Report on WIFI fingerprint map creator and locator

Mohammadreza Bakhshizadeh Mohajer

August 2021

POLITECNICO
MILANO 1863

DEIB
Supervisor: Prof Alessandro Enrico Cesare Redondi

1 Introduction

The goal of this project is to create a WIFI fingerprint localization system. The problem is broken down into two distinct parts, one is the fingerprint map creator which for each location, provided the coordinates it sniffs and filters out the Radio Signal Strength Indicators (RSSIs) of specific WIFI access pints (APs) and assigns them to the given coordinates and the second one is the locator which by sniffing the WIFI beacons of the APs specified in the fingerprint map file tries to find the location of the device and indicate it on a map.

1.1 Challenges

The obstacles which one may encounter in this project is the fact that in a noisy environment both by means of physical movements and by means of available number of APs that are sending beacons in different time intervals which may create collision or prevent a device from accessing the beacon of other APs in a reasonable amount of time. These problems have been faced in this work as well.

2 Implementation

The tools which have been used for implementing this project are Linux Kali on virtual machine, Python for writing the codes, a WIFI dongle for sniffing the traffic, and two cellphones in different locations as WIFI APs.

2.1 Codes

As it was mentioned above, the code has two separate parts. The requirement for these programs to work is that the WIFI interface supports monitor mode as to enable it to capture the traffic. The first part of the code is called the creator. By running the program it asks the user to enter at least two WIFI AP MAC addresses. After that the program inquires the location coordinates that the user is located to map the acquired RSSIs to that specific location.

After entering the coordinates the program starts to capture the traffic for a two period of two seconds- which can be modified through the code- and extracts the RSSIs of the beacons captured from the target APs. The code runs for 5 attempts and if no beacon packets were captured or the number of the packets were not sufficient, it asks for confirmation to continue the search. In case of capturing ten beacons from each AP successfully, they are allocated to the indicated coordinates which in turn are saved as a dictionary in a Python file. Each file consists of the MAC addresses of the APs used for creating the map, the coordinates, and ten captured RSSIs per coordinate per AP. In the end, the saved file's name is 'coordinates' plus the map creation date and time tag.

The locator part of the code has the responsibility of sniffing the traffic and matching captured RSSIs with the ones in the fingerprint map file. The program first asks for the path and the name of the map to be used. Then it extracts the APs' MAC addresses and using the monitor mode of the WIFI interface it starts scanning for beacons. After finding the RSSIs from the beacon packets of the APs the program tries to match them with the ones in the coordinates file. As soon as a match occurs it prints out the location and shows it on a map which can be provided to the program through modification of the code. In case of not finding any beacon packets from the target APs a warning is printed which asks for confirmation to proceed with the program.

3 Conclusion

Fingerprint localization in an area dense with WIFI APs may have the advantage of using any AP available to create the map but also if the beacon traffic is high it is recommended to set the beacon setting of the APs to a channel less crowded and sniff on the same channel to obtain much faster results. The accuracy of this localization technique depends on changes in the environment and the indicated location can have a variety of one to two meters from the actual location which may deteriorate with an increase in the speed of movement of the objects in the area. If the area is densely populated, a better acquiring technique is needed to filter out the noise in the data which can be implemented using the sensors already available on most of the commercial devices as is mentioned in [1].

References

[1] Alakhras, Marwan and Hussein, Mousa and Oussalah, Mourad. (2020). Location Fixing and Fingerprint Matching Fingerprint Map Construction for Indoor Localization. Journal of Sensors. 2020. 1-14. 10.1155/2020/7801752.