Indoor localization solution based on Wi-Fi fingerprint

- How it works

The main idea of Wi-Fi fingerprint is to collect signal characteristics of spots at predefined points in the area of interest and then build a fingerprint database. The location of an object is then determined by matching online measurement with the closed location against the database. It is a two-stage method of wireless indoor positioning. First, a training(offline) stage builds a radio map by measuring signal strength at a number of calibration points, i.e. fingerprint database of all wireless access points in a given area. Second, a positioning(online) stage measures signals and estimates a wireless device's location by matching the measured signal to the fingerprint.

- Strengths and weaknesses

Strengths:

1. Located in almost every building, fairly good available signal strengths.
2. Wi-Fi signals are able to penetrate walls.

Weaknesses:

1. laborious and time-consuming calibration process.
2. Signal strength changes due to time and environment changes such as the presence of physical object.
3. Interfere possible with other applications in the 2.4 GHz ISM.

- Commercial usage

One possible use of Wi-Fi fingerprint is for emergency rescue operations, i.e. to find victims under piles of rubble when the rubble contains the remains of the Wi-Fi base stations.

- Compare with other solutions

Radio Frequency identification(RFID) positioning technique which based on proximity detection is a popular wireless positioning solution. It tracks the movements of objects through a network of radio enabled scanning devices over a distance of several meters.

Compared to RFID, Wi-Fi fingerprint technique is simple regarding implementation. Wi-Fi fingerprint technique can be implemented totally in software and does not require specialized hardware in mobile devices. However, RFID requires a RFID tag to be put on tracked objects. Besides, low cost is another advantage of Wi-Fi fingerprint solution since a Wi-Fi network exists as a part of the communication infrastructure which avoids expensive infrastructure deployment. In addition, both techniques achieve relatively high accuracy.

Another Wi-Fi indoor localization solution is based on radio signal propagation models.

Comparing with Wi-Fi indoor positioning system via radio signal propagation models, fingerprint techniques uses empirical data which avoids deriving a propagation model for each Wi-Fi access point in a real-world indoor environment that is extremely complex, thus resulting in a relatively high accuracy. In addition, fingerprint techniques usually do not require knowing exact location of Wi-Fi access point.