

# In-store Consumer App Project

*This report is the culminating deliverable of a semester-long Computer Science field project at Brandeis University, led by Professor **Pito Salas** [pitosalas@gmail.com](mailto:pitosalas@gmail.com), in collaboration with **Mia Stern** [mstern@demandware.com](mailto:mstern@demandware.com), Technical Lead and our point of contact at **Demandware**.*

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## Deliverables

### Github

<https://github.com/BrandeisXDemandware>

We produce two proofs of concept (available under the MIT open source licence):

1. An iOS app that integrates layers of indoor Google Maps with Beacon-generated coordinates to allow for more accuracy in indoor navigation.
2. An Android app that integrates Beacon-generated location cues to produce notifications (Back-end Server access: [Link](#). username: `jing@example.com`, password: `secret12345`).

\* We include a README file for each project, that contains exact information on how the code is used.

### Prototype

[Link 1](#) or [Link 2](#)

Using Proto.io we create a vision for an app and introduce a number of user stories to showcase our recommended features.

### Website

<https://BrandeisXDemandware.github.io>

### Presentation

<http://tinyurl.com/demandwarexbrandeis>

### Report

<http://tinyurl.com/demandwarexbrandeis-report>

This document is the summary of the project. It presents the problem space, market research, our solution, recommended features, technology review, user cases, and future work.

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# 1. Problem Space

E-commerce had changed the way consumers think about service and shopping. Online shopping, such as through Amazon.com, offers instant access to inventories, recommendations and reviews, better deals, and more targeted and personalized shopping experience than in a retail store. Thanks to the internet, consumers can now shop quicker than ever, from anywhere they choose, not being bound to a specific location or time.

As a result, consumer behaviors have changed. Consumer expectations are shifting toward instant gratification and customization<sup>1</sup>. Retail shopping now seems more time consuming. Limited inventories and mundane experiences give consumers more reasons to shop online at the convenience of their homes instead. E-commerce is growing<sup>2</sup> while retail stores are experiencing a decline in sales causing some to cut down their on operations. For instance, JCPenney and RadioShack, which the latter had filed bankruptcy in 2015<sup>3</sup>.

Modern connected consumers use their smartphones to look up deals and tend to treat the retail stores as a showroom<sup>4</sup>. According to the Mobile Movement Report (2011), 79% of smartphone users reported to have used their phones to help with shopping and 23% of consumers who used mobile phones in stores made a purchase from a competitor's website<sup>5</sup>. These numbers suggest a bleak future for retail stores if the resulting customer experience from retailers does not adjust to compete with e-commerce<sup>6</sup>.

## The Future

Even though e-Commerce seems to be the future, it might not actually be the case. E-commerce alone has been exhibiting diminishing growth rates in recent years and it is projected to continue diminishing (see Chart below). Both retail leaders and pure online companies are learning that “the future of the industry is not merely online, but rather in creative omni-channel offerings that

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<sup>1</sup> <http://www.forbes.com/sites/barbarathau/2015/02/10/a-look-at-the-retail-model-of-the-future/>

<sup>2</sup> <http://www.businessinsider.com/e-commerce-and-the-future-of-retail-2015-slide-deck-2015-7>

<sup>3</sup>

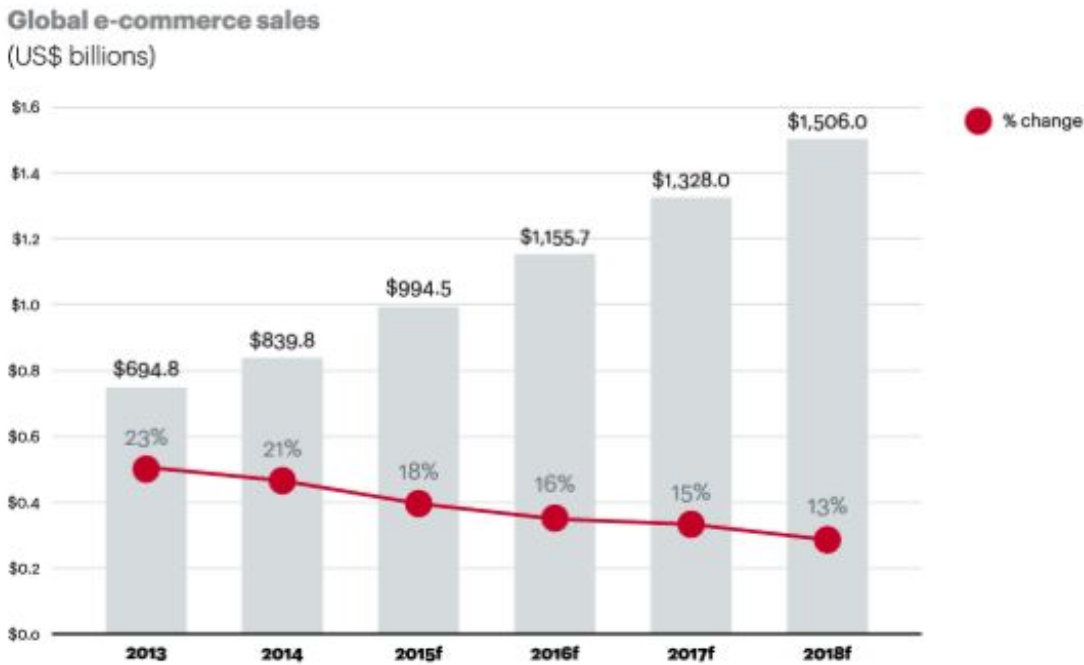
<http://www.forbes.com/sites/antoinegara/2015/02/05/radioshack-cuts-the-cord-after-90-years-files-for-bankruptcy/>

<sup>4</sup> Consumers surfing competitor websites to find better deals and transacting with competitors while in the store aisle.

<sup>5</sup> Vibes. Mobile Consumer Report. Combat Showrooming with Personalization. October 2013.

<sup>6</sup> PSFK. Future of Retail, 2016.

link online and physical shopping”<sup>7</sup>. As a result, the line between eCommerce and retail will be blurred.



*Chart: The slowing down of E-commerce sales growth.*

Retailers such as Gap and Nordstrom continue to expand their online offerings while online leaders, such as Amazon are stepping into physical markets. Gap is a retail leader who diversified into the online shop, and survived. According to the comparison provided by the Business Insider report<sup>8</sup>, Gap’s business is more diversified than JCPenney. 15% of Gap’s sales are from digital sources, whereas JCPenney continue to rely heavily on in-store sales, which composes 99% of their business. The result is that JCPenny’s growth is declining while Gap’s growth stays positive.

## Retail Shortcoming

Another major shortcoming of retail stores, we found, is actually customer service. According to a survey done by the Simon-Kucher & Partners Consultancy Group, retailers’ “competitive issue with the big online retailers isn’t pricing. It’s a fulfillment and service battle”<sup>9</sup>. The consultancy claims that it is wrong to “to use pricing to correct a weakness in another area, like product selection or speed of delivery”.

<sup>7</sup>[https://www.atkearney.com/consumer-products-retail/e-commerce-index/full-report/-/asset\\_publisher/87xbENNHPZ3D/content/global-retail-e-commerce-keeps-on-clicking/10192?\\_101\\_INSTANCE\\_87xbENNHPZ3D\\_redirect=%2Fconsumer-products-retail%2Fe-commerce-index](https://www.atkearney.com/consumer-products-retail/e-commerce-index/full-report/-/asset_publisher/87xbENNHPZ3D/content/global-retail-e-commerce-keeps-on-clicking/10192?_101_INSTANCE_87xbENNHPZ3D_redirect=%2Fconsumer-products-retail%2Fe-commerce-index)

<sup>8</sup> <http://www.businessinsider.com/e-commerce-and-the-future-of-retail-2015-slide-deck-2015-7>

<sup>9</sup> <http://www.forbes.com/sites/barbarathau/2013/10/08/why-consumers-really-shop-online/>

When we look at the difference between online and traditional retailers in terms of customer service, one main reason for brick-and-mortar retailers' shortcoming is the lack of information on individual customer. Nowadays, online retailers have access to customer's profile information, transaction history, browsing history and etc. It allows online retailers to provide a more personalized shopping experience on their native websites or apps by analysing that data and shopping patterns to cater to customers' needs and predict their behavior. On the other hand, associates in the a brick-and-mortar retail stores are strangers and have absolutely no idea what customers want.

However, it is also worth mentioning that traditional retail stores offer customers something that online retailer can never achieve, the physical examination of products and the physical shopping environment. In a study done by A.T. Kearney in 2014, of 2,500 shoppers they have surveyed, "90% of shoppers surveyed would prefer to buy in a brick-and-mortar store"<sup>10</sup> that is because "[people] love going out, shopping with people and touching stuff".

## A Possible Solution

Since customers still go to brick and mortar stores, and will continue to do so, we want to intercept their mobile activity right in the store. We designed a native in-store consumer app that provides an interactive and personalized experience in the store. This application combines features that commonly exist in online shopping while providing the benefits of brick-and-mortar retail stores.

## 2. Features

Here are the main features we suggest to be included in our in-store mobile consumer app. Every feature includes a pitch and an explanation. Further information on the underlying technology (see section 7. Technology), usage stories (see section 3. Usage Scenarios), as well as, reasoning and app comparison that brought us to choose these specific features (see sections 4 and 5).

### Location-Based Notifications

**Pitch:** Have you ever walked by a store and wondered whether there's a sale? Or had attempted to figure out if prices had gone down for the products you are looking for? Worry no more. This

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<sup>10</sup>

<http://www.forbes.com/sites/barbarathau/2014/07/25/report-amazons-got-nothing-on-brick-and-mortar-stores/>

feature sends real-time push notifications, recommendations, and sales on products based on customers' previous online and in-store shopping records and their current location in the store.

**Explanation:** Customers want personalized interaction in the store<sup>11</sup>. They want to be recommended with the items they are interested in, and they want to see personalized sales<sup>12</sup>. We track the location of the customer in the store (and close to its entrance) using beacons, and prompt the customer with location specific notifications to increase the likelihood of entering the store and performing a purchase. More on this later in the analysis of Beacons.

## Interactive Map

**Pitch:** Ever searched for a product for more than a couple of minutes, or had felt puzzled on how to reach a specific aisle where your intended products reside? Search products and have them overlay on the map to allow easy navigation in the store. With customers and associates on the map, the interface also allows easy interactions between them.

**Explanation:** Our main interface for the application is an interactive store map that provides the customer the ability to search the store's products and see them displayed on the map, to shorten the search time for products in the store and increase the likelihood of them fulfilling the sale. In addition, customers are able to see where the associates are in the store, which allows for quick access to assistance and reduces the customer's' frustration in the store.

## Customer-Associate Interaction

**Pitch:** We call this feature Customer-Associate Interaction 2.0. Chat and communicate with associates about sales, products, prices, recommendations and even ask for a different size while in the fitting room.

**Explanation:** In addition to viewing associates on the interactive map, customers and associates can initiate a communication channel between them. This is similar to a chat, in which associates can send customers directions on how to reach a requested product, customers can initiate a request for a specific product or a checkout session if they want to pay and pick up in store.

## Mobile Checkout

**Pitch:** Paying has never been easier. Pay with the fingertip and choose to have the items shipped or picked up in-store.

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<sup>11</sup>

<http://www.forbes.com/sites/steveolenski/2015/10/21/5-ways-to-engage-customers-using-personalized-marketing/>

<sup>12</sup> Ibid.

**Explanation:** Customers can use Apple Pay or Google Wallet to initiate the transaction on the app. Customers can now request pickup, while in the store by initiating a request from an associate. The main advantage is that the shopping carts are the same across the omni-channel offerings, including the online store, mobile app, and DSS platforms, the customer need to have the ability to fulfill the transaction anywhere<sup>13</sup>.

## 3. Usage Scenarios

### Scenario 1

#### Mary's shopping day

At 11:00am Mary is at home. She goes online and searches for that red dress on KateSpade.com (Online store interaction).

At 2:00pm Mary passes by the store. She gets a notification on her phone. The red dress just popped up! (Location-Based Notifications on a native app that are generated from data gathered on the user across the omni-channel presence).

At 2:01pm Mary enters the store. Mary clicks on the notification and a map shows up telling her where she can find the dress that she wishes to buy. (Interactive Map interface allows her to see the path to the items she wishes to buy, reducing the time between customer and purchase).

At 2:15pm Mary is in the fitting room. She definitely likes the color, but the dress is a bit too loose on the sides. She messages philip, an available assistant, asking for a smaller size. (Customer-Associate Interaction in the store gives her the best customer service she could have wished for).

At 2:30pm Before leaving. Philip adds the dress to Mary's digital shopping cart. Mary pays with her fingerprint and leaves with the red dress. (Mobile Checkout allows the customer the ease of choosing an item, picking it up, and paying for it all through their mobile phone).

### Scenario 2

James is in the store and has some sweatshirts in his shopping carts, but he still feels that the price is too high. He does not know where the sweatshirt aisle is. He opens his shopping application. He uses the map interface to locate an active associate and he clicks on William (associate icon showing he is active and his photo). In the customer-associate interaction page,

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<sup>13</sup> <http://blog.demandware.com/operations/dont-shortcut-your-buy-anywhere-fulfill-anywhere-strategy>

the UI is basically a messenger chat page with buttons for requests. Using the messenger and request buttons, James can request customer service from William. In this case, William sends the location of the sweatshirt aisle to James' map. After that, James can navigate to the aisle.

### **Scenario 3**

James is trying out some shirts in the dressing room. He wants to request a different size and have an associate bring it to him. On the request page, he scans the barcode of the shirt to add the product into the request for the associate. In a couple minutes, the associate will arrive with a different-sized shirt for James.

### **Scenario 4**

Now James wants to checkout. He has a number of options. He can checkout by lining up and checking out the traditional way. Or he can use his phone. In the shopping cart section of the app, James can choose the “pickup in store” option. It will request an associate to find James in the store and check out with him. But James is in a hurry, and he is smart. He knows he can use Apple Pay to pay. It is the most time efficient way, and he does not have to fill in any form (such as credit card info) to pay every single time. So, he decided to pay with Apple Pay.

## **4. Analysis of existing apps**

By experimenting and using some of the existing apps developed by retailers. We look for differences and similarities in these apps. We explore some of the drawbacks. By comparing these similarities with our suggested prototype, we show the advantages these features have over what exists currently in the market.

The list of mobile apps we have experimented are H&M, Express, Forever 21, Target, American Eagle, Nordstrom, Walmart, Macy's and the Apple Store. We have also looked at a number of apps from companies that only provide online retailing, such as Amazon, Google Express and Geek.

In order to compare these apps, we came up with a set of standards that we will check each app against. We check the app under these criterias:

1. Is there an online inventory?
2. What are some of the payment methods?
3. Is there any notification system that let user knows about updates, deals or messages?
4. Is there a recommendation system that takes advantage of profile and data analysis?



5. Is there any in-store interaction feature?
6. Can the app show an in-store map?
7. Does the app allow barcode scan of product?
8. Product pickup in store/shopping?

To analyze the existing competition in the in-store application space, we experimented and used many brand-specific and universal apps. We check if all these apps have the above features and functionalities (See Table 1 in the Appendix for the detailed analysis). The top row of the table includes the features we evaluate every app by. Most of the apps we experiment with are developed by brick-and-mortar retailer companies each with an e-commerce platform. We also look at 3 online only retail stores such as Amazon and Google Express.

We can see that all apps have online inventories, in which users can search for product. Macy's is the only app that pushes this feature further, letting user search products by taking a picture of an item. We believe that an in-store app should allow customers to search through online inventory as well as store inventories, as such searching feature would allow connected customers to engage with the store inventory like never before.

Every app on the list except for the Apple Store app, has a barcode scanner. We believe barcode scanner is a must-have function. With so many apps include this scanner, there is reason to believe that it helps improve customers' shopping experience and customer actually uses it. As for the Apple Store app, the way Apple sells their product in the stores make barcode scan unnecessary.

All of the apps except for Amazon, Nordstrom and Geek has a recommendation system that use data analysis on users to recommend products in a personalized way. While Amazon and Geek are pure e-commerce retailers, it is actually surprising that Nordstrom is the only brick-and-mortar store using a recommendation system on its app. As we mentioned before, recommendation system provides a more personalized shopping experience for users, and it is one of the main reasons that shoppers shop online. As a result, we believe a recommendation system is important for our app to provide an in-store personalized shopping experience as well.

We believe that a notification system is a good feature to include in our app as well. A notification can be pushed to either the mainscreen of the phone (with permission) or inside the native app. These messages can be deals or updates, or any message retailers wish to communicate to customers. We can see the importance of a notification system as we notice that half of the single brand apps (Express, Forever 21, American Eagle) and half of the multi-brands retailers (Nordstrom, Macy's) have this function included in their apps, mainly to send deals, and information on new arrivals to users. Moreover, a notification reminds the user about the app and

the store. In our app, a notification system can be used to push real-time messages from store associates, opening up some more interaction possibilities.

Payment method in mobile app is a whole new world. So far, only the Apple Store and Target allows Apple Pay. Apple Pay allows checkout to be done using your fingerprint and reduces the transaction time to merely a few seconds. It is a great innovation, and as a result, we want to include it in our app.

When it comes to in-store interaction or simply having an in-store map on the app, this is where existing apps are lacking. Target's app is the only app with a store map. In our app, incorporating the location-based technology, associates and users would be able to see each other's location in the store. It will create a much more engaging and interactive in-store experience. The interaction can now go beyond just messaging, and bridge physical and remote customer service using this feature of the app. For instance, users can request help from an associate on the app. Because an associate knows where the customer is and has access to the user's profile, the associate can walk over to meet the user in person and provide personalized customer service.

The last feature we explored was product delivery methods. All of the apps have shipping, and only some provide an in-store pickup option. Giving the flexibility of pickup or shipping will promote customer loyalty in the store, and increase satisfaction and sales<sup>14</sup>.

## 5. Distinguishing ourselves

We found that Target is the pioneer in developing an in-store mobile app providing the most interactive features compared to other existing apps. Target uses beacons in their stores, as well as allows payment with Apple Pay, and in-store pickup options. To distinguish ourselves from these industry leaders, we extend some of these features to augment the customer's experience in the store. Our research has shown that location-based customer service can be pushed further. With beacons we can implement a dynamic map in the app as opposite to Target's static map. As mentioned before, location-based technology bridges physical and online customer service, which is something Target has not been able to do yet. Beacons can not only provide location specific information on people but also products in the store. It can allow users to search for the exact location of a product, making in-store navigation easier. As can be seen in our prototype demo (see Prototype in the Deliverables section on the first page), the associate-customer request service feature can be done only because of the use of beacon technology. As a result, we believe beacons really open up many new in-store location-based features.

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<sup>14</sup> <https://www.internetretailer.com/commentary/2015/03/13/secrets-success-buy-online-pick-store>

## 6. Technology

To further understand the problem space and produce viable solutions and features to be included in the application, we conducted technology research and experimented extensively with beacons, indoor maps, and mobile payments. We then produced a number of proofs of concept to showcase the feasibility some of the features we recommend (proofs of concept are available through our github repository (see Github in the Deliverables section on the first page). Here is the analysis of the technologies we used.

### I. Beacons

To give our phone some location awareness, we decided to use beacons as a location signal media.

#### **What are Beacons?**

Beacons are small wireless sensors using Bluetooth Low Energy signals that store-owners can attach to any location or object in their store. These beacons broadcast tiny radio signals which customers' smartphones can receive and interpret, unlocking micro-location and contextual awareness.

The lifetime of a beacon depends on its configuration. At default factory settings, Estimote Beacons last for about 2.5 - 3 years. Moreover, the typical range of Bluetooth low-energy radio modules is up to 70 m (for Estimote beacon). Of course, it depends on its location, because radio signals could be absorbed or diffracted.

Moreover, some beacons include motion and temperature sensors which provides users with additional information.

#### **Why beacons?**

We analyze other existing technologies that provide location awareness:

##### **RFID**

- Requires installation of expensive machinery on site.
- Phone will require extra hardware to receive RFID signals.
- A relatively old technology and does not have a sufficiently good supported protocol.

##### **NFC**

- It has a very short range (< 20 cm).
- NFC on iOS devices is locked and is only available for service such as Apple pay.

### **QR Code**

- Requires a scanning action with a camera
- Provides limited information

In comparison, these are the **beacon advantages:**

- Beacons have good platform support on both iOS and Android.
- Beacons have a good signal range <70m.
- Beacons have a more accurate location identification (Ranging <10 cm, Location Coordinate < 2 m).

### **Why Estimote Beacons?**

We chose to work with Estimote Beacons (Y Combinator Graduate, New York)<sup>15</sup>. The beacons from Estimote are actually more expensive than some of the other options (listed later) in the market (~\$30 per beacon). But we still chose Estimote because the beacons come with temperature sensor and motion sensor, which can be interesting if we are thinking of putting beacons on actual products. More importantly, compared to other competing beacon brands, Estimote has a much more open platform, which includes a demo app source code on Github, well documented development guidelines and good Q&A page, which can make development much easier considering our limited time frame.

And here are some cheaper options that we had also considered:

### **Swirl**<sup>16</sup>

Amy Croot, Product Manager at Demandware, mentioned to us this brand before. They are based in Boston and have worked with some big brands. Moreover they seem to have a very well documented platform too, however, not as open as Estimote's. A major downside is that they are not selling their beacons or listing their prices online. We had tried to contact them, but did not get a response. It might be worthwhile to consider them as an alternative.

### **Radius Network**<sup>17</sup>

This is a small company located in DC. The beacons they are selling are much cheaper, but their development kit and documentation is not as open as the other competitors. Moreover, we can

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<sup>15</sup> <http://estimote.com/>

<sup>16</sup> <http://www.swirl.com/>

<sup>17</sup> <http://www.radiusnetworks.com/>

develop for free with only one of their kits, and if we want to use multiple kits (notification kit, geo kit, etc), we will need to pay \$9/mo for them. Since their platform is relatively close, the online resource is also limited compared to Estimote's.

There are some other options (such as Onyx Beacons<sup>18</sup>), but they don't have any obvious advantage compared to Estimote.

## **Beacon Setup with Estimote SDK**

### **Background Monitoring/Ranging System:**

With the ranging system, our mobile phones can detect nearby beacons and notice when phones get away from the beacon's range. In the application, we can set up a listener for beacons and have a trigger function for entering a beacon region and leaving a beacon region. Such trigger function can be pushing notifications about sales and recommendation based on customers most nearby beacon, or monitoring customers' shopping behavior with the *region enter* and *region exit* functions.

For each beacon, there are three identification numbers: a UUID, a major number and a minor number. All three identification numbers can be modified. UUID can be the same for all the beacons in a specific location and beacons in the same location will have different major and minor number. When we set up a listener and listen to all the beacons in the same location with a specific UUID and if we want to listen to just a subset of our beacon, we can set a range of major or minor number (for example,  $>7777$  or  $=7777$ ) that we are interested in.

To prevent beacon coverage overlay in the space, we can use their ranging system to sort the detected beacons by signal strength in an array.

While different manufactures might have different SDK setups, the basic idea behind them is similar. Here is the documentation from Estimote about their monitoring system: <http://developer.estimote.com/ibeacon/tutorial/part-2-background-monitoring/>.

### **Indoor Location System:**

While the iBeacon standard was not designed for precise distance measurements, but for providing mobile apps and devices with location context, Estimote developed an SDK to provide precise, blue-dot location services indoors using trilateration of signal strength<sup>19</sup>.

With an automatic configuration tool provided by Estimote, we can setup the indoor location system by placing beacons on each wall in the the store and use their application to map the

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<sup>18</sup> <http://www.onyxbeacon.com/>

<sup>19</sup> <http://developer.estimote.com/indoor/>

border of the space. Once the space is mapped, the configuration will be uploaded to the Estimote cloud and we can access the configuration directly in the map through the cloud.

Once we have setup everything, we can simply use a location fetching function to get a location object, which has x, y coordinates and the current orientation in respect to the north.

## **Potential Problems with Beacons**

### **From Beacons to Application:**

Because each store has a different size and layout, there is not a single solution for where to put the beacons and therefore, we need a rather complex system to streamline the process of setting up beacons in stores and configuring information in the respective application, for example, what kind of notifications do we want to associate with what beacons.

### **Scaling:**

We found a very interesting article written by Shelley Bernstein, the Vice Director of Digital Engagement & Technology at the Brooklyn Museum<sup>20</sup> and how she dealt with scaling issues. Bernstein talks about the difference between setting up 3 beacons in a room and setting up 30 beacons in a huge retail store. This requires to spend more time in optimizing the layout and maintenance of the beacons. With so many beacons, it will be hard to keep all of them attached to the wall (because she found that they tend to fall, and be picked up by strangers and potentially never returned to her) and make sure their battery doesn't die out. Moreover, carrying a phone and a laptop while configuring beacons in a huge space proved to be a difficult task.

### **Indoor Location Accuracy:**

While the ranging system works in a very high accuracy (<10 cm), the indoor location system does not work as well (<2 m) since this is not what beacons were designed to do. Such accuracy can potentially impact user experience and cause trouble in in-store navigation as the distance between two aisles might be less than 2 meters. This raises the need to design a smarter algorithm for the navigation system.

### **Setup-Difficulty:**

While the indoor location mapping sounds easy with Estimote's automatic configuration application, we fail the configuration many times with some internal error and the successful rate is about 30%, so that can lead to extended setup durations and frustration.

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<https://www.brooklynmuseum.org/community/blogosphere/2015/02/04/the-realities-of-installing-ibeacon-to-scale/>

## II. Map Interface

### Indoor Map

We use an indoor layout map for our main app interface. Since our brands have many retail stores across the country, drawing and developing their indoor layout map could be painful. However, as you can see in our interface (see Prototype and iOS proof of concept in the Deliverables section in the first page), Google Maps is now providing an Indoor Map service for business owners to upload their stores floor plans and their Google's Map team will draw the layout for them on Google Maps, after which business owner can align the floor plan and push it to the real map<sup>21</sup>!

A similar service is also provided for Apple Map<sup>22</sup>. Apple launched an Indoor survey app recently and it allows user to map the border and highlight their indoor location with this app.

As these mature map platforms are making effort to draw out the indoor layout of all the buildings, we believe that indoor layout could be something very exciting to work on.

### Beacon and Map Integration

We map beacon coordinates to Google Map coordinates. We place a single beacon in the center of each wall in each room. With the help of Estimote indoor location SDK, we walk from beacon to beacon and use our smartphone to recognize each beacon, and calibrate the beacon's location. Once we complete the configuration process, the beacon-estimated location map is automatically uploaded to the Estimote Cloud. The beacon map has x, y coordinates and orientation and we can see real-time positions with x, y and orientation within that space. We can also adjust the map on the online interface to make sure the beacon-estimation resembles our floor plan layout precisely.

We can convert longitude and latitude coordinates from Google Maps to x, y coordinates using mercator projection<sup>23</sup>. Then we can map beacon's longitude and latitude coordinates on Google Maps mercator projection with x, y locations. For any user inside an indoor space of beacon map, we can combine relative x, y coordinates and orientation fetching from Estimote Cloud and showing the user's indoor location on the Google Maps map interface.

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<sup>21</sup> <https://www.google.com/maps/about/partners/indoormaps/>

<sup>22</sup> <http://www.theverge.com/2015/11/2/9657304/apple-indoor-mapping-survey-app>

<sup>23</sup> <http://www.math.ubc.ca/~israel/m103/mercator/mercator.html>

### III. Swift mobile checkout

To streamline the checkout process, we employ integration with Apple Pay and Android Pay in-app purchase API where user can make purchases with a single touch rather than having to fill in billing, shipping, and contact details.

While the Android in-app purchase is on its way, here are the prerequisite for using the in-app purchase API for Apple Pay:

In addition to implementing Apple Pay with the PassKit framework, which will release the payment credential token, you must:

- Set up an account with a payment processor or gateway, if you don't already have one. You can find a list on [developer.apple.com/apple-pay](https://developer.apple.com/apple-pay/).
- Register a Merchant Identifier via Certificates, Identifiers & Profiles
- Submit a Certificate Signing Request to obtain Public and Private keys that will be used to encrypt and decrypt Payment Tokens
- Include an Apple Pay entitlement in your app<sup>24</sup>.

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<sup>24</sup> <https://developer.apple.com/apple-pay/Getting-Started-with-Apple-Pay.pdf>.



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## 8. Appendix

Table 1 - Existing app comparison

	<b>Access to online inventory</b>	<b>Payment method(s)</b>	<b>Notification System</b>	<b>Recommendation System</b>	<b>In-store Interaction</b>	<b>In-store Map</b>	<b>Barcode Scan</b>	<b>Pickup/shipping</b>
<b>H&amp;M</b>	Yes. Can search online inventory	Credit card	No	No	No	No	Yes	Shipping only
<b>Express</b>	Yes. Can search online inventory	Credit card, PayPal	Yes. Messages such as offers, holiday's special and new arrivals	No	No	No	Yes	Shipping only
<b>Forever 21</b>	Yes. Can search online inventory	Credit card, PayPal	Yes. Messages such as offers, holiday's special and new arrivals	No	No	No	Yes	Shipping only
<b>American Eagle</b>	Yes. Can search online inventory	Credit card, PayPal	Yes. Messages such as offers, holiday's special and new arrivals	No	No	No	Yes	Shipping and pick up in store
<b>Nordstrom</b>	Yes. Can search online inventory	Credit card	Yes. Notifications on sales in nearby stores. This function uses the GPS of user's phone	Yes. There is an option to shop recommendations for the user	No	No	Yes	Shipping and pick up in store
<b>Walmart</b>	Yes. Can search online inventory	Credit card, PayPal	No	No	No	No	Yes, with QR code scan	Shipping and pick up in store

<b>Target</b>	Yes. Can search online inventory	Apple Pay, Credit Card	No	No	No	Yes. Even if you are not in the store. When search product , item shows up on the map of a nearby store	Yes	Shipping and pick up in store
<b>Macy's</b>	Yes. Can search online inventory. Image search. Search by taking picture of a product	Credit card	Yes. Messages such as offers, holiday's special and new arrivals	No	No	No	Yes	Shipping and pick up in store
<b>Apple Store</b>	Yes. Can search online inventory	Apple Pay, Credit Card	No	No	No	No	No	Shipping and pick up in store
<i>****Online retailers only****</i>								
<b>Amazon</b>	Yes. Can search online inventory	Credit card	Yes. Messages such as offers, holiday's special and new arrivals	Yes. Amazon make very good use of profile analysis to make recommendations	Not eligible	Not eligible	Not eligible	Shipping
<b>Google Express</b>	Yes. Can search online inventory	Credit card	No	No	Not eligible	Not eligible	Not eligible	Shipping
<b>Geek</b>	Yes. Can search online inventory	Credit card, PayPal	Yes. Messages such as offers, holiday's special and new arrivals	Yes	Not eligible	Not eligible	Not eligible	Shipping