Research Location Tracking

Introduction

In this research paper location tracking with Android will be researched for the Android project.

Project context

The project is about making a club museum tour app. Users will get different types of output depending on where they are standing in the club museum.

Motivation

Currently, I have no experience with location tracking (neither with Android or iOS). This means I don't know what type of tools there are, what terminology I need to use to do effective desktop research, what tools I will need to make the app work and most importantly, IF the Android location tracking is accurate enough to make the concept work. By doing research on location tracking with Android I will be able to tell whether the Android location tracking is accurate enough and if it is I can effectively start developing a POC and ultimately the app as an end product.

Research questions

The question that will be answered in this research paper.

Main question

Is Android location tracking accurate enough?

Sub questions

- How accurate is Android location tracking?
- How can one make location tracking with Android as accurate as possible?
- What types of tools/apis does Android provide in order to manage the location of a device/user?
- Are there potential weaknesses/threats/drawbacks of using these tools?
- How can one give a different type of output based on the location of a device/user with Android?

Results

The research output after having answered the sub questions.

Android location tracking accuracy

How accurate is Android location tracking?

According to the [Android documentation on geofencing](#), the location accuracy when Wi-Fi is available is usually between 20-50 meters. When indoor location is available, the accuracy range can be as small as 5 meters. Unless you know indoor location is available inside the geofence, assume that Wi-Fi location accuracy is about 50 meters.

How can one make location tracking with Android as accurate as possible?

In an ideal situation, the user is outside, not too close to buildings and near multiple Wi-Fi networks. This is unfortunately not an option for the app concept. You can however, give users the option to turn on the 'High Accuracy' mode which improves the accuracy of location tracking. You can also advise the user to turn on Bluetooth since that improves the accuracy as well as long as there are Bluetooth devices nearby.

However, all these factors still won't bring the accuracy below 5 meters. Luckily, there's a new way to improve location accuracy which is called RTT (Round-Trip-Time). RTT uses Wi-Fi location functionality to measure the distance to nearby RTT-capable Wi-Fi access points and peer Wi-Fi Aware devices. This allows the location accuracy to be within 1-2 meters which means it's precise enough for indoor location tracking. One downside is that there's not a lot of support for this technology. There's very few Access Points that support it and only the most recent Android phones have support for RTT.

Another option is to install Bluetooth beacons in a certain area. Beacons constantly transmit small packets of data e.g. their ID and transmission power which phones can pick up and use the data to do something with it. The average maximum range of a beacon is 70 meters.
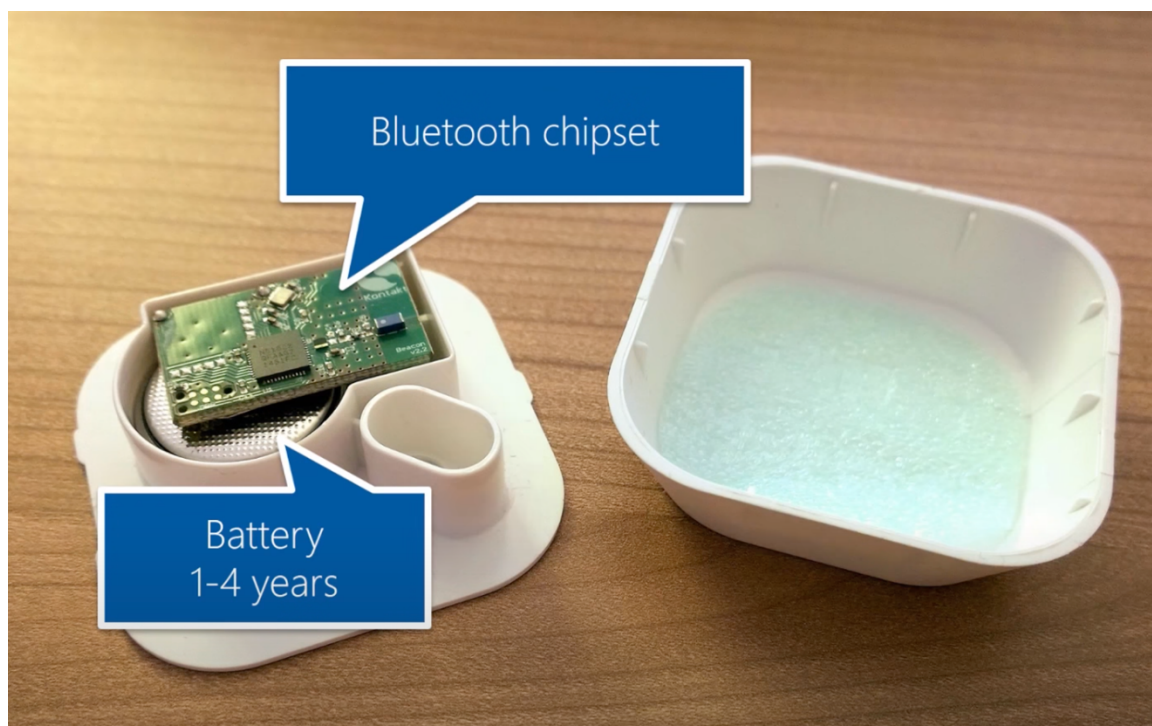
There are different types of beacon formats. iBeacon (from Apple) and Eddystone (from Google) for example. The difference according to Geomarketing.com:

iBeacon can only communicate with apps, whereas Eddystone works across apps and browsers.

"Eddystone can do that because it's really four different — but related — products," said consultant and beacon specialist Stephen Statler. "Eddystone URL can 'talk' with browsers, while Eddystone UID and EID can talk with apps. Eddystone TLM is the fourth and works in the background to manage beacons."

Android location tools
What types of tools does Android provide in order to manage the location of a device/user?

Location API
The Android 'android.location' API provides classes that help manage location. However, according to many articles, the technology is not accurate enough and simply not made for indoor tracking.

Conclusion & Recommendations
During my research I had a hard time getting the needed hardware and the same goes for finding software documentation on how to detect a user is nearby and how you can track the distance between the user/device and multiple beacons. Apparently, the Bluetooth Beacon technology has already been available since 2013, but is not applied much in the real world. It's mostly used to offer users an indoor navigation system (e.g., at airports, shopping malls and museums).

So, is Android location tracking accurate enough? The answer is yes, provided you have hardware like Bluetooth Beacons and/or Access Points set up you can achieve an accuracy that's good enough to support a decent user experience.

Sources

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