2011 Taste of Research Summer Scholarship Program

Experimentally Determining Differences in RSSI Readings Between Different Wi-Fi Chipsets

Author: Gough Yumu Lui - Supervisor: Binghao Li

Research Theme: Digital Future

Background

In many indoor environments, it is not possible to receive accurate positioning information via satellite based systems such as GPS. One alternative is the use of Wi-Fi access points (APs) to provide positioning information. The current method of Wi-Fi positioning relies on a technique called fingerprinting, where the signal strengths (RSSI) of APs at reference points are recorded into a database during training. This database is then queried by a user to provide their location.

For this system to work well, the RSSI reported by the user should match well with that of the RSSI recorded in the training phase. Unfortunately, with the wide variety of devices available, we cannot guarantee that all devices will perform equally under the same environment.

Aim

To experimentally investigate how a wide variety of different Wi-Fi based devices report their signal strengths in both an indoor and outdoor environment.

Testing Methodology

- A wide variety of devices including Laptops, USB Wireless Cards and Mobile Phones were employed during testing (see Figure 1).
- A dual band (2.4Ghz and 5Ghz) Belkin Play Wireless AP was set up at a fixed position.
- The device under testing was placed on top of the bin at the same height as the AP.
- The device was set to log the RSSI of the AP on all available bands simultaneously.
- Every 5 minutes, the trolley was moved to one of 15 distances from the AP (0.3m, 0.5m, 0.8m, 1m, 1.5m, 2m, 2.5m, 5m, 7.5m, 10m, 15m, 20m, 25m, 30m and 35m).
- The data was downloaded and processed using a C program and Matlab to produce the results.
- The testing was conducted both indoors and outdoors (See Figure 2 and 3).

Figure 1. Some of the devices used in testing

Figure 2. Indoor Testing

Figure 3. Outdoor Testing

Results

- Significant differences were found in the mean RSSIs between different cards (see Figure 4 and 5).
- Some cards (Netgear MA101, Netgear WPN111) were unable to report meaninfgul RSSIs.
- Temporal patterns were found in the RSSI readings from some cards.
- Variances in RSSI were found to be much lower in the 5Ghz band compared to the 2.4Ghz band.
- Different generations of chipsets from the same vendor exhibited significant differences in their RSSIs.
- Certain cards appear to report certain values of RSSI which do not appear to be correlated with the true signal strength.
- Compensation factors have been derived.

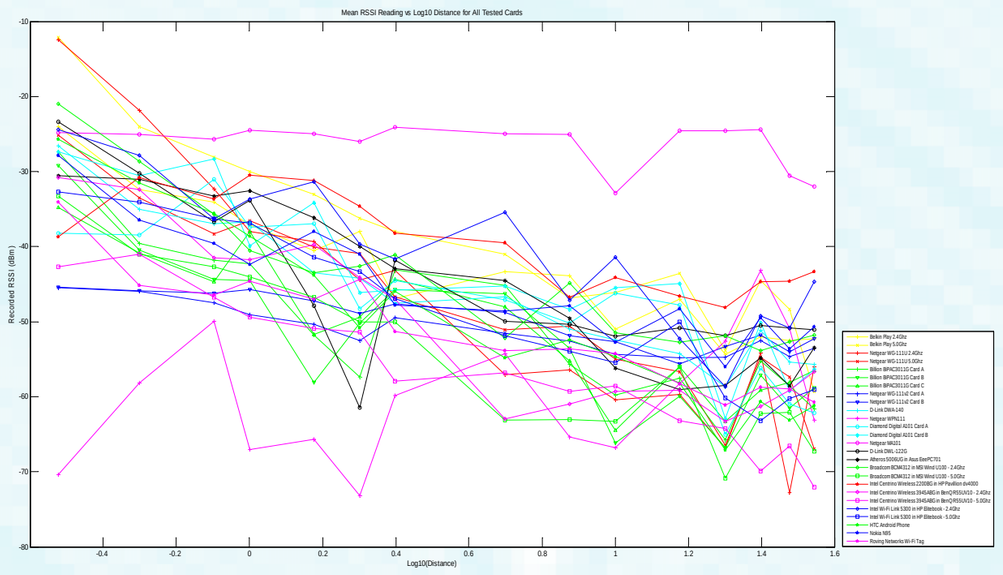

Figure 4. Mean RSSI Trends for Indoor Testing

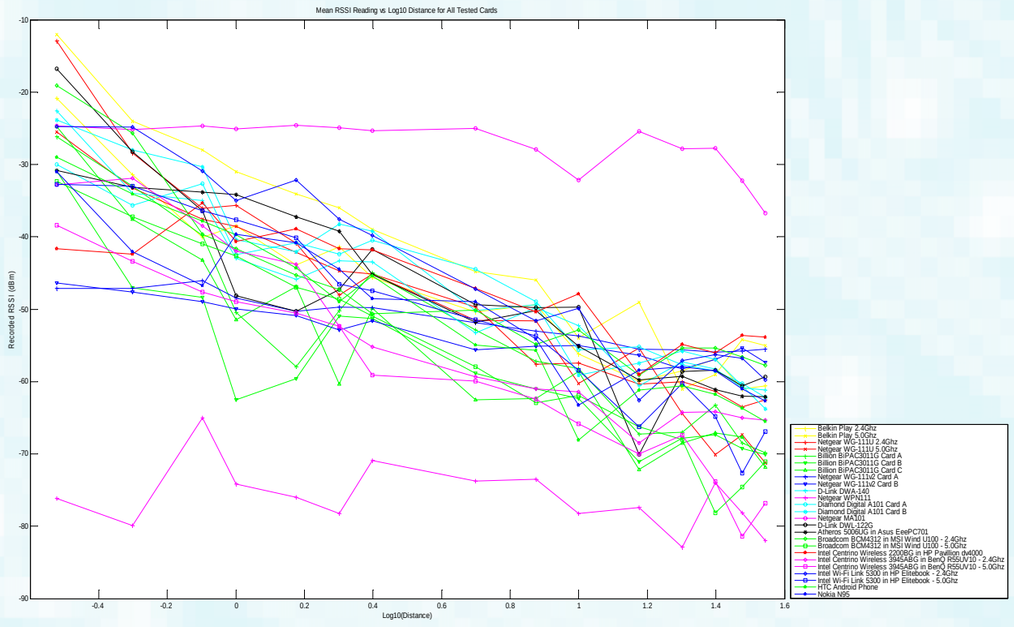

Figure 5. Mean RSSI Trends for Outdoor Testing

Conclusion

It was discovered that there are significant differences in the RSSI values reported from different chipsets. These differences will have a negative impact on the accuracy of a fingerprinting based Wi-Fi positioning system. Furthermore, some chipsets were found to be incompatible with fingerprinting due to incorrect RSSI readings.

It was also found that the 5Ghz band provides a much more stable signal for fingerprinting – its use has the potential to increase the accuracy of a fingerprinting based positioning system.

If many devices are to be used in a fingerprinting system, it is essential that a calibration test be performed first to establish how RSSI readings from the client correlate with the recorded fingerprint RSSI values.

UNSW

ENGINEERING @ UNSW