Illuminating the In-Store Experience

*Indoor Positioning Services Using LED Lighting Benefit Shoppers and Retailers*

Online technology has enabled retailers to make solid inroads into driving positive shopper experience and building customer loyalty. Web and mobile retail platforms have facilitated product research, and enabled product comparisons and peer reviews. Outdoor location technologies such as the Global Positioning System (GPS) have transformed store location from a simple online address directory to a dynamic map-based way-finding experience. Mobile devices are a vastly popular in-store shopping tool, as over 83 percent of shoppers¹ are using mobile devices while in the store to compare prices, look for best offers, or even search for product ratings.

In spite of these milestones, technology has still not completely cracked the code in enhancing the overall retail experience for shoppers – most particularly when they are in the store. In some cases, mobile phones have hurt in-store sales, directing consumers to other stores and other products. A study² from Tradedoubler found 32 percent of consumers change their mind about purchasing a product after using their phone in-store, 20 percent decide to make a purchase elsewhere and 22 percent decide to make the purchase online².

**In-Store Positioning Technology: The Front-Running Solution for Indoor Location and Wayfinding**

Retailers are seeking better ways to use technology to engage and assist customers when they are in store, at the point of purchase decision. New indoor positioning and wayfinding solutions have emerged as powerful new tools in enhancing the in-store experience. In-store positioning technology is similar to the GPS that so many of us have come to depend on while driving in unfamiliar areas. GPS technology is very effective for exterior navigation where there is sufficient line-of-sight; however, the signals from the GPS satellites are weak or often non-existent in interior spaces and are rendered ineffective for indoor positioning. As such, a new technology tailored to indoor environments has evolved that uses fixed location transmitters, a mobile device, digital indoor maps, and a loyalty app to provide location and navigation within the store.

Opus Research predicts that by 2018, roughly $10 billion in consumer spending will be influenced by indoor location.³ By using the best available indoor positioning platforms, retailers can drive customer engagement and loyalty, while at the same time reaping considerable operational efficiencies.
How Indoor Positioning Services Enhance the Customer Experience

Efficient, Convenient, and Personalized Shopping

Indoor positioning services, paired with retail loyalty apps on mobile devices, allow shoppers to tailor their in-store experience to make it more efficient, convenient, and satisfying. Shoppers can quickly gather items from a shopping list, get pairing suggestions, and use the application’s “blue-dot” mapping feature to get step-by-step guidance to the exact in-store location of the items they want to purchase. They also benefit from better deals, because the retailer can send coupons and discounts tailored to their specific needs at the exact moment they are mulling over an item on the shelf. Shoppers can also get help quickly as the indoor positioning technology sends a knowledgeable store employee right to their location in the store aisle.

More Choice through Omnichannel Shopping

Indoor positioning services, working with the retailer’s mobile loyalty app, optimize online, mobile, and in-store channels providing shoppers with a complete set of information and tools to find, buy, and receive the items they want. And, if the shopper wants more choices than what she sees on the shelf, the app can connect her to the retailer’s online store to browse additional styles, sizes, and colors, and get online-ordered merchandise delivered directly to her – with just a few taps of the mobile device screen.

Hassle-Free New Store Experience

Consumers shop at familiar stores because visiting a new, unknown store can be inefficient and time consuming. New store aversion can limit the shopping experience, keeping consumers out of stores that better meet their needs. Indoor positioning services guide shoppers through an unfamiliar environment so they can enjoy a new shopping experience with all of the ease and amenity of their “home store.”

How Indoor Positioning Services Help Retailers Improve the In-Store Experience

Smarter Merchandising

Indoor positioning services enable better connections with customers. Advanced data analytics, using location data, paired with point-of-sale and inventory data can better track the effectiveness of store design. Retailers can assess in-store traffic patterns and dwell times, coupon conversions and other information to assess the impact of marketing and merchandising strategies as well as store layout. Better understanding of what shoppers do in store can improve store layout, and drive more effective shelf and display strategies. Further, merchandise can be quickly re-stocked or re-deployed based on shoppers’ actions, easing customer frustration. Better store layout keeps buyers in the store, rather than sending them out the door.
**Optimized Operations**

When the retailer’s mobile app includes an employee mode, indoor positioning services can help optimize employee deployment in store by providing digital work orders that send them quickly and directly to a customer needing assistance or to a location requiring urgent attention, such as a spill or malfunctioning equipment. Further, retailers can appeal to shoppers with experts on call from a central location, available to answer questions and offer suggestions.

**Front-Running Technologies for Indoor Positioning**

A key component of the in-store positioning solution is the fixed location transmitter. The simplest form of fixed location communication for indoor positioning services is a beacon device that produces a repeating signal. Beacons located in specific physical locations within a store can be used as anchor points that help determine a position by a remote device through processes known as triangulation or trilateration. Beacon technology enables indoor location for people and products. It is being tested by more than half of the top 100 U.S. retailers who are eager to engage smartphone-wielding shoppers in their stores and provide them with a real-time, omnichannel shopping experience.

*The Indoor Positioning Beacon Winner: Smart LED Lighting*

Light-emitting diode (LED) technology is known for generating significant energy savings, maintenance reductions and overall improvement in lighting quality. Because LED lighting can be rapidly modulated or cycled on and off, adding an intelligent driver, such as the eldoLED® driver, can power LEDs in a manner that produces Morse code-like light patterns that can be recognized as a unique beacon. Intelligently driven LED beacons, such as those enabled ByteLight™ Services from Acuity Brands, interact with the image sensors of a smart phone to deliver a highly effective way to enable location and navigation within indoor environments. Store ambient lighting serves as an LED beacon, and when the lights are on, allow the mobile device to display both horizontal location and orientation with greater accuracy than other indoor location systems. Typical performance is less than 10 cm (4”) horizontally, and orientation to within 2 degrees.

A smartphone equipped with a retail loyalty app senses the overhead LED lighting beacon, transforming it into an indoor location waypoint. These LED-based waypoints provide shoppers with their precise in-store location and help them navigate to other specific locations in the store. They also allow retailers the capability to create a more connected, personalized, and engaging shopping experience for their customers by using in-store WiFi or commercial cellular networks to deliver specific and targeted digital content to a shopper’s smartphone.
CALLOUT: Indoor Positioning Technologies: Capabilities and Limitations

<table>
<thead>
<tr>
<th>Platform</th>
<th>WiFi based</th>
<th>Bluetooth</th>
<th>VLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pros</td>
<td>30’-300’ (10-100 m) radius detection</td>
<td>6 – 60’ (2-20 m) radius detection</td>
<td>0.3 – 1’ (.01 – .03 m) radius</td>
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<tr>
<td></td>
<td>Already present at some level</td>
<td>Bluetooth® services running can trigger loyalty app</td>
<td>Most accurate of the three listed and only technology to provide orientation</td>
</tr>
<tr>
<td></td>
<td>Relatively fast to implement</td>
<td>Detects phone when in pocket</td>
<td>Encourages engagement with loyalty app</td>
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<tr>
<td></td>
<td>No “Opt-in” potentially leading to more privacy concerns</td>
<td></td>
<td>LED fixtures reduce operating costs from energy savings and reduction in maintenance, and improve store aesthetics</td>
</tr>
<tr>
<td></td>
<td>Detects phone when in pocket</td>
<td></td>
<td>Consumer friendly, requiring both loyalty app and intent</td>
</tr>
<tr>
<td>Cons</td>
<td>Additional access points are required</td>
<td>Fleet management challenges when battery operated and manually placed on end caps</td>
<td>Requires coordination of engineering, construction and operations with marketing and IT</td>
</tr>
<tr>
<td></td>
<td>Cloud based analytics add latency and takes away WiFi bandwidth</td>
<td>Medium speed to implement</td>
<td>Only works with phone in hand</td>
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<tr>
<td></td>
<td>Manual fingerprinting is required each time as access points get added and relocated</td>
<td>Opt-in with loyalty app</td>
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The Indoor Positioning Enabler Winner: VLC
Visual Light Communications (VLC) – the principal technology behind ByteLight Services - offers value and precision unmatched by other beacon technologies. The pinpoint accuracy it delivers is paramount, since other beacons are not as reliable and can only locate to within several feet – not much of an aide if looking for a small item in a vast, densely-packed grocery store aisle. Further, VLC works quickly to initially locate a shopper (or product). Its low latency means a person or item can be positioned within 1/10 of a second, and that position is updated as often as five times per second. Orientation is also provided which displays the direction in which a shopper is facing, another necessary detail for quickly and easily navigating to the right location.

Of course, this package of advantages is layered atop the technology’s finest attribute: simplicity. With VLC already embedded into the framework of the LED lighting system in the retailer’s ceiling, installation and activation are simple additions that provide high value to the retailer.

ByteLight Services employs Lumicast™ Visible Lighting Communication (VLC) from Qualcomm Atheros, Inc., a subsidiary of Qualcomm Incorporated, as its VLC solution. Lumicast creates the “code language” of the LED light that comes from the fixture enabled by Bytelight, as well as the decoding algorithm resident in the retail loyalty app on the shopper’s mobile device to create positioning information.
Acuity Brands demonstrated – at LIGHTFAIR 2014 and Lux Live in London 2014 – ByteLight™ Services for Indoor Positioning using LED lighting based upon intelligent drivers from eldoLED®. Using Lumicast™ Visible Light Communications (VLC) technology from Qualcomm Atheros, Inc., a subsidiary of Qualcomm Incorporated, a smartphone was able to determine its position relative to LED ambient light fixtures to within a four-inch radius, as well as deliver an accurate orientation of the direction the user was facing. Using strictly light-based signals received from the ambient fixture, the system displayed greater accuracy than had previously been publically demonstrated using commercially available lighting fixtures, driver technology and smartphones. More recently at LIGHTFAIR 2015 the addition of Bluetooth® technology was shown to provide a 6’ radius of detection when the phone was “listening” while in a pocket or purse, and this capability was integrated with Lumicast technology under the ByteLight services platform.

Hybrid VLC/BLE Solutions Maximize Indoor Positioning Effectiveness

VLC is clearly the best performing technology to enable indoor location-based services - as long as the customer has his or her mobile device out and in active use. However, the accuracy diminishes if the device is in passive use, out of sight in a pocket or purse. As such, the best indoor positioning services will satisfy both the active and passive uses.

The ByteLight Services for Indoor Positioning solution from Acuity Brands combines the use of VLC and Bluetooth® low energy (BLE) technologies. This new indoor location technology and innovative approach using LED luminaires provides significant advantages to both retailers and shoppers, including:

- Uses existing lighting infrastructure rather than requiring additional equipment like stand-alone beacons, bringing faster ROI to LED deployments
- Determines the precise location and direction of opt-in shoppers anywhere there is light, with accuracy within inches
- Reaches every connected shopper that has a mobile device equipped with a camera and/or Bluetooth® low energy technology
- Reduces maintenance costs by being battery-free, since the Bluetooth® low energy (BLE) radio is powered by the light fixture
- Increases energy savings potential of LED lighting through the addition of a BLE mesh network to allow wireless dimming of light level through an interface to existing energy management systems.

LED Lighting-Based Indoor Positioning Is Designed For Security and Privacy

Unlike other indoor positioning technologies, ByteLight Services’ LED lighting beacons address many privacy and security concerns that might be voiced by shoppers or consumer advocacy groups. To engage the ByteLight beacon, shoppers must opt-in to the in-store positioning service via the retailer’s or
other smartphone loyalty application. Opt-in ensures that shoppers who are willing to grant access to their smartphones in exchange for a personalized shopping experience can do so, and that those who aren’t interested aren’t burdened. Once the loyalty app is activated, the ByteLight beacon can locate the shopper’s device, but does not capture or access personally identifiable information.

CONCLUSION
Indoor positioning services provide a strategic platform for the connected retail store of the future – with significant benefits for both shoppers and retailers. Taking a comprehensive, hybrid approach - such as ByteLight Services - that leverages LED lighting and the two best performing indoor location-based services: VLC and BLE, enables retailers to quickly find, engage and satisfy shoppers with the highest accuracy across the largest store area. Higher sales, greater customer satisfaction, operational efficiencies and stronger ROI on lighting assets make LED-based indoor positioning a winning proposition all around.

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1 Survey of US Retailers’ Use of Indoor Location; Opus Research; August 2014
2 “Retailers lose a third of consumers through in-store smartphone use,” by Helen Leggatt, April 14, 2014, BizReport
3 Mapping the Indoor Marketing Opportunity, Opus Research; DATE
4 “Beacons Beckon,” by Diana Bradley, PR Week, February 2015, page 34