CS 252: Lab 1

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Wireless Measurements

All the measurements are recorded using *NetMonitor Cell Signal Logging Lite* app for Android. The complete CSV and KML files can be found here (use LDAP).
Here is the graph showing the signal strength over around 2.3 km path.

Figure 1: Path marked according to the signal strength in the region

(a) Figure 2 shows the colors mapped to ranges of dBm to show the signal strength in the image above.

Color	RSRP/RSSI (in dBm)
bad	≤ -105
not bad	≤ -85 & > -105
good	> -85

Figure 2: Mapping from signal strength to colors

(b) Following is the list for all the unique base-stations(LTE- eNodeBIDs) which were connected to our phone in this test. These are shown in figure 14.
(A) 917262, (B) 900599, (C) 914314, (D) 913836, (E) 905429, (F) 620573, (G) 914334, (H) 605429

The points $A \cdots H$ in figure 14 are based on educated guess using *Open Signal* app, the app showed 8 nearby stations. To match the locations (from Open Signal) with eNodeBIDs(from Net Monitor), we used the CSV file from the latter app to track the base-station changes during the path, finally mapping the new eNodeBID to the most probable base-station around that location.

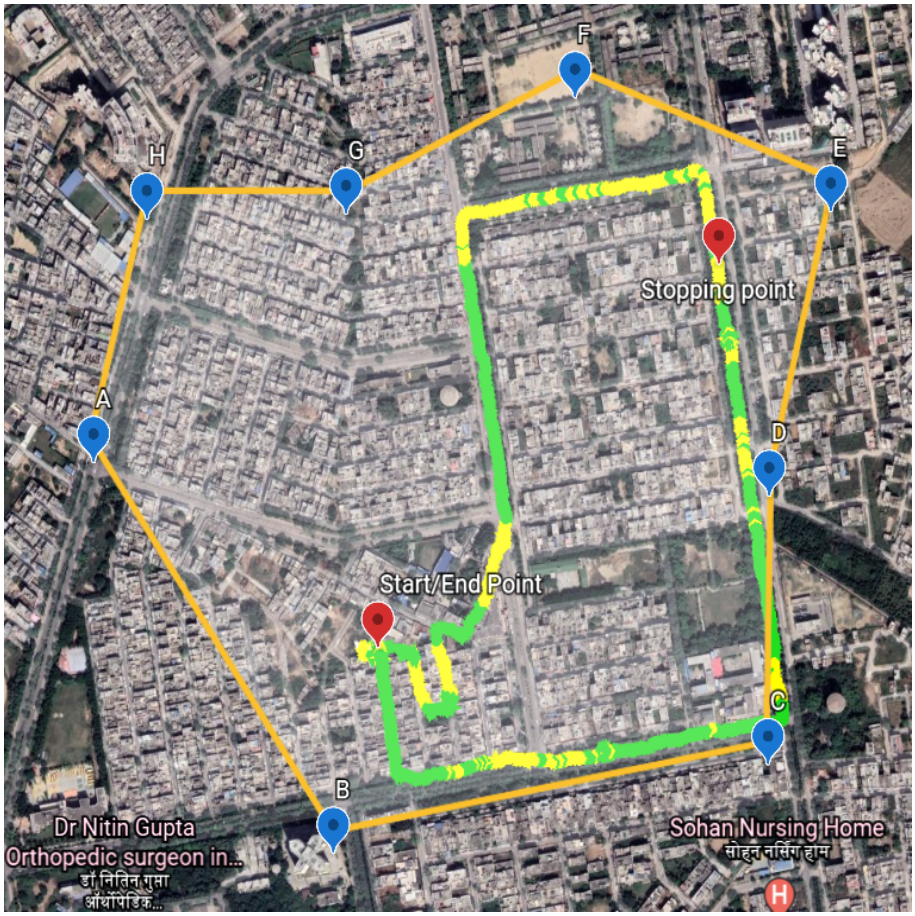

Figure 3: Approximate base-station positions (these explain the data acquired)

(c) There were some specific stretches where the quality of signal was not so good for a considerable amount of time. Two of these can be explained due to the dense housing as well as on both sides of the road, leading to obstruction of signal. The housing regions are annotated in the Figure 4a and 4b.
One more case, can be explained due to the position of that stretch relative to the nearby base-stations, it is far away from all the stations, leading to *not bad* signal strength. See Figure 4c.

(a) (b) (c)

Figure 4: Annotated, zoomed map regions

(d) Measurements were taken at the same place (marked as *stopping point* in the map) for around 100 seconds, the RSRP readings more or less remained the same with fluctuations of 6 dBm, except for some minor fluctuations caused by fundamental variations in the measurement circuits due to interference, and the major drops can be explained by passing-by vehicles on the open side of the road. The other side was blocked by houses/buildings.

Figure 5 depicts the RSRP/RSSI readings during the 100 seconds of stoppage.

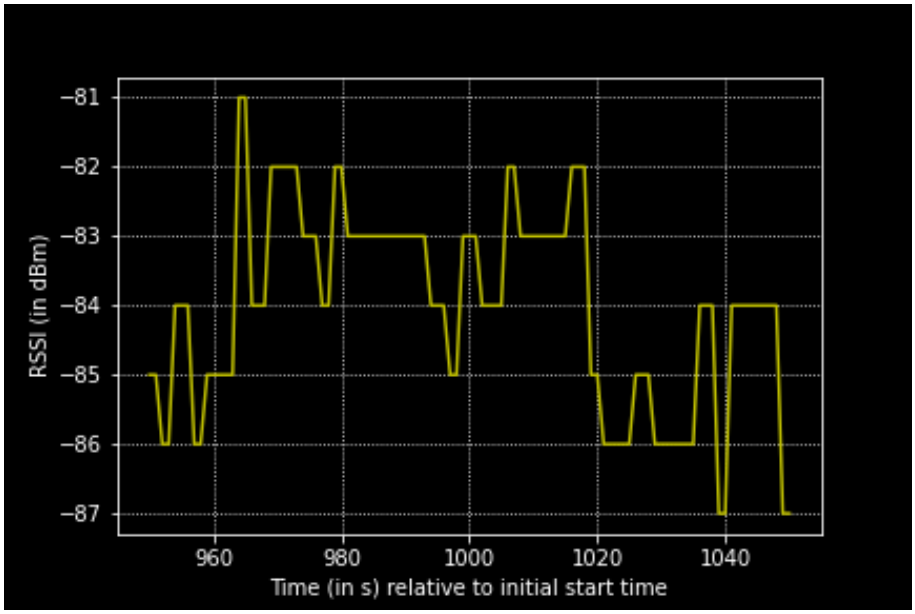

Figure 5: RSSI/RSRP(in dBm) vs Time(in s)

Wireless Measurements (2)

All the measurements are recorded using *NetMonitor Cell Signal Logging Lite* app for Android. The complete CSV and KML files can be found here (use LDAP).
Here is the graph showing the signal strength over around 1.1 km path.

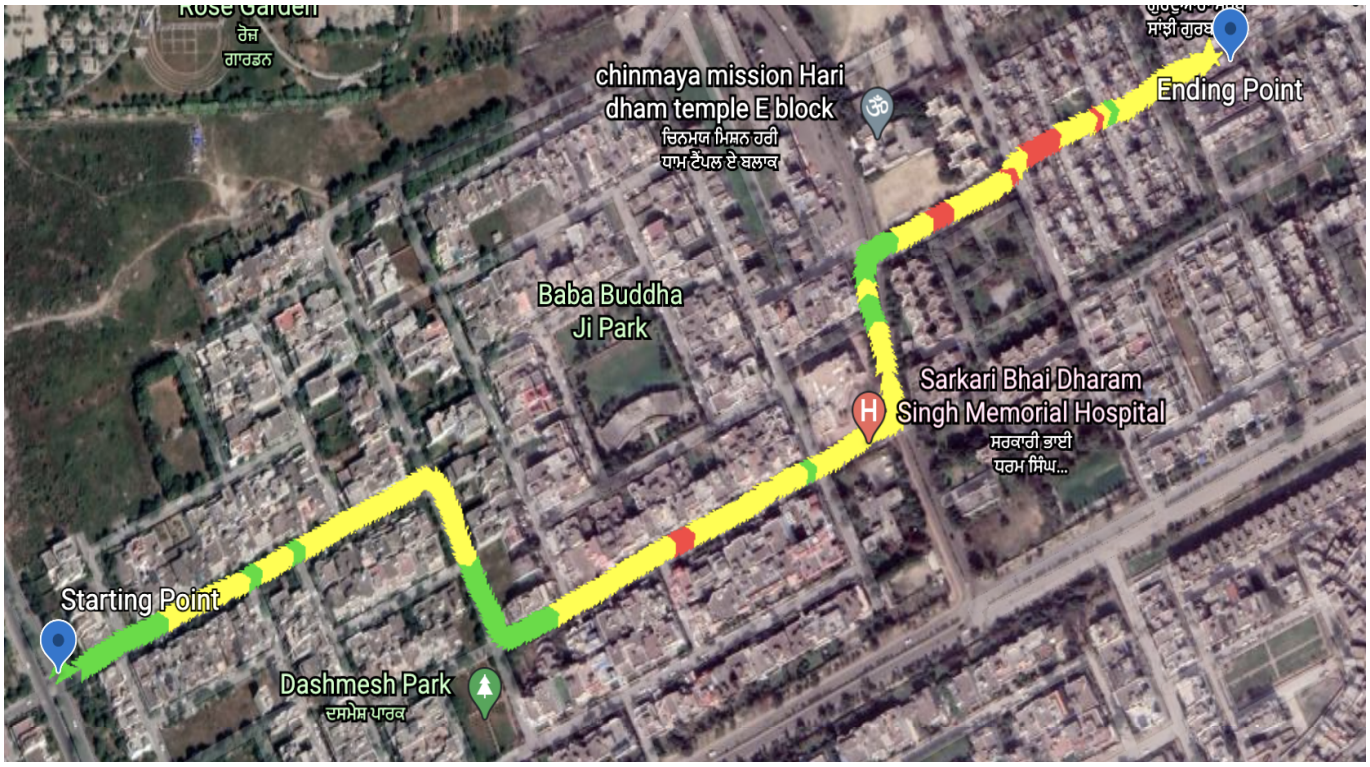

Figure 6: Path marked according to the signal strength in the region

(a) The following table shows the colors mapped to ranges of dBm to show the signal strength in the image above.

Color	RSRP/RSSI (in dBm)
bad	≤ -100
not bad	≤ -85 & > -100
good	> -85

Figure 7: Mapping from signal strength to colors

(b) Following is the list for all the unique base-stations(eNodeBIDs) which were connected to the phone in this test.

- 2341
- 279
- 10321
- 4415
- 2611
- 256
- 3124

Although it is not known to which 7 base-station was the phone connected to at a particular instant, (the app did not show this), the 8 nearby stations are marked in the map as $A, B, ..., G$ (source: Opensignal App)

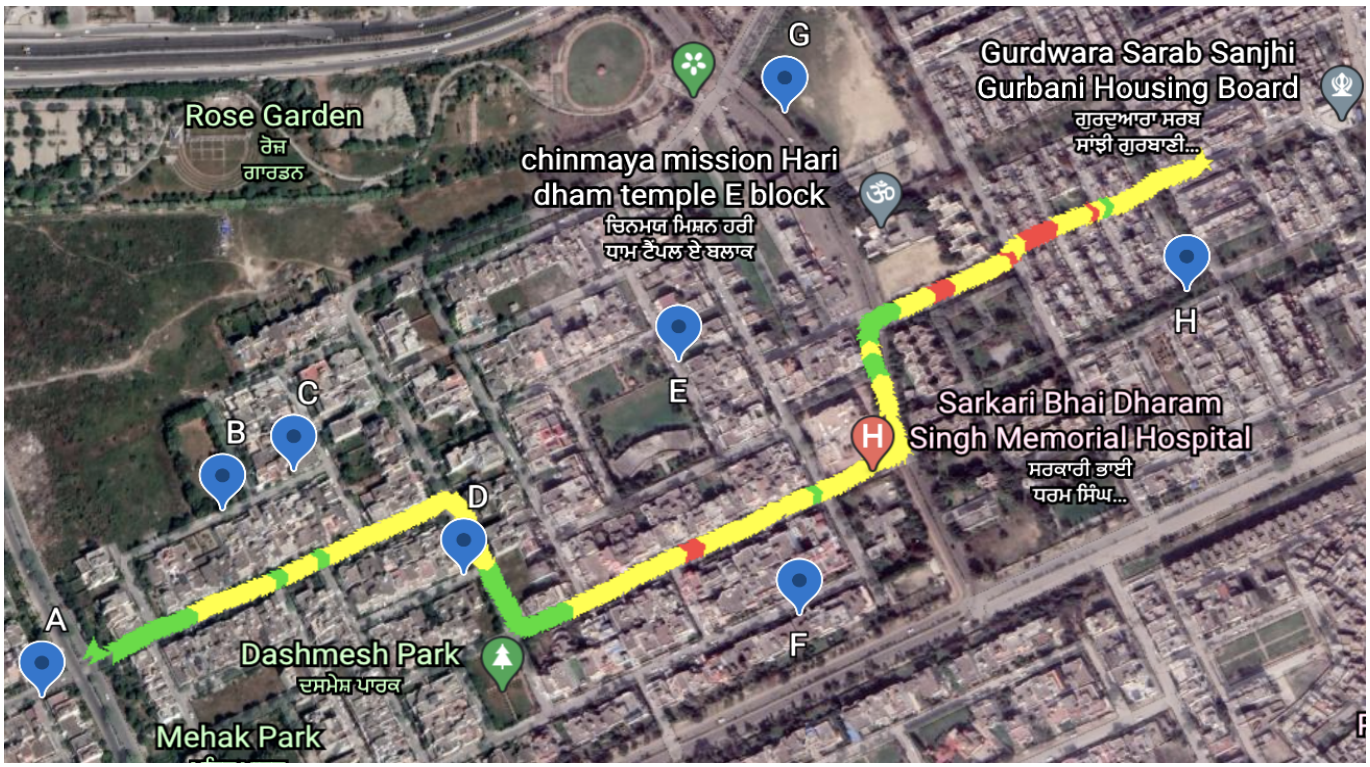

Figure 8: Approximate location of base-stations)

(c) At some locations, the base stations were nearby and the signal strength was *good* there. This is explained ahead. But in most regions, the signal strength is *not bad*. This is likely due to the fact that the area was densely crowded by houses that cause obstruction of signal. (this can be seen in the map above)
Near A and D, the signal strength is *good*. This is likely because there is a station nearby only and there is road which leads to less obstruction (see fig 9a and 9b).
In figure 10a as well, the station G is far, but there is no obstacle in the way, only road. So the signal strength is *good* at a turn.
In one region (10b), the signal is *bad*, which is probably because there is no station nearby (G and H are the closest ones) and the area is very densely crowded with houses (shown by a red rectangle) causing obstruction.

(a) (b)

Figure 9: Zoomed map regions with good signal strength

(a) (b)

Figure 10: Annotated, zoomed map regions with good and bad signal strength respectively

(d) Measurements were taken at the same place (marked as *starting point* in figure 6) for around 75 seconds, the RSRP readings showed a fluctuation of $4dBm$. A likely explanation : Since I was standing on roadside, vehicles kept on passing by. The network of the phones of people in them might be interfering with mine, causing variation. Also, the vehicles themselves might be acting as an obstruction in the path.

Below graph depicts the RSRP/RSSI readings during the 75 seconds of stoppage.

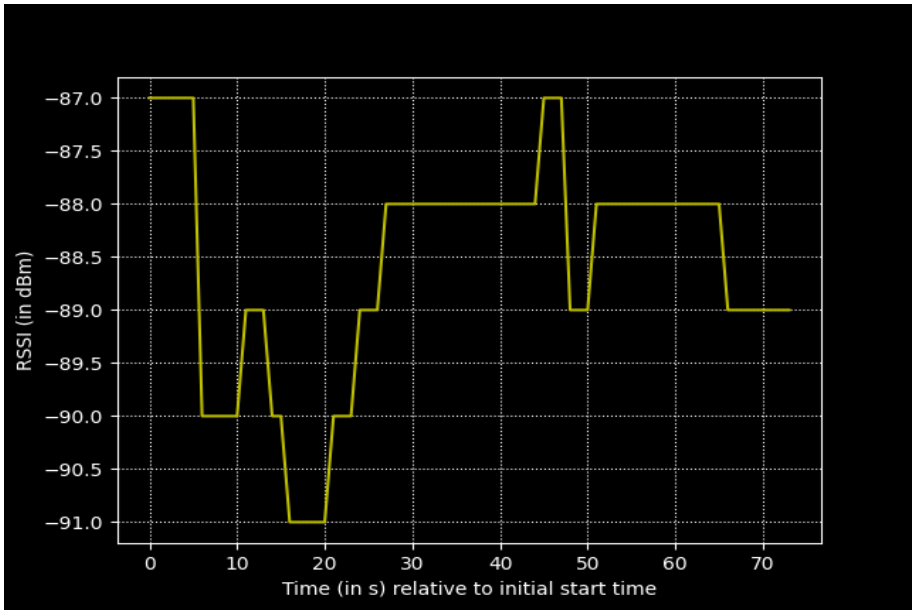

Figure 11: RSSI/RSRP(in dBm) vs Time(in s)

P.S.- I was earlier having trouble getting the path on the map in the app, so I had talked to Sir regarding this and he had told me to mention that in the report. But later I managed to do it.

Wireless Measurements (3)

All the measurements are recorded using *NetMonitor Cell Signal Logging Lite* app for Android. The complete CSV and KML files can be found here (use LDAP).
Here is the graph showing the signal strength over around 1.77 km path.

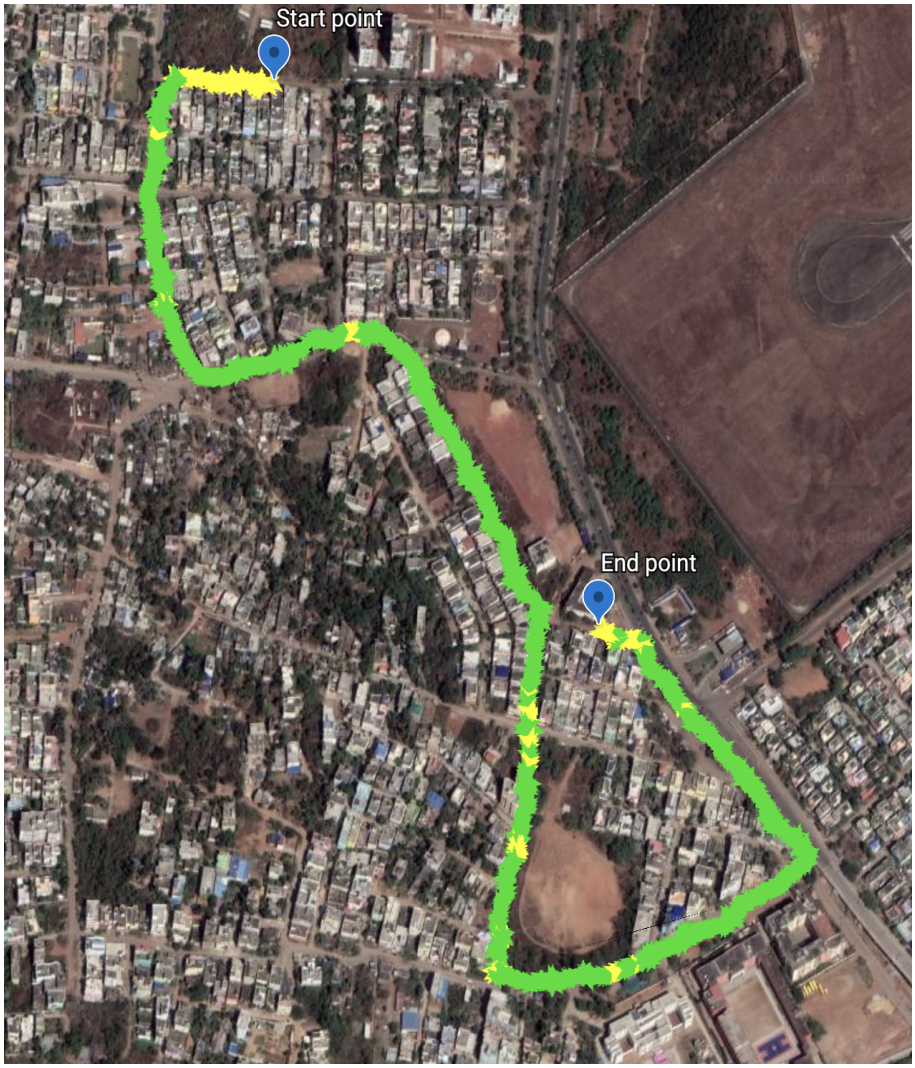

Figure 12: Path marked according to the signal strength in the region

(a) The following table shows the colors mapped to ranges of dBm to show the signal strength in the image above.

Color	RSRP/RSSI (in dBm)
bad	≤ -105
not bad	≤ -85 & > -105
good	> -85

Figure 13: Mapping from signal strength to colors

(b) Following is the list for all the unique base-stations(eNodeBIDs) which were connected to our phone in this test. These are shown in Figure 14
(A) 5836, (B) 785, (C) 9526, (D) 5318, (E) 197012, (F) 197013, (G) 197014

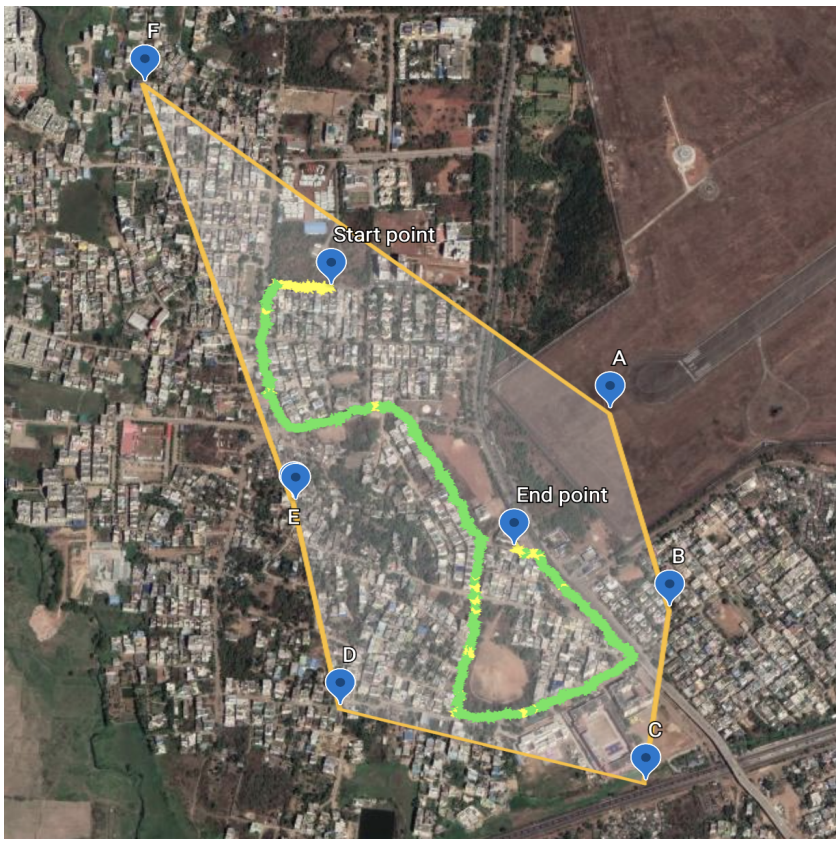

Figure 14: Approximate base-station positions (these explain the data acquired)

(c) There was a specific stretch at the start where the quality of signal was not so good for a considerable amount of time. It can be explained due to the position of that stretch relative to the nearby base-stations, it is far away from all the stations, leading to *not bad* signal strength. See Figure 15.

Figure 15: Approximate base-station positions (these explain the data acquired)

(d) Measurements were taken at the same place (marked as *stopping point* in the map) for around 140 seconds, the RSRP readings started getting worse after initial *good* signals. This might be because of drop in signal strength due to interference with other devices in the house.

Figure 16 depicts the RSRP/RSSI readings during the 140 seconds of stoppage.

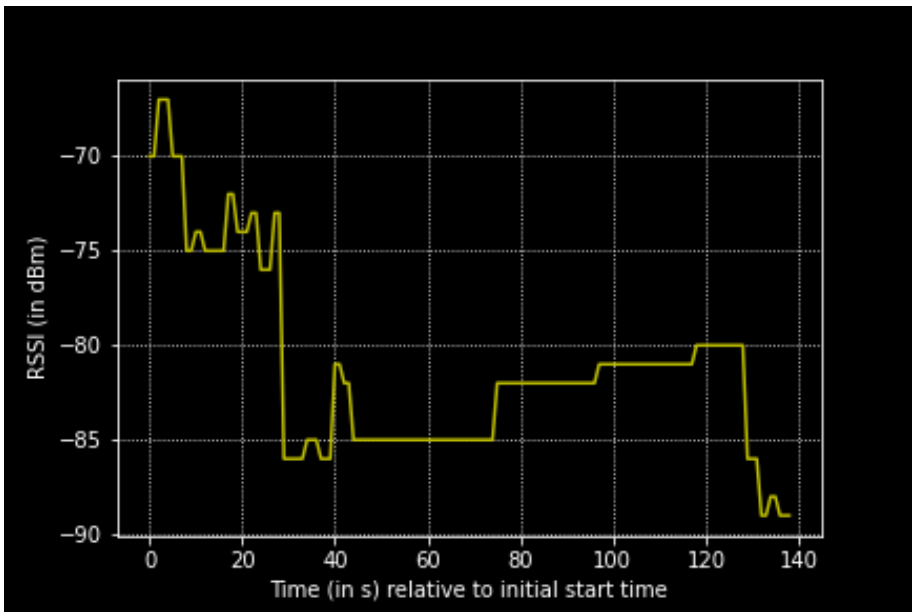

Figure 16: RSSI/RSRP(in dBm) vs Time(in s)