

## INSIDE GAME

Indoor wayfinding brings location awareness in from the elements

By Matt Alderton



**BYTELIGHT** combines beacons with visible light communication inside LED lighting systems.

**G**EOINT MAY SEEM UBIQUITOUS, but there's at least one place its long arms have yet to fully reach: indoors.

Whether you're driving through the desert in an MRAP or across town in a Prius, you can use the GPS in your vehicle to access turn-by-turn navigation. When you're out and about, you can use your smartphone's location-based apps and services to find the nearest gas station, grocery store, or coffee shop. You can even use location technology to find the nearest eligible single for a date. When you step indoors, however—inside a hotel, hospital, shopping mall, museum, or convention center, for example—your signal fades. Or sometimes disappears altogether.

That's because GPS is a line-of-sight technology. To work most effectively, it

needs a clear path from your device on the ground to a satellite in the sky. Pesky things like walls, floors, and roofs make it a challenge to find an unobstructed patch of sky. And because humans spend approximately 89 percent of their time indoors, there's a huge potential market for those seeking to solve this challenge.

Indoor wayfinding technology eschews the skies for ground-based technology that delivers the same location awareness indoors as GPS delivers outdoors. So finding your way from one booth to another inside a convention center or navigating to a certain store within a large shopping mall is now as simple as getting driving directions to those buildings.

### FIRST TRY: WIRELESS

Indoor wayfinding dates back more than a decade. Recognizing the indoor

limitations of GPS, early Wi-Fi vendors hypothesized that wireless Internet could be leveraged for indoor positioning. When consumers connected their device to a wireless network, the thinking went, the network could use the strength of their wireless signal relative to various access points to determine the user's location inside a building and report it back to them for indoor navigation.

There was just one problem: Early adopters discovered Wi-Fi location technology is imprecise, slow, and unreliable. It can tell consumers roughly where they are, but not precisely, resulting in plenty of "way" but very little "finding."

Lacking a high-quality user experience, the much-hyped technology stalled.

### A 'BEACON' OF HOPE

Indoor wayfinding reached an inflection point in 2013 when Apple introduced its iBeacon standard, begetting a new class of indoor location hardware called "beacons." Made by companies such as Aruba Networks, among others, beacons determine location by leveraging the connection between consumers' mobile devices and on-premises access points. Rather than Wi-Fi signals, however, battery-powered beacons emit Bluetooth Low Energy (BLE) signals—radio waves that require very little smartphone power—to transmit a location signal with sub-meter accuracy. When mobile apps and operating systems in the proximity receive a BLE signal, devices can register a location or trigger a location-based activity, such as a social media check-in or push notification.

As the number of beacons inside a facility increases, so does the accuracy and breadth of location services. Combining beacons with other technologies can therefore further enhance their performance. Boston-based ByteLight, for example, combines beacons with visible light communication (VLC) inside LED lighting systems. Coupled with Bluetooth signals, VLC emits a unique lighting pattern that can be registered through smartphone cameras. Using both signals in tandem, consumers' devices send their location and direction of movement to the ByteLight platform, and in turn receive location-based services through a mobile app.

#### ROOM TO IMPROVE

Beacons represent a huge improvement over Wi-Fi-enabled indoor wayfinding. They're not perfect, however, leaving room for advances in accuracy and speed. Battery life is another concern, with many beacon batteries lasting

less than a year. Finally, facilities must consider security—both the beacons themselves and the data they collect are vulnerable to theft—and cost: The time and money needed to configure, deploy, and maintain beacons can add up quickly.

#### WAY MORE THAN WAYFINDING

App developers such as Meridian are leveraging beacons to help department store customers find the women's shoe department, stadium-goers find the bathroom, family members find their loved one's hospital room, and air travelers find their gate. Indoor wayfinding's "killer app," however, will likely be far more evolved than indoor navigation alone. Already, for example, beacons are used by retailers to send coupons when customers pass or linger at a certain product, by hotels to automatically check in guests upon arrival, and at tourist attractions to send visitors on self-guided explorations.

A Google project known as Project Tango, which endeavors to "give mobile devices a human-scale understanding of space and motion," offers a glimpse of what's next. By combining indoor wayfinding with augmented reality, motion tracking, and environmental sensors, the project aims to provide real-time, 3D contextual information—without GPS, Wi-Fi, or even beacons. One day, for instance, Tango-equipped smartphones may be able to help the visually impaired navigate by "seeing" obstacles in front of them. Homeowners could use the technology to instantly capture dimensions of a room before shopping for furniture as well as to model how the room would look with the furniture in it. Miniature unmanned aerial vehicles outfitted with Tango could even help emergency responders determine the layout and contents of a burning building, then locate and rescue occupants trapped inside.

The possibilities have no boundaries—even though the buildings do. ■



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