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Indoor localization: technologies and apps

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Project Overview

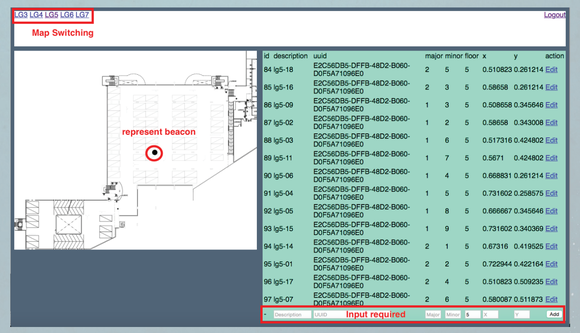
This project aims at building an application called “Parkner” which can be used to locate the car of a user inside car park using iBeacon technology.

iBeacon

Client side: A mobile application supporting both Android and iOS devices.

Server side: A web–based backend for managing iBeacons’ configurations

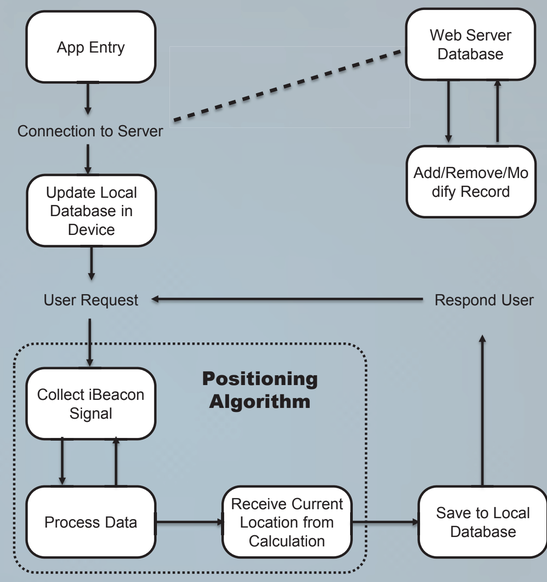
Client side user interface



Server side user interface

To achieve this goal, our group has conducted some studies on the behaviour of iBeacons to decide the essential factors in this project such as placement of iBeacon, optimised height to set the iBeacon and the distribution of the reference points used for fingerprint database of cosine similarity algorithm.

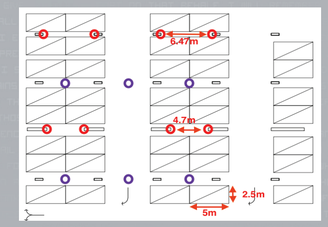
Methodology



1. Support both Android and iOS gadgets
2. Available for all indoor carparks in HKUST
3. Web backend with authentication for secured iBeacon management
4. Use self–adjusted cosine similarity algorithm to improve the accuracy
5. Design of iBeacon placement grid to minimise the cost with reliable result

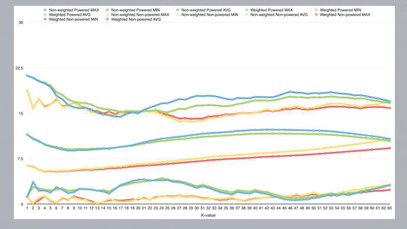
Result

We have successfully implemented the iOS and Android versions of Parkner and the iBeacon management system for carpark manager to manage the iBeacons. Also, we designed a pattern of iBeacon placement to reduce the cost with higher quality.



Placement of iBeacon

For the main algorithm we used in calculation, we tried different combinations of settings to test the equation. We finally figured out the optimised settings to get the best result in the carpark in HKUST.



Test result of algorithm

On average, the latency of locating the position will be no more than 6 seconds and the error of the calculated result compared with actual position is 6 meters.

Future Enhancement

1. Collect more bluetooth fingerprints in different levels of carpark loading to reduce the error due to unstable signal
2. Implement the routing feature for users to create a path to find their cars