A HYBRID INDOOR POSITIONING SYSTEM USING WLAN AND iBEACON.

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Abstract

Rapid innovation in the area of wireless data communication has brought a wave of new applications to mobile phone and laptop users worldwide. The widespread deployment of wireless devices has attracted researchers to study the feasibility of utilizing embedded radio frequency (RF) transceivers to provide location-based services (LBS) to users, as well as communication services. Outdoor mapping has become easier and flexible due to GPS, which is widely used. One of the key enablers for mobile sensing applications is the capability of understanding indoor environments. An indoor positioning system (IPS) is a system to locate objects or people inside a building using various technologies.

In indoor positioning, there are several technologies like Wi-Fi, Bluetooth Low Energy Devices, RFID, and NFC. Among these, two technologies, technology that is cost-efficient and flexible is considered.

In this study, WLAN and Bluetooth Low Energy Beacons like ibeacon are taken to experiment the indoor position of the user individually, compare the technologies in different environmental factor and generate the fusion of two technologies to check which technology produces an efficient, more accurate system among all the technologies

We spend much of our time living indoors in urban areas. Today, it is said that the people living in urban areas of Thailand spend approximately 90% of their time indoors. Under such circumstances, location-based services that use the Global Positioning System (GPS) for outdoor location-based service have dramatically become widespread. In particular, outdoor location-based services is most common due to the GPS function. Correction technology has also enhanced the accuracy of such services(Kohtake & Morimoto, 2011). Although the needs of users have been reported, however, indoor location-based services have not become so common. This indoor and outdoor navigation is possible only because of satellite navigation and they are various terms used when we speak about this satellite navigation, but the most familiar terms are the GNSS and GPS. GNSS refers to Global Navigation Satellite System which is used to refers for the constellation of satellites providing signals from space that transmit position and time of the location to the GNSS receivers which is then transmitted to the user. Since GNSS is a term used worldwide, this term includes e.g. the GPS, GLONASS, Galileo, Beidou and other regional systems. Though satellite systems don't often fail if one fails GNSS receivers will pick up signals from other systems. The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. This positioning system is the most widely spread for the LBS in the world and currently, it is the world's most utilized satellite navigation system. Due to widespread of GPS, we know that the outdoor positioning has improved, and it has completely satisfied the user but when we talk about indoor positioning though it has gained its attention it is difficult to navigate inside a room precisely

with the cost-efficient technology due to various factors. This study reveals the indoor positioning system in which cost-efficient technologies are used. An indoor positioning system (IPS) is a system to locate objects or people inside a building using various technologies. There are two ways for indoor positioning one is using Non-Radio Technologies and the other is using Wireless Technologies. In this study, we have shown about wireless technology, which is used for indoor positioning. Under the concept of wireless technologies available, they are several technologies, which are used. Amongst them are the Wi-Fi and Bluetooth Low Energy Beacons. As we know that Wi-Fi chips have become ubiquitous, positioning with existing Wi-Fi infrastructures in public buildings have become more feasible. Wi-Fi approaches based on received signal strength (RSS) have gained a large amount of attention. (Li et al.).

The other technology in this study is the BLE Beacons; this method is used for tracking the wireless Bluetooth signal that is a feature of most mobile phones. Bluetooth scanners are being installed at locations of interest. These scanners continuously scan for Bluetooth signals emitted by the mobile phones and register every detection (Oosterlinck, Benoit, Baecke, & Van de Weghe, 2017). And in this study, we shall introduce to the ibeacon which is a protocol developed by Apple.ibeacon differs from some other location-based technologies as the broadcasting device (beacon) is just one-way transmitter to the receiving smartphone or receiving the device. (write some more lines about ibeacon). The most important part of this study is the fusion of two technologies, which is the usually termed has hybrid of two technologies that is to combine the BLE Beacon and Wi-Fi technology signal strengths in order to improve the positioning accuracy and performance of user localization and tracking while reducing the workload required for positioning.

Below is the given framework on how the signal is detected and how the positioning is taken place

Signal detector:

When you run the software it will immediately scan, retrieve, and display detailed information about wireless network such as signal strength are available together and displays the number of access points to connect, for this application, we need to know that there should be at least the three access points is required. In ibeacon, we have added the UUID, Major, Minor values and Tx values.
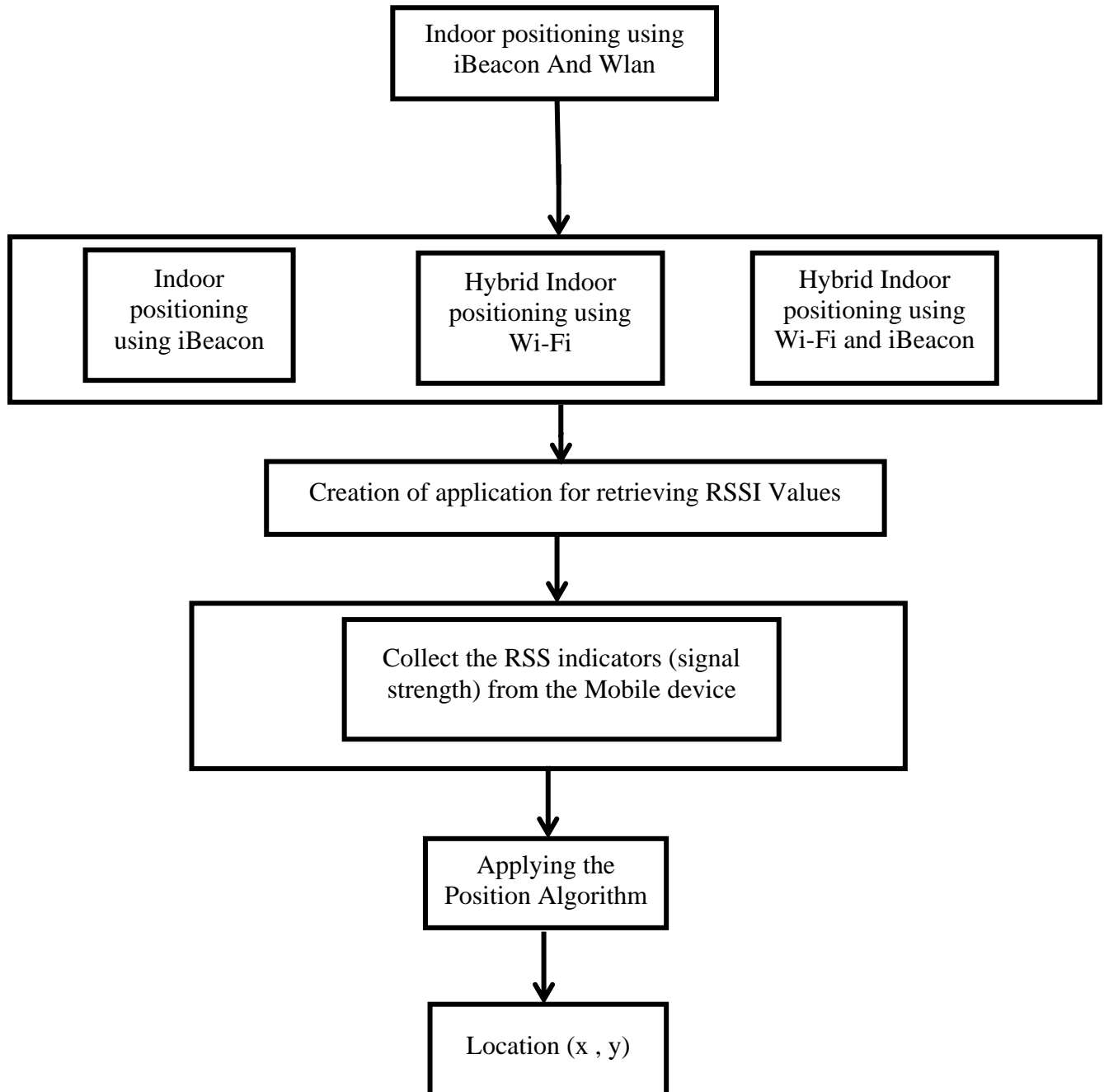
Euclidean distance:

Calculation of true distance. The distance between two points is the length of the path connecting them.

Positioning Model:

The signal strengths received at a receiver from three different access points are used to determine the position of the receiver. The method considers the relationship between distance and signal strength from the given access points. If one distance is known from one access point from at least three distances, the position of the receiver can be calculated. The mean of sample signal strength information is the first calculated in addition to the variable numbers. There are three propagation models that have been used for calculation and comparing: a linear model, a polynomial model and exponential model. They are different kinds of position models which are used, in this, we are using the fingerprinting algorithm in positioning.

Comparison of Algorithms: Different algorithms and its comparison with its accuracy is done in this system

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│ │  positioning │  │positioning   │  │positioning   │      │
│ │ using iBeacon│  │ using Wi-Fi  │  │using Wi-Fi   │      │
│ │              │  │              │  │and iBeacon   │      │
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       ┌──────────────┐
       │ Applying the │
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       │ Location (x , y)│
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