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RESEARCH ARTICLE OPEN ACCESS

Indoor Mall Navigation

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ABSTRACT
Big shopping malls usually provide a directory to their available shops, but these directories are most of the time static and do not provide any interactivity features to the visitors. In this work, we present a mobile shopping mall navigator. The main purpose behind the conceptual idea of this project is that when visitors often change their plan to go to other shops instead of the ones in their minds, it can be full of effort especially considering the crowded levels and location of the navigation material. The application developed is practical and feasible as smart phone application helps you in building an alienated mall. An application that needs real-time, fast, & reliable data processing.

Keywords- Indoor Navigator, Mall Directory ,Indoor Maps, Android Shopping Application**,** Barcode.

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I. INTRODUCTION

Android is an open source platform that was supported in 2003 presently developed by Google[17]. Manual looking is that the ancient manner of looking whether the purchase to choose their needed product and carry their merchandize at the side of them[1].Ancient looking good could be a tedious and time overwhelming job[17]. In ancient looking ,the client has got to wait in long queue and wait at the money counter[17].This consumes lot of our time and energy[17]. To avoid this way, the client himself will scan the barcode and pay the bills on-line by his smart phone application[17]. In recent years, significant developments in locational technologies and in the power and the size of the mobile devices have brought advanced portable location-aware systems into our day-to-day life[2]. Navigation systems are one of the more common location-aware services , and many people use them on daily basis[2]. Providing location information through a user-friendly interface is crucial in navigation system, as is the accurate determination of user locations and target locations[2]. Global positioning systems(GPS), which offers maximum coverage, has been widely used to provide location information since Selectively Availability(SA) was turned into 2000[2]. However, it is well-known that GPS performs too poorly inside building to provide usable indoor positioning[2]. It is for that reason that indoor navigation systems are considered much more challenging than outdoor navigation system[2]. Commercial ad research –based organizations have therefore carried out a larger no of indoor positioning and navigation projects[2]. Most passed and current indoor navigation systems are electronic sensor-based, relying on infrared, ultra sound radio frequency, and so on, all of which necessitate and extra installation cost. Hence, the main purpose of the project is that it is a real-time ,fast, & reliable data processing and also the customers would not suffer from getting an effort especially considering the crowded levels and location of the navigation purpose.

II. LITERATURE SURVEY

This paper outlines the software navigation engine that was developed by SPIRIT Navigation for indoor positioning on commercial smart phones .A distinctive feature of our approach is concurrent use of multiple technologies for indoor positioning. Measurements sensor (magnetometer),WiFi and BLE modules, together with the floor premises plan are used for hybrid indoor positioning in the navigation engine. Indoor navigation software uses such technologies as PDR, Wi-Fi fingerprinting, and map matching. Being blended in the particle filter, dissimilar measurements allow solving a set of principal tasks. First, the navigation engine can automatically start in any place of a building wherever user switches on his or her smart phones. There is no need to enter initial position manually or to start outdoors where initial position can be determined by GPS/GNSS receiver . Then, operating in the tracking mode, the navigation engine provides real-time indoor navigation for displaying current user position either on the floor plan or on Google Indoor Map if the latter is available for building . At last , the navigation engine can allows can recover tracking from failures that are the known problem of the particle filter occurring when all particles are accidentally discarded. The automatic recovery of tracking in this case allows continuing tracking in this case allows continuing tracking and increasing availability of indoor navigation. The navigation engine exits in a form of SDK that serves for building mobile applications both for Android and IOS. Positioning results given for different indoor environments in a shopping mall and in a big exhibition hall show fast TTFF indoors and accurate and reliable real-time indoor positioning with accuracy of about 1-2m. [1]A global indoor positioning system (GIPS) is a system that provides positioning services in most buildings in villages and cities globally. Among the various indoor positioning techniques, WLAN-based location fingerprinting has attracted considerable attention because of the wide availability of WLAN and relatively high resolution of the fingerprint-based positioning techniques. This paper introduces methods and tools to construct a GIPS by using WLAN fingerprinting. An unsupervised learning-based method is adopted to construct radio maps using fingerprints collected via crowd sourcing , and a probabilistic indoor positioning algorithm is developed for the radio maps constructed with the crowd sourced fingerprints. Along with these techniques, collecting indoor and radio maps of buildings in villages and cities is essential for a GIPS. This paper aims to collect indoor and radio maps from volunteers who are interested in deploying indoor positioning systems for their buildings. The methods and tools for the volunteers are also described in the process of developing an indoor positioning system within the larger GIPS. An experimental GIPS, named KAIST indoor locating system (KAILOS), was developed integrating the methods and tools. Then indoor navigation systems for a university campus and a large-scale indoor shopping mall were developed on KAILOS, revealing the effectiveness of KAILOS in developing indoor positioning systems. The more volunteers who part

QR code has been applied in many ways from marketing products, locating promotional items on shelves, finding stores and etc. In this study, we report on an android based application development aimed to provide navigation services to locate parked vehicles in an indoor parking space of shopping malls. We utilize the motion sensor, bar code scanner function and camera function built in smart phones. This application is able to show the route from user current location to his parked vehicle based on an indoor map of the parking area stored in a database. In addition, it is also able to automatically detect user's current movement based on steps calculation. A field test was conducted in a shopping mall indoor parking space to evaluate the performance of the application. In general, the application has shown promising results.[3]Due to the limitation of GPS in indoor environment and the rapid growth of Wi-Fi hotspots and mobile devices, indoor Wi-Fi-based positioning has been attracting growing interest. In this paper, we implement a practical and convenient indoor positioning system based on the fingerprint method and Kalman filter on Android mobile devices. This paper not only discusses the positioning algorithms, but also addresses various challenges in practical application, such as the effect of antenna orientation and signal fluctuation. Specifically, an improved mapping algorithm based on k-nearest neighbors (K-NN) is introduced to tackle the orientation effect, and an orientation-based fingerprint database is established through studying the received signal strength patterns in different directions to handle the large fluctuation caused by orientation change. Finally, our experimental result indicates that the proposed indoor positioning system can achieve up to 1.2 meters accuracy in 90 percent of time, which is sufficient for supporting various navigation and infotainment services in large-scale indoor environments(e.g., shopping malls)[4].Global Navigation Satellite Systems (GNSS)-based navigation with smart phones is very popular. But in areas where no GNSS signal is found navigation could be useful. Examples are navigation in shopping malls, in big offices, in train stations or museums. The goal is to estimate the position in GNSS shaded areas to make navigation possible. The MEMS sensors (Micro Electro Mechanical System) installed in current smart phones, such as accelerometer, gyroscope, magnetic field sensor and barometer allow now navigation also in GNSS shadowed areas. Due to the low quality of these sensors, however, support of the position estimate is needed. In this work, a concept is presented for the construction of an indoor navigation system based on low-cost sensors of smart phones. The position estimate from the available sensor data forms the basis of the position determination. So position estimation is always possible independent of location. First results with Kalman filter and particle filter are shown. The presented concept serves as a basis for the construction of a smart phone-based navigation solution for indoor use. Therefore the available MEMS sensors should be used as a position estimator and a wide variety of supporting information can be processed. A first approach for implementation on a smart phone is shown as an example.[5] Although a large number of Wi-Fi fingerprinting based indoor localization systems have been proposed, our field experience with

Google Maps Indoor (GMI), the only system available for public testing, shows that it is far from mature for indoor navigation. In this paper, we first report our field studies with GMI, as well as experiment results aiming to explain our unsatisfactory GMI experience. Then motivated by the obtained insights, we propose GROPING as a self-contained indoor navigation system independent of any infrastructural support. GROPING relies on geomagnetic fingerprints that are far more stable than Wi-Fi fingerprints, and it exploits crowded sensing to construct floor maps rather than expecting individual venues to supply digitized maps. Based on our experiments with 20 participants in various floors of a big shopping mall, GROPING is able to deliver a sufficient accuracy for localization and thus provides smooth navigation experience[6]. Indoor navigation is a well-known research topic whose relevance has been steadily growing in the last years thrust by considerable commercial interests as well as by the need for supporting and guiding users in large public environments, such as stations, airports or shopping malls. People with motion or cognitive impairments could perceive large crowded environments as intimidating. In such situations, a smart wheeled walker able to estimate its own position autonomously could be used to guide users safely towards a wanted destination. Two strong requirements for this kind of applications are: low deployment costs and the capability to work in large and crowded environments[7].

III. EXISTING SYSTEM

Manual Shopping is the traditional way of shopping where the customers choose their wished product and carry the products along with them. Traditional shopping is a tedious and time consuming job. In traditional shopping, the customer has to wait in long queues at the cash counter. This consumes lot of time and energy of both the shopper as well as cashier. Hence,will discuss more in details.

I. Table Power Draw Of Relevant Hardware Components

Component	Draw (mA)	Description
screen. Full	221.90	Screen at full brightness.
wifi.on	3.5	Wi-Fi on not receiving, transmittingor scanning.
wifi.active	73.24	Wi-Fi transmitting or receiving.
wifi.scan	75.48	Wi-Fi scanning.
radio.on	2.15	Cellular radio with standard signal strength
gps.on	90.8	GPS usage
cpu.idle	17.4	CPU draw when not active, but not in suspend.
cpu.active	57.9	CPU draw at lowest frequency.
accelerometer	0.45	MPU6515 accelerometer.
Magnetometer	5.0	AK8963 magnetometer
light & proximity	12.675 Proximity and light sensor.	Proximity and light sensor.

II. Table Calculated Battery Life Under Each Test.

Test	Breakdown(per minute)	Hours of Battery
Network Location Provider	3*wifi.scan. 3 * wifi.active	7.853
Wi-Fi RSS Ranging	12 * wifi.scan	7.503
Indoor/Outdoor Detection	acceletometer, magnetometer, light & proximity	7.576
Proposed Method	Wi-Fi RSS Ranging, Indoor/Outdoor Detection	7.217
GpsLocationProvide	gps.on	6.113

III. Table Calculated Battery Life Over Time Spent Indoors

Minutes Indoors	Hours of Battery	
	GPS	Proposed
0	6.113	6.113
15	6.113	6.356
30	6.113	6.619
45	6.113	6.906
60	6.133	7.217

IV. TABLE CALCULATED BATTERY LIFE- PROPOSED APPROACH (E=0.25).

Minutes Indoor	Hours Of Battery	
	Without Error	With Error
0	6.113	6.356
15	6.356	6.485
30	6.619	6.619
45	6.906	6.759
60	7.217	6.906

I. Table Results.

Test	Minutes to Reduce 1%	Hours of Battery
Baseline	6.01	10.02
Location Service Provider	5.85	9.75
Inferential Location Provider	5.80	9.67
Fused Location Provider	5.54	9.23
I/O Detector	5.50	9.17
GPS Location Provider	5.19	8.65

The results of our experiment are shown in Table V. The “baseline” test shows the battery drain when no localization method is being executed (i.e. screen at constant brightness and networking enabled and connected). The “InferredLocationProvider” test displays the results of the standalone Wi-Fi RSS ranging, while the FusedLocationProvider displays the overall battery drain of our modifications - the combined Wi-Fi RSS ranging and the indoor/outdoor detection. We also include the battery drain of the standalone indoor/outdoor detection.The results in Table V are sorted in descending order of battery efficiency. Recall, in we ranked these same methods in Table II by estimated battery life. In Table II, the “Wi-Fi RSS Ranging” test corresponds to the “InferredLocationProvider” test in Table V and “Proposed Method” corresponds to “FusedLocationProvider.” We noted in that in reality, we expect the indoor/outdoor detection to perform worse than predicted, due to computational complexity and thus higher CPU utilization.

In our theoretical analysis, we made the note that idle vs. active CPU time was not considered due to the dynamics involved (CPU usage is dependent on the actual implementation). However, in performing the actual experiment, we can see the effects of CPU utilization on the battery life. Of note, both the InferredLocationProvider and the NetworkLocationProvider perform very similarly - this is due to both methods using mainly Wi-Fi and no other extra hardware components. As we have assumed each Wi-Fi scan or network request to take one second, when in reality it may be half a second or less, which accordingly reduces energy consumption(by allowing for more idle CPU time). Because of this, the energy efficiency of the FusedLocationProvider becomes bounded by that of the indoor/outdoor detection, which uses multiple sensors and relatively higher computational time as shown by its lower energy efficiency result. Finally, as expected, the GpsLocationProvider performs the worst. Going by these results, the InferredLocationProvider saves an extra hour of battery life, while the modified FusedLocationProvider saves about 35 minutes.

As mentioned, the indoor/outdoor detection performs worse in reality due to the constant energy draw from the sensors as well as higher computational time (or, alternatively, less idle CPU time). Taking this into consideration, although the battery lasted longer than we predicted, results match the relative order of energy consumption as shown in Table II.It should be repeated that these tests were done indoors. In reality, a user will move between indoor and outdoor environments. Thus, the hours of battery can be expected to lie somewhere between the GpsLocationProvider’s result (8:65hours) and the FusedLocationProvider (9:23 hours) (similar to the Table III and Table IV).

Realistically, the factors that affect the battery life are far more dynamic in normal operation, but the relative differences will still persist.If the energy efficiency of the indoor/outdoor detection can be improved, it would also improve the energy efficiency of our modified FusedLocation-Provider. In our tests, we found the indoor/outdoor detection accuracy to be about 80%, however we are using a different device and are in a different environment than what was tested (thus, additional tweaking of the detection process was required). We also attempted to improve the accuracy of the indoor/outdoor detection by considering Wi-Fi-based metrics(such as Wi-Fi RSS variance and the number of in-range access points over time), however these were not feasible due to the dense deployment of wireless access points in populated areas. Although the primary purpose of our work concerned energy efficiency, there are some notes to be made about location accuracy and performance. Wi-Fi RSS ranging is not a new concept and RSS is often disputed for its accuracy in regards to localization. We found this to be true in our case as well, with the location accuracy often being off by a few meters. Generally, in indoor locations, such in accuracies can be overlooked if the localization is quick. Additionally, we chose RSS ranging for its simple implementation in order to prove the point that indoor localization methods triggered by indoor/outdoor context could lead to battery savings. With this fact shown, we leave improvements to indoor localization to future work as location accuracy was not intended to be the key focus of this work. In regards to performance, performance is naturally proportional to battery consumption. For example, lower performance implies greater CPU utilization which, in turn, lowers energy efficiency. As a result, Table V also reflects relative performance. In this case, it can be said that all of our modifications perform better than the GPS Location Provider. Generally, the GPS is criticized for its energy consumption, not for its performance hit, leading us to conclude that our modifications would not affect usability of a device hosting our modifications to the operating system.

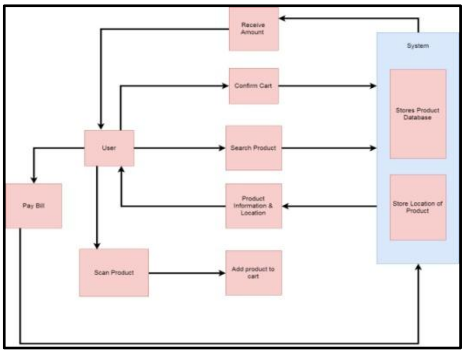

Fig 1: Block Digram of existing system

Advantages of existinng system
- Propose system reduce the user shopping time
- Provide the navigation to user for better experience of shopping
- Barcode help to identify product uniquely.
- Users can explore more products.

Disadvantages of existing system
- Existing system is time consuming.
- In mall its difficult task to find the required product
- We cant look throw all the products on daily basis.

IV. DESIGN

This section describes our development environment and our modifications to the Android operating system for our experiment. Our experiment involves the implementation of anindoor/outdoor detection service, a new indoor-based locationprovider, and a modification of the FusedLocationProvider API to take the new provider into consideration. Development Surrounding:

We develop our experimental solution by integrating it into the Android Open Source Project (AOSP) – Android version 4.4.2 (KitKat).Although we also would like to directly modify the FusedLocationProvider API, Google Play Services is proprietary and thus, its source code is unavailable. As a result, we settle for modifying the open-source FusedLocation package bundled with the AOSP - which may be older, but provides the same functionality allowing applications to specify accuracy and power requirements, then selects the most appropriate location information based on the underlying location providers. Our solution is tested on the LG Nexus 5 smartphone, which features a 2.3 GHz quad-core processor, 2 GB of RAM, a 2300mAh battery and all the sensors required by the indoor/outdoor detection. The device is on a cellular plan without data, but network requests can still be made over Wi-Fi.

Operating System Modifications :The main feature of our experiment is the implementation of an indoor localization method into the OS to sense indoor locations in an energy-efficient way. Pairing such a localization method with indoor/outdoor detection ideally should improve a device's energy efficiency and accuracy. First, we adapt the solution from as a system service in the Android operating system using source code supplied by the authors.Our implementation utilizes a "manager" class to serve as intermediary between applications (clients) nd the actual service. We also follow the Observer pattern, whereby multiple clients can receive updates when indoor/outdoor context changes. As a result, our design for the service mirrors the structure of standard Android system services and also would provide application developers with a familiar way to access indoor/outdoor context. Next, we have opted to create a new location provider, called the InferredLocationProvider, as the platform into which any smart phone-compatible indoor localization method can be implemented (to infer the user's location while indoors). As mentioned, we chose to implement a simple localization method based on Wi-Fi RSS ranging. Using the Android APIs, RSS to all in-range APs can be obtained via a Wi-Fi scan, which occurs automatically a few times per minute and can also be manually requested. The implementation of the Inferred LocationProvider also follows a similar structure as the other location providers, GPS and network. This involves modifications to the location services framework to allow our new provider to be accessed via the same APIs.Because of the type of indoor localization method we chose to implement, we assume the absolute locations of the APs can be known a priori or can be looked up via an online database. Using the APs' locations and relative distances to the smartphone determined via RSS, we use ranging to determine the smartphone's location. Although RSS-based ranging has been proven to be inaccurate, we are merely using it to evaluate the potential energy saved by using an indoor localization method while the smartphone is detected to be indoors. Our modifications to the operating system Our implementation of the InferredLocationProvider allows application developers to explicitly request location from it in the same fashion as the other providers. However, Android also provides the FusedLocationProvider API to streamline the process. Thus, we also present a modification of the API as included in the AOSP. In our modifications, when the FusedLocationProvider prepares to invoke the GpsLocationProvider according to an app's requirements, it also registers to receive contextual updates from the indoor/outdoor detection service. If the smartphone is detected to be indoors, the FusedLocationProvider will switch

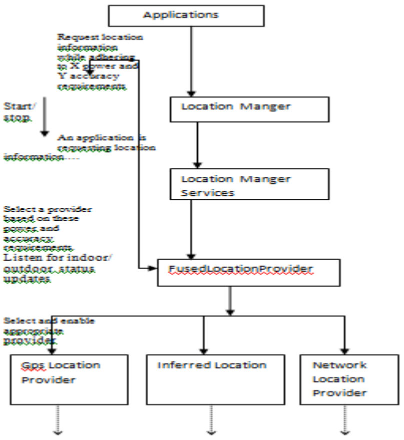

Fig. Simplified view of our modifications to the location framework any current location requests from the GPS to the Inferred-LocationProvider and will swap back if the context changes to outdoors. Because of this design, all applications that rely on the FusedLocationProvider API will correspondingly be affected, which is desired. In regards to performance, the indoor/outdoor detection

service is instantiated upon system boot, but performs no work unless invoked by the FusedLocationProvider as mentioned previously (or unless it is explicitly invoked by a developer). Both the detection service and the InferredLocationProvider should cause a smaller performance hit than invoking the GPS. In short, our modifications serve as a mechanism for choosing between location providers, on behalf of the user, based on indoor or outdoor context. Because Google advises that application developers use the FusedLocationProvider API to improve location accuracy and reduce energy consumption, our system can target a large subset of location-based applications running on a user’s phone. We expect our solution to greatly reduce energy consumption.

However, the accuracy (and part of the energy consumption) depends on the implemented indoor localization method. As we have chosen a relatively simple localization method, we expect that better methods can be implemented to improve indoor location accuracy.

V. CONCLUSION

In a step aimed at promoting shopping methods and make people life easier, we are going to build this mobile application that could play an important role in Indian society as a whole. The usage of Pocket PC mall navigator as a shopping mall navigator, in addition to helping the users to find shops efficiently and effectively, were able to create awareness in using smart mobile devices for flexibility in almost every task among the shopping.

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