

CS4222 PROGRAMMING ASSIGNMENT 3: INDOOR LOCALIZATION

FEB 26TH AY 2016-2017 / SEM 2

DUE: MARCH 12TH (SUNDAY) 23:59

1. This assignment is to be completed by each project group.
2. Upload a tarball/zip of your code, data collected, and Readme file with the name “CS4222-PA3-YourGroupName.zip” into the IVLE Submission folder (Student Submission – PA3) before the due date. Specify your matric numbers clearly in the Readme file.
3. There is a 10% penalty per day for late submission
4. For any clarification on this assignment, please email the TA (Hong Hande) at kevinhandhung@gmail.com

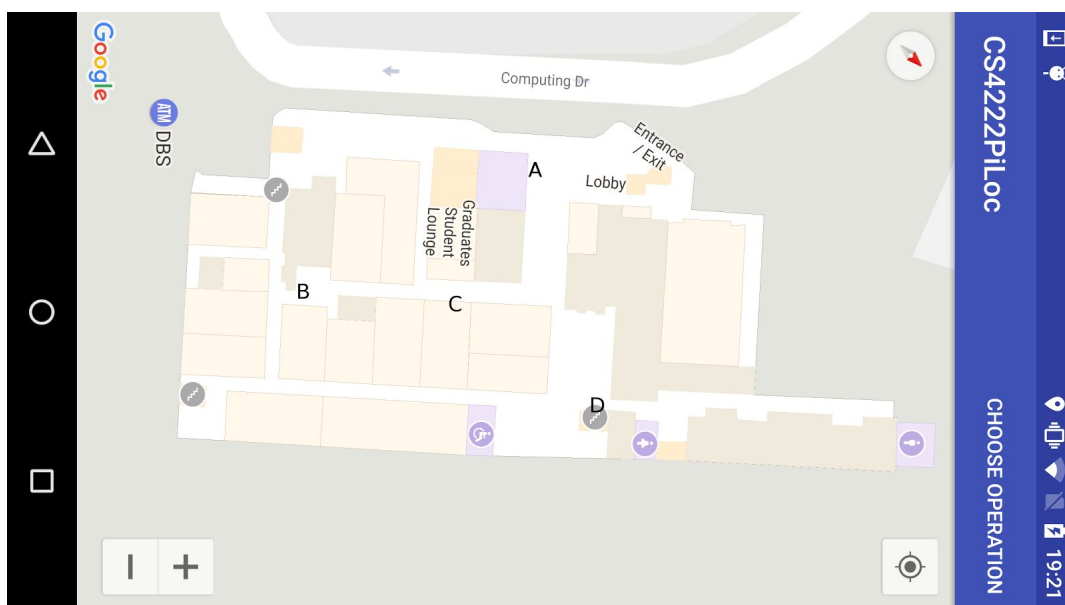
1. OVERVIEW

The objective of this assignment is to help you understand and gain experience in WiFi fingerprint based indoor localization. You will use the provided *PiLoc Indoor Localization* SDK and the sample application to collect WiFi fingerprints and perform real-time indoor localization. Analysing localization results will help you better understand the characteristics of WiFi fingerprinting.

2. ASSIGNMENT TASKS

2.1. Task 1: Getting Fingerprints for Different Locations

In this task, you need to record down WiFi fingerprints for the following four locations (labeled A~D) in COM1 Level 1 in the morning, afternoon, and evening:



For example, sample fingerprints for Location 1 at a time(for illustration only):

Location A:

e8:ba:70:52:c2:ea 89 ; 00:26:82:84:b3:d9 89 ; e8:ba:70:61:ad:22 82 ...

Hint: The `getFingerprint()` method in PiLoc SDK returns fingerprints for the current location.

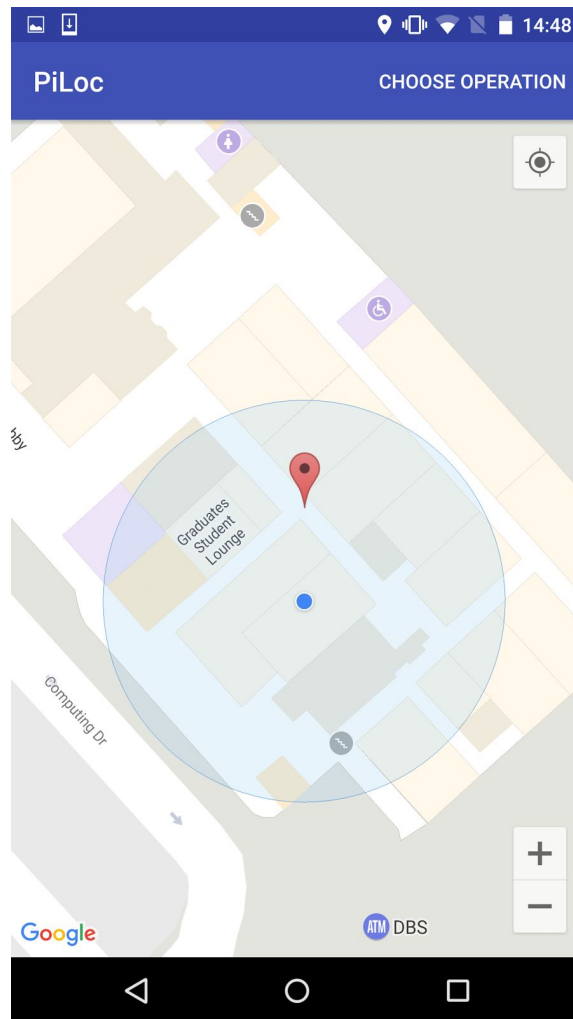
Compare the fingerprints you collect in different places and at three different times. Brief report your findings.

2.2. Task 2: Getting Indoor Location Using WiFi fingerprint

In this task, you need to use the **LatLng getLocation(RadioMap mRadioMap, Vector<Fingerprint> fp)** method to find the location on the map for the given fingerprints. You need to design your own algorithm to match the fingerprint to the radiomap database. We have created a radio map for COM1 Level 1 (Search name NUS School of Computing) on the server by uploading fingerprints. Your task is to download the radiomap and then find the location for the following fingerprints:

MAC	Absolute RSSI (dbm)
84:b8:02:00:3b:bb	83
88:f0:31:8d:21:cf	82
84:b8:02:00:3b:bf	80
88:f0:31:8d:21:cb	85
a8:9d:21:74:0c:09	75
74:a2:e6:ec:55:c5	71
74:a2:e6:ec:55:c9	64
a8:9d:21:74:0d:9f	69
a8:9d:21:44:05:aa	85
a8:9d:21:0f:7e:89	58
a8:9d:21:0f:7e:87	51
a8:9d:21:74:0d:99	66
a8:9d:21:0f:7e:8f	45

You need to construct the fingerprints first and call the **getLocation** method to find its location on the map. A sample `getLocation` method is provided. however, it doesn't work well. You need to develop your own **getLocation** function. Please attach a screenshot after the program returns the location (red pin) on the map. One sample screenshot (the location here is just for illustration, the red pin show the indoor localization result and the blue dot is the location given by google map) will be:



2.3. Task 3: Creating the Radiomap for One Indoor Floor

In this task, you need to follow the instructions provided in the tutorial to construct a radio map for any candidate indoor floor in Singapore. Each of the group will be given a shopping mall with indoor map. You need to first configure the floorplan (Set of points to indicate coverage and density) using the CS4222PiLoc APP. After uploading the configuration for the map, you can walk around and collect the fingerprints until it covers the whole floor and then upload it to the server using the app. After uploading the radiomap (fingerprints of the whole floor), you should be able to download it to the app and perform real-time localization on your phone.

List of candidate location:

West Coast Plaza
 Clementi Mall
 IMM Jurong east
 The Star Vista
 Ngee Ann City
 The Centerpoint

Lau Pa Sat
Vivocity
Jurong point, Jurong west
Paragon Shopping Centre
ION Orchard
Wisma Atria
313@Somerset
The Orchard Central
The Shoppes

Each group will pick different location and site survey will only need to be done in one of the floor.

Report the following:

- (1) What is the estimated localization error for this floor (in meters)? Will the accuracy increase as more fingerprints are collected (e.g., the floor is covered by more walking rounds)? Do all locations in this floor have same localization errors?
- (2) What do you think might be the possible factors that affect the localization accuracy?
- (3) How do you think might improve the localization accuracy?

3. SUBMISSION

Please submit a single tarball/zip named “CS4222-PA3-YourGroupNumber.zip” in the student submission folder in IVLE by the due date. The tarball should contain your source code, logs of data collected, any graphs/analysis, and a README file. The README file must have your names and matric numbers, and a brief summary of your analysis/answers. If you submit multiple times, only the latest submission will be evaluated.

4. GRADING

This assignment has 8% weightage to your final grade.

Total points: 80 points

Task 1: 20 points (Finding correct fingerprints for four locations)

Task 2: 30 points (Finding the correct location (screenshot) for the given fingerprints)

Task 3: 30 points (Successfully uploading walking trajectories and WiFi fingerprint to the server, report reasonable observations)