

Report 2

Junyang Shi (466958), Dmytro Arbuzin (415158)

December 12, 2014

Contents

1	Basic feature implementation	2
1.1	Process of the experiment	2
1.2	Analysis of each basic feature	2
2	Extra feature implementation	3
3	Time estimation and feedback	3

1 Basic feature implementation

1.1 Process of the experiment

Experiment of each basic feature:

- **Acquire the available sensors on our devices :** Press the Sensors list item in the Menu and sensors will be shown on the screen.
- **Obtain Wi-Fi fingerprint :** Press the Wi-Fi item in the Menu and Wi-Fi scan list will be shown on the screen.
- **Estimate the location of the measurement data :** Press the Measurement item in the Menu and the estimated location of the measurement data will be shown in a token on the screen.

Algorithm : we compared the measurement data with reference data(18 provided files from six location, each location with three files obtained from different time of the day). Since each file has 15 measurements, we firstly calculate the average signal strength for all access points(APs) that occur in each file. Specifically, for those APs which occur in every measurement, we calculate the average directly, and for those APs which do not occur in every measurement, we use a def value (-110 by default) to represent their signal strength in missing measurement and then calculate the average. This is done for both measurement data and reference data. Then We traversal the access points of the measurement data. For each access point(identify by BSSID) appears both in measurement data and reference data, we calculate the difference based on the equation below:

$$difference = \text{sqrt}[(measureAP1RSSI - referAP1RSSI)^2 + ...AP2... + ...]. \quad (1)$$

The reference data which has least difference means the closest estimated location of measurement data.

- **Localization with our own mobile devices :** First press the Wi-Fi item followed by Save Wi-Fi item in the Menu for several time in a single location then use the localization item to estimate the location.

Detail Process : At each location, we first scan Wi-Fi access points and save the result in a file. Then, we repeat this action several times, the data will be written in the end of the file every time. The program will generate an access points list which contains the BSSID of access points that occurred every time we scanned and the corresponding average signal level of each access point.(The more time we scan and save access points, the higher accuracy achieved). Finally, the above algorithm is used to localize.

1.2 Analysis of each basic feature

- **Analysis of measurement data :** We choose measurement data "A126.json". With our algorithm, it shows that the location of measurement data is A136.
- **Localize ourselves :** The result is not stable when we localize ourselves by the room A141. In some situation, the estimated location is A141 after scanning and saving Wi-Fi access points for several times. However, the accuracy is not very high.

With a set of give measurement data, the location is exactly A141 based on the algorithm. With our own measurement data, for a few cases, the estimated location shows the same result with given data.

2 Extra feature implementation

Calibration database

- Users can create their own database based on Save Wi-Fi item in the Menu. The real time scan lists of Wi-Fi access points are stored to files in Json Format. In a single location, the experiment time to build calibration database is unlimited, every measurement result will be handled(stored in files). Only the most frequent occurred access points and the corresponding average signal strength will be selected to build the database. Therefore, the accuracy is highly enhanced. When localizing based on the database, the files in database will be read to compare with real time data.

3 Time estimation and feedback

- **Total time spent :** 30 hours.
- **Feedback :** Since unstable characteristic of the experiment itself, it's more helpful if some hints is given concerning localization in real time. In our case, we scan once and then use the Wi-Fi access points list to localize in the beginning. However, the accuracy is relatively low. Now, we scan several times, write it to file, then read from file and use the algorithm to localize. The accuracy is enhanced.
In addition, the assignment gives us access to learn mobile sensors as well as indoor localization technology based on Wi-Fi fingerprint.
In a word, the assignment is very helpful.