**Objection:** To find a cheap solution for beacons for indoor mapping

Looking at some of our options for indoor mapping there’s WiFi, BLE, NFC. Each technology has their own pros and cons which may or may not make it viable for our purposes. What we need is something that can either triangulate the precise location of the person in real time, or be dense enough that it can update the position without being real time.

With WiFi signal triangulation, the way it would work is based on the signal strength of each access point (AP) that is in the building. A few problems come to mind when AP are involved. The first being that the APs need to be located near a power source. This makes for a difficult scalability and doesn’t offer anything for portability. They are also bulky and wouldn’t be practical to install all over the building. The existing infrastructure within the building might not be able to accurately triangulate the position due to the sparsity of the APs within the building. This would lead us to either supplement the APs with another technology, or to buy more. APs are one of the more costly solutions to the problem and they are bulky, and they are also not that easy to install.

BLE is a more viable solution. It improves upon the WiFi triangulation by not needing a power source in order to function. BLE run on a small battery and as a result can be placed anywhere. This allows for high scalability and portability. They have a large range (1m to 70m) and run on the same frequency band as WiFi. Since they run on the same frequency as WiFi we need to be careful about interference, and because it’s a radio frequency it has the same problems as WiFi. That is, it can be absorbed by glass, metal, the human body, etc. just as a WiFi signal can. The BLEs are more cost effective than an AP but they still range from fourteen to 200 dollars. Any Eddystone BLE is supported with many APIs and would be easy to integrate.

Another solution would be NFCs. One obvious drawback of the NFCs is the proximity. Most NFCs require the user to be ten centimeters away in order to detect it. One good thing about them is that the cost is cheaper. The amount that we could use for this project is almost limitless because of the cost (17 dollars for 50 pieces). Since we would have an almost unlimited supply of them we could map every little thing that would be needed, offices, elevators, stairs, bathrooms, junction points, etc. They could act as the nodes for the map and point the user in the right direction.

Looking at everything as a whole the most appealing technology is the BLE because of the ease of integration. The only thing that would be a problem would be the cost of the technology if we had to buy a bunch of them. Currently more research needs to be done on the density needed for tight spaces. The second best choice would be the NFCs because of their cost and versatility on what can be programmed into them.

References: <https://blog.beaconstac.com/2015/07/ibeacon-vs-nfc-vs-gps-which-indoor-location-technology-will-your-business-benefit-from/>

<https://nfclab.com/papers/nfcinternal.pdf>