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Survey of Navigation Approach for Books with IMU

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Abstract

A Wireless Personal Area Network (WPAN) is a personal, short distance of an wireless network for interconnecting device entered around an individual person's workspace WPAN's address wireless networking and mobile computing devices such as PCs, PDAs, Peripherals, Cell phones, Pages and Consumer electronics the role of PAN is a computer network used for data transmission amongst devices such as computers, telephones, tablets and personal digital assistants the existing system of WPAN has many issues, like large scale indoor environment when WiFi coverage is poor, Battery Consumption is high in Smartphone due to continuously scan nearby WiFi routers and there is no accurate, robust and consistent localization and tracing services. So we need highly dedicated application on the user's smart phones. The work related in the proposed system occasionally correct the drifting error of PDR in poor WiFi coverage area. Beacon application manages users Smartphone to scan nearby WiFi routers. An accurate indoor localization and tracing of book in library using Smartphone built in inertial measurement unit (IMU) Sensor this work mainly focuses on locating a book in library. Once the book is identified, using pedestrian Dead Reckoning (PDR) approach, the route to approach the book is achieved the scope of this system to provide accurate, practical and large scale indoor location services.

***Keywords:** IMU; PDR; PDA; WPAN; Beacon*

I. INTRODUCTION

Indoor Positioning System (IPS)

IPS is a system to locate objects or people inside a building using radio waves, magnetic fields, acoustic signals, or other sensory information collected by mobile devices. There are several commercial systems on the market, but there is no standard for an IPS system. Indoor positioning system use a different technologies, including distance measurement to nearby anchor nodes (nodes with known positions, e.g., WIFI access points), magnetic positioning, dead reckoning. They either actively locate mobile devices and tags or provide ambient location or environmental context for devices to get sensed.

Detecting the device's orientation (often referred to as the compass direction in order to disambiguate it from Smartphone vertical orientation) can be achieved either by detecting landmarks inside images taken in real time, or by using trilateration with beacons. There also exist technologies for detecting magnenometric information inside buildings or locations with steel structures or in iron ore mines.

Our proposed system is indoor positioning system using multiple sensing techniques including IMU sensors, WiFi fingerprinting and opportunistic to a Wireless sensor network (wsn). The Inertial Measurement Unit (IMU) used (BLE) Bluetooth low energy task to reduce the energy efficient than classic Bluetooth and WiFi. IPS aim extending the multiple sensing techniques to get accurate tracing result also finding accurate position using trilateration algorithm is proposed. Trilateration is a technique of a given book based on several already known spots and the corresponding distances to them (for instance, distance measurements that beacons broadcast). In the context of GPS and navigation systems, a position is calculated, with the intersection of three spheres. To remove uncertainties, four spheres will actually give a unique value that will be used to locate someone on the Earth. One of the two points that are computed from the intersection of three spheres can be eliminated due to being an irrelevant solution (situated in the outer space), thus, the rest one should be enough to locate someone. The case of GPS corresponds to a three-dimensional world. Hence it requires Basic math calculations that involve angles. Bringing this idea to the case of indoor localization, a 2D scenario might serve the purpose because almost all use cases relies on a building as the main venue to place the beacons, plus,

people will not be anywhere than on a plain floor.

RELATED WORKS

[1] The indoor position and navigation with location based services (LBSs) is done by hybrid system assisted by the RSS fingerprint and utilize iBeacon to assist Wi-Fi indoor positioning. Wi-Fi APs can divide the space into different sections, and iBeacon can accurately locate where you are in the indoor environment. The indoor positioning techniques mostly utilize Wi-Fi, ZigBee, RFID, and Bluetooth Low Energy (BLE).The received signal strength indicator(RSSI) traditional position estimation fingerprinting method which can be easily captured on standard portable devices. The Wi-Fi and iBeacon use Bluetooth Low Energy (BLE) for indoor LBS since it is a cost effective and easy to deploy solution. iBeacon is an efficient, cross-platform, built-in, technology for both Android and iOS devices, which uses Bluetooth Low Energy (BLE) for indoor positioning. Since the technology utilizes the BLE, it offers users less power consumption. Fingerprinting localization approach is based on the matching of the online data to the existing database. The degree of the accuracy of hybrid system in locating objects is acceptable and higher when compared with other systems working in indoor environments.

[2] In the hybrid system, a certain number of Wi-Fi APs provide the umbrella coverage and positioning in campus, under the coverage theġiBeacons precisely localize the mobile users in indoor areas. By measuring Receiver Signal Strength (RSS),Wi-Fi fingerprint positioning technique has been proved to match, and sometimes outperform GPS in terms of accuracy. The RSS is taken at different points in the interested area. Then the mobile users scan the signal strength and send it back to find the closest match so that to localize the mobile user. iBeacon utilizes BLE technology and provides a good level of location awareness and long last services. The use of the campus pre planned Wi-Fi APs reduces the cost and iBeacons ease the deployment.

[3] It improves the scheme of landmark and inertial navigation to address reliable and accurate indoor localization. Integrating the exploit of calibration function of the iBeacon for step length and heading estimation to optimize the inertial navigation. With the enhancement of mobile computing and sensing, inertial navigation for localization has been gaining much attention. The localization

system can be mainly divided into two part. One part is the inertial navigation which is implemented by using gyroscope, accelerometer and magnetic sensors of the device. The received signal strength (RSS) from the iBeacon is related to the distance. When the RSS exceed a threshold, we can calibrate the position of user through the position of the iBeacon. Various sensors are used in the inertial navigation and the iBeacon calibration is realized by calling the Bluetooth module.

[4] It presented work based on user interest modeling using spatial behavioral data collected from indoor environments. Predicting user interests from their physical movement has a lot of important applications in contextual computing and developed an iBeacon-based mobile app to capture user's indoor physical movement and collect the temporal feedback for comparison. iBeacon protocol supports BLE enabled devices (e.g., a smartphone) to perform context-specific actions when they are in close proximity to BLE beacons.

[5] It tested the accuracy of a known method used to estimate the distance between two devices communicating through the iBeacon technology. The effects of the output power, placement of the devices, existence of walls and the possible radio interference, on the accuracy of that distance estimation are investigated. The Bluetooth Low Energy and iBeacon technologies open a novel way to develop low-power indoor positioning techniques and systems. It exposed how beacons are affected from other signal propagating devices such as mobile phones, computers or other beacons.

[6] The paper designs and implements an indoor positioning system based on iBeacon. Gaussian filter and Unscented Kalman filter method is adopted to robustly extract strong signals from iBeacon device.The extracted signals are compared with-in database. Apple's iBeacon is an indoor positioning technology that is meant to be used with the BLE enabled beacons, it uses latest BLE4.0 technology, with low power consumption, low latency and transmission distance characteristics. iBeacon periodically transmits a broadcast signal that accurately determine user's current location by using positioning algorithm.

[7] The technique used in the paper is fingerprinting technique, which requires careful collection of training data at known locations. An app is developed to facilitate

and expedite the process of collecting training data with iOS devices. The training data is collected by the app and saved in the cloud for future retrieval. The training data is collected from different floor maps, performed initial analysis on this data, and tested a fingerprinting algorithm in order to provide indoor localization. The app provides UI elements to select the building and floor where training data will be collected. Upon selecting the two options, the correct map is displayed on the screen.

[8] The paper present a novel (Bluetooth Low Energy) BLE Received Signal Strength Indication (RSSI) ranking based fingerprinting method that uses Kendall Tau Correlation Coefficient (KTCC) to correlate a new signal position with the signal strength ranking of multiple low-power iBeacon devices situated in a retail space. This offers a higher positioning accuracy and is supported in recent smartphones. The validation shows that the method can get an average positioning error of 0.87 meters. This is improved compared to existing state of the art systems.

[9] The paper present a framework of combining smartphone sensors and iBeacons for accurate indoor localization. The Pedestrian Dead Reckoning (PDR) is applied for localization using smartphone sensors. An iBeacon will periodically broadcast an advertisement packet containing a unique ID and a calibrated RSS value at one meter distance. The value determines the distance between an iBeacon and a device.

[10] The paper proposes a smartphone inertial sensor based indoor localization and tracking system with occasional iBeacon corrections. In the PDR approach, the current position is determined by the previous position, current walking length and walking direction. Based on the distribution of iBeacon measurements, calibration range is defined where an extended Kalman filter is applied.

CONCLUSION AND FUTURE ENHANCEMENT

In general, tracing systems are not working properly indoor localization. Due to low WiFi signal coverage area to overcome these problems. The Bluetooth Low Energy is proposed will getting proper navigation system indoor localization. IPS (Indoor Positioning System) using multiple sensing techniques including Inertial Measurement Sensor, WiFi fingerprinting and opportunistic iBeacon corrections by sensor fusion based on particle filter. Future more this BLE gives

accurate direction and location in poor WiFi coverage area.

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