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Background and Specification Progress Report

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# Background and Context

## Contextual awareness:

Contextually aware services are becoming a more and more popular method to engage and inform a user, with constant advances in technology increasing the precision and nature of contextually aware services, and providing new and interesting tools to provide these services.

Context has been defined several times in several different papers depending on the needs of the researcher(s), but one of the most relevant to the project at hand would be Dey and Abowd, who define context as:

*“… any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application,including the user and applications themselves”*[[1]](#footnote-1)

Building widely available contextually aware services has the main problem of requiring all client devices to possess the ability to measure their environment ( and to the same scale ) – this requires the use of an already well-established method of defining context.

## Location-based services / route planning:

Location based services have made great progress over the last few years, bringing the ability to locate a cellular device down to a building using GPS technologies. Massive platforms have been built on using location to build a contextually aware service[[2]](#footnote-2), so it makes sense that this field continues to advance at a rapid pace. Location based services work hand-in-hand with contextually aware services, providing the ability to give context, whilst also being able to take location using contextual markers.

A natural extension of these location services are route-planning services that allow users to find the most expeditious route to any location, from their current. Whilst the biggest problems that location technologies are constantly trying to solve are precision and accuracy, route planning adds more problems – namely efficiency, and correctness.

## Crowdsourcing Data:

Defined as ‘Obtaining (information or input into a particular task or project) by enlisting the services of a number of people, either paid or unpaid, typically via the Internet’[[3]](#footnote-3), crowdsourcing is becoming a wildly popular method to collect large amounts of data with minimal effort on behalf of the client, with services such as CrowdFlower offering incentives for users to give data. The biggest problems in this sector are encouraging user participation, and reliability of data.

## Existing Solutions in these sectors

### Google Maps:

Google already provide high level location-based services, allowing users to pinpoint their location incredibly accurately – this has been boosted by their use of public wireless points to increase the accuracy of triangulation using Wi-Fi as well as GPS. A major issue is that Google provide world-based maps, with local area being the lowest level, meaning that it cannot provide truly pinpointed contextual services throughout a building in a useful manner ( usually it is just presented as a worldwide latitude / longitude ).

Google also crowdsources a lot of the data that they use – mostly automatically, to provide autocompletion services and the like; their Maps application can collect anonymous location data periodically to improve their own services[[4]](#footnote-4)[[5]](#footnote-5).

### Estimotes:

A rapidly accelerating tech start up, Estimote provides ‘beacons’ using low-power Bluetooth in order to send an ID[[6]](#footnote-6) to an Estimote enabled application – these can then be programmatically associated with locations, events, etc and calculates it’s distance from the phone using RSSI ( the received signal strength ), meaning that it can be used very effectively to provide location-based services. This is currently one of the most prominent devices currently using it’s base technology ( iBeacon ). Currently it’s major drawback is the price, which limits Estimote beacons / stickers to small buildings – covering an area such as King’s would be incredibly costly, and any structural changes regarding the beacons would require significant effort to represent in an application developed to use Estimote. Another issue is that using RSSI to develop an idea of location can become very complex in a large building with lots of people in it (which would cause signal attenuation at different levels throughout the day).

### Cisco Context-Aware Software

An established standard in networking, Cisco provide a complete package, based around monitoring ‘assets’ and providing back-end support to network hardware, along with some contextual services that allow location tracking of connected wireless users[[7]](#footnote-7). The software is designed with an open-ended API to allow the development of business applications that integrate with the network, although this may still limit businesses in their ability to collect data, and provide useful functionality in return.

## Relevant Papers:

### Participation inequality: Encouraging more users to contribute (Nielsen, J., 2006)

This article addresses a major problem with crowdsourcing data which Nielsen refers to as ‘participation inequality’, stating that ‘user participation often follows a 90-9-1 rule, with 90% of users being ‘lurkers’ or users that will observe but not contribute’[[8]](#footnote-8). Nielsen also covers how to overcome this participation inequality ( after briefly summarizing with ‘you can’t’ ). One method in particular is of interest when considering the aims of this project and it’s associated application: ‘make participation a side effect’[[9]](#footnote-9) – essentially the act of collecting data without the user having to do anything - this is less intrusive to the user’s day-to-day use of the application, but can also have obvious ethical ramifications if the user is unaware if they are submitting data

### A Survey on context-aware systems (2007)

This article provides some great insight into approaching the development of contextually aware applications – it lays forward architectural approaches, noting that modern software design principles emphasize encapsulation ‘in order to separate business logic and GUIs’[[10]](#footnote-10). It also details sensor types – the most interesting being ‘logical sensors’, which in practice would use multiple sources of information, ‘combining physical and virtual sensors with additional information from databases or various other sources in order to solve higher tasks’[[11]](#footnote-11). It even goes on to detail already existent location-aware systems, such as those used in tours.

# Use Case Diagram:

# Bibliography

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1. (Abowd, 1999) [↑](#footnote-ref-1)
2. See Google, forgo Apple Maps [↑](#footnote-ref-2)
3. http://www.oxforddictionaries.com/definition/english/crowdsource [↑](#footnote-ref-3)
4. (Google - Collection of anonymous location data, n.d.) [↑](#footnote-ref-4)
5. (Google - Privacy Policy, n.d.) [↑](#footnote-ref-5)
6. (Estimote - Intro To Beacons, 2014) [↑](#footnote-ref-6)
7. (Cisco - Mobility Services - Context Aware Software, n.d.) [↑](#footnote-ref-7)
8. (Nielsen, 2006) [↑](#footnote-ref-8)
9. *Ibid* [↑](#footnote-ref-9)
10. (Baldauf, (2007)) [↑](#footnote-ref-10)
11. *Ibid* [↑](#footnote-ref-11)