Bluetooth-based Indoor Location Tracking Solution

Radio frequency localization principle is based on measurement of Received Signal Strength (RSS) from the anchor transmitters. Further corrections are made at runtime with compensation algorithm to remove noise and interference to accurately determine the location of the unknown node. This method can be accomplished with fixed-strength radio frequency transmission that allows RSS to be reliably measured. There are also variants that use different radio frequency to achieve different distance vs. precision vs. power consumption performance metrics.

Leveraging on commonly available ISM band of 2.4GHz spectrum radio equipment, there are indoor positioning systems based on WiFi transmission (IEEE 802.11), Zigbee or equivalent (IEEE 802.15.4), and Bluetooth (IEEE 802.15.3).

This technology offers indoor location solution using Bluetooth Low Energy (BLE) beacons because of its advantages of being low-cost, easy to deploy and maintain.

**Potential Applications**

Indoor tracking for:

- Staffs and Visitors tracking
- Class Attendance taking
- Identification of nearest emergency response personnel, service staff, in-house dispatcher
- Assets tracking
- Footfall, heat-map, identification of heavy footfall region
- Unusual incident detection (through unexpected crowding)
- Optimal tasks scheduling based on location and proximity or personnel
- Indoor navigation (with enhanced precision configuration and navigation mapping add-on)
- And more...

**Customer Benefits**

While typical indoor location tracking system using Bluetooth beacon requires a smartphone with customized smartphone apps to be installed, this system does not require a smartphone or apps to be installed. This system is non-intrusive.

This solution is more convenient for visitors by not requiring tracking apps to be installed on the user smartphone. The same system can also be used to track assets, together with personnel, using special-purpose beacons with additional sensors.

**Technology Features & Specifications**

A Singapore-based company offers two indoor positioning platforms that consist of Bluetooth beacons and readers, and a data server that aggregates and calculates locations of nodes. The data server also collects diagnostics information about the deployed beacons in the field.

The indoor tracking technology requires one group of devices to be fixed to infrastructure as known (location) nodes, and another set of nodes that is mobile (moveable) and needs to be tracked.

Two systems:

- Configuration A: Bluetooth Low Energy (BLE) Beacons (fixed node), BLE enabled smartphone (mobile nodes)
- Configuration B: Bluetooth Readers (fixed nodes), BLE Beacon cards (mobile nodes)

The technology provider uses the signals from their specialty BLE beacons together with a sophisticated algorithm to triangulate and compensate for noise and temporal interference. For applications that require high-precision tracking, this system is able to indicate the location of a mobile node within 1 meters radius. For the low-precision applications, only one beacon is required per zone of interest.

Configuration using Bluetooth-enabled smartphones allows tracking by installing a customized applications onto existing smartphone of the users. The customized application can include business logic like attendance reporting module, closest neighbor collaboration and communication tool, indoor navigation and wayfinding applications, etc.

Configuration using Bluetooth employee badges with Bluetooth receivers allows tracking of staffs and visitors carrying the Bluetooth-enabled badges around the facilities. Tracking is non-intrusive as it does not require the installation of smartphone applications on visitors’ mobile devices, neither does it requires visitors to learn to operate the tracking device.

In both configurations, the positioning algorithm aggregates the received signal from fixed nodes, computes their location and
presents them on a location map. Information can also be curated to create statistics like footfall and heat-map.

Bluetooth-enable beacon badge measures no bigger than a regular credit card, and about 3mm in thickness to accommodate a built-in battery. Employee photo and information can be laminated onto the badge or simply held together within a badge casing.

Battery life of Bluetooth badge and beacons can last up to 2 years depending on configured update-rate of the broadcast signal. A battery-low indication is notified to the control center allowing maintenance to be scheduled.

The technology provider provides this indoor tracking platform as a service license. They are also open to licensing the use of this platform and hardware for integration into other platforms like BMS system, control center, etc.

**Market Trends and Opportunities**

Indoor tracking cannot be addressed with the GPS-based tracking system which is commonly used outdoors with a clear view of the sky. Instead, the use of additional indoor signals from beacons and WiFi are commonly used for indoor tracking.

According to ResearchandMarkets, Bluetooth beacon devices market size is expected to grow at a CAGR of 223% from 2016 – 2020.

For more information on technologies we have to offer, please visit our website at [https://www.ipi-singapore.org](https://www.ipi-singapore.org) or enquire at techscout@www.iipi-singapore.org