spherical distance),
- r is the radius of the sphere,
- ϕ_1, ϕ_2: latitude of point 1 and latitude of point 2
- λ_1, λ_2: longitude of point 1 and longitude of point 2

Figure 6.1: HAVERSINE FORMULA

V. CONCLUSION

This paper provides technique for indoor tracking using the WIFI routers. The Smartphone sensors accelerometer and the orientation sensors are also used to find out the accurate location of the smart mobile. These techniques don't require any additional hardware and as the sensors require very less battery consumption than the GPS it can be used to save the battery life.So with this the areas under the big roofs which are not tracked by the GPS can be tracked and also can be navigated over the site map. In future the system can be integrated with the outdoor location tracking system one system can be formed for tracking any location on the smart-phone.

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