

DEEP LOCATION: The future of indoor positioning

Paul Dupont explores the alternatives to GPS for navigating the interior of large venues and how Augmented Reality and Machine Learning are signposting the way ahead

Since the early-2000s, GPS technology has been helping consumers navigate the outdoor world. From enabling ridesharing and food delivery services to helping avoid heavy-traffic areas, GPS is now an integral part of all our lives.

Within buildings, however, GPS signals are distorted by a variety of physical barriers and interference sources resulting in a significant drop in positioning accuracy. Consequently, when a user enters a building such as a hospital, shopping mall or airport, it is very challenging for a device to pinpoint its location.

Enhancing visitor experience

The Pointr Deep Location platform is a powerful engine that addresses the challenges of indoor location and navigation. It allows users to navigate complex buildings such as airports or shopping malls. It enables a range of location-based services and contextual promotions that enhance the visitor experience. It allows venue operators to track the real-time position of assets, create digital twins of venues and more.

Pointr's Deep Location technology enables location-based services and analytics in large spaces such as airports and shopping malls

Indoor Positioning Systems (IPS) such as Deep Location are the alternative to GPS for navigating the interior of large venues. There are a variety of technologies used for indoor positioning today which are continuously evolving and improving (see inset). This article will explore the applications and benefits of different technologies in more detail.

What services can Indoor Positioning Systems (IPS) provide?

Similar to GPS, IPS can both accurately determine the indoor position of a user and provide personalised directions to a specified destination within large spaces such as airports, shopping malls, hospitals, stadiums and hotels. Users get turn-by-turn directions across multiple floors, which can be shown on a map or in a real-life environment thanks to Pointr's Augmented Reality (AR) navigation technology.

Pointr's Augmented Reality

navigation technology guides visitors with real-life directions

Real-time notifications

Indoor positioning also enables a range of location-based services such as location sharing and contextual notifications to improve the visitor experience.

Visitors can receive relevant information directly to their smartphones depending on their position. For example, real-time notifications can be sent to passengers to let them know that boarding for their flight has just started and which security queue is fastest. Staff locations can be monitored and analysed to improve operational efficiencies. Product location and quantity information can be gathered with scanners to ensure you always have stock where you need it.

Location data collected by Indoor Positioning Systems are an effective source of business intelligence and analytics.





Pointr's Deep Location technology enables location-based services and analytics in large spaces such as airports and shopping malls

Retailers analyse the physical flow of shoppers through highly granular statistical data (visualised as heatmaps), allowing the optimization of space utilization: Which parts of the food court get the most customers? Are the large meeting rooms mostly occupied by 1-2 people at a time? Which shopping mall entrances get more traffic when it rains?

Investment considerations

So how effective are the Indoor Positioning Technologies in use today? Not all Indoor Positioning Systems are created equal and there are major factors that venue owners must consider before making an investment.

- 💡 Accurate: Location data should be within 1-3 meters of the user's actual position.
- 💡 Fast: Users should be able to see their position within 2 seconds of opening an app.
- 💡 Flexible: Maps and notifications should be easy to configure from a single dashboard.
- 💡 Robust: Must be designed to last several years without modification or calibration.
- 💡 Hardware Agnostic: Equal performance on both iOS and Android devices.
- 💡 Limitless Users: Location data should be calculated on the device to ensure consistent service even during peak demand.
- 💡 Battery-optimised: Software should be optimised to not drain the phone battery.

Pointr believes BLE Beacons are the most effective hardware for Indoor Positioning Systems available to date.

Unlike any other positioning technique, Beacons can also provide background capabilities This enables positioning even when the user is not using the app. For instance, if a visitor in a supermarket has a phone

in their pocket, the retailer can still enable geofencing and contextual notifications, provided that the user has given prior consent.

The benefits of Bluetooth Beacons for Indoor Positioning:

- 💡 Compatible with both Android and iOS
- 💡 Low energy consumption - they don't drain battery on the user's phone
- 💡 Low deployment cost
- 💡 Low maintenance - especially when integrating into lighting or WiFi infrastructure
- 💡 Provides background tracking capabilities, even when the app is closed

Patented system

At Pointr, we developed a patented system to combine BLE signals with inertial phone sensors using a large machine learning engine that we call Deep Location to enhance the accuracy of the indoor positioning.

Deep Location is able to offer a highly accurate positioning system with 1-3 meters accuracy. Android and iOS users alike are able to use location-based services that can run in the background and use minimal battery life. Pointr's Deep Location technology also works offline so there is no reliance on data connection.

Pointr is also constantly innovating to capitalize on the best location technologies available and future-proof our systems for venue owners. With the development of Bluetooth 5.1 and UWB technology already underway, the functionality of Deep Location looks set to only improve.

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INDOOR POSITIONING TECHNOLOGIES

Bluetooth Low Energy (BLE)

Beacons are small devices installed in a building that emit a Bluetooth signal detectable by over 95% of all smartphones. Beacons can be integrated into lighting, WiFi access points or battery powered. Maintenance of battery-powered beacons is usually conducted simultaneously with light-bulb replacements, creating little additional cost.



Fingerprinting is a technique that creates a full map grid of a venue's area by tracking the steps of an operator and recording ambient



RF signals to memory. Signals are typically collected from existing WiFi systems and the local magnetic field. While this technique has been deployed in numerous venues (as it requires no additional infrastructure) it is inefficient to maintain. The initial fingerprinting process is labour-intensive and recalibration is required every time a venue makes a change to layout. The system cannot usually operate offline leading to high data charges and battery drain.

Geomagnetic (Compass) technologies are widely used outdoors as they are already integrated into smartphones.



However, magnetic fields are strongly affected by a user's immediate surroundings causing the compass to provide an incorrect reading. A good test is to put 3 phones next to each other on a table and run the Compass app. Often, compasses will point in different directions from each other due to variations in the magnetic field inside a building (especially if you're away from the windows or underground).

VLC (Visible Light Communication)

uses LED lights to wirelessly transmit specific light patterns to a smartphone's front camera, thus accurately providing position data. This is effective in venues where the existing light sources are compatible with VLC systems. VLC's users must grant smartphone camera access creating potential privacy concerns. VLC also requires a significant capital investment (fitting a building with new lighting), and does not offer any background functionality to app users.

