Construction of Wireless Propogation Model

Submitted By:
Deepali Mittal(153050016)
Achala Bhati(153050056)

Aim of Project

- Construction of wireless propogation model (outdoor) using large number of signal strength measurements.

Steps of Experiment

- Take 2 laptops to make one as transmitter and other one as reciever.
- Create Wifihotspot in laptop 1 to make it as Transmitter.
- Install Wireshark in laptop 2.
- Put laptop 2 in monitor mode using command
  1) sudo ifconfig wlan0 down
  2) sudo iwconfig wlan0 mode monitor

Steps of Experiment(cont..)

- We can put laptop 2 in monitor mode directly using Wireshark without any commands i.e. modifying the properties of the wlan0 interface.
- We performed experiment in the main ground(Outdoor) of IIT Bombay Campus.
- We got transmitter power using the command

  iwconfig (which was 15dbm in our case)
- Then We also maintained the clear line of site between Transmitter and the receiver.

Steps of Experiment(Cont..)

- Experiment was performed at distances ranging from 1 to 20m.
- Packets were captured on receiver side for various distance for 1-2min each.
- On all captured pcap files we filter the entries based on our transmitter's SSID (i.e. deepali in our case).
- We use command to get signal strength at receiver side

```
tshark -r 1.pcapng -Y "wlan_mgt.ssid eq deepali" -T fields -e radiotap.dbm_antsignal -E separator=/t
```

Steps of Experiment(cont..)

- Command Explaination:
- Options :
  1. -r : name of input pcap file
  2. -R : to specify filter
  3. -T : output format
  4. -e : to specify required field
  5. -E : to specify field print option

Steps of Experiment(cont..)

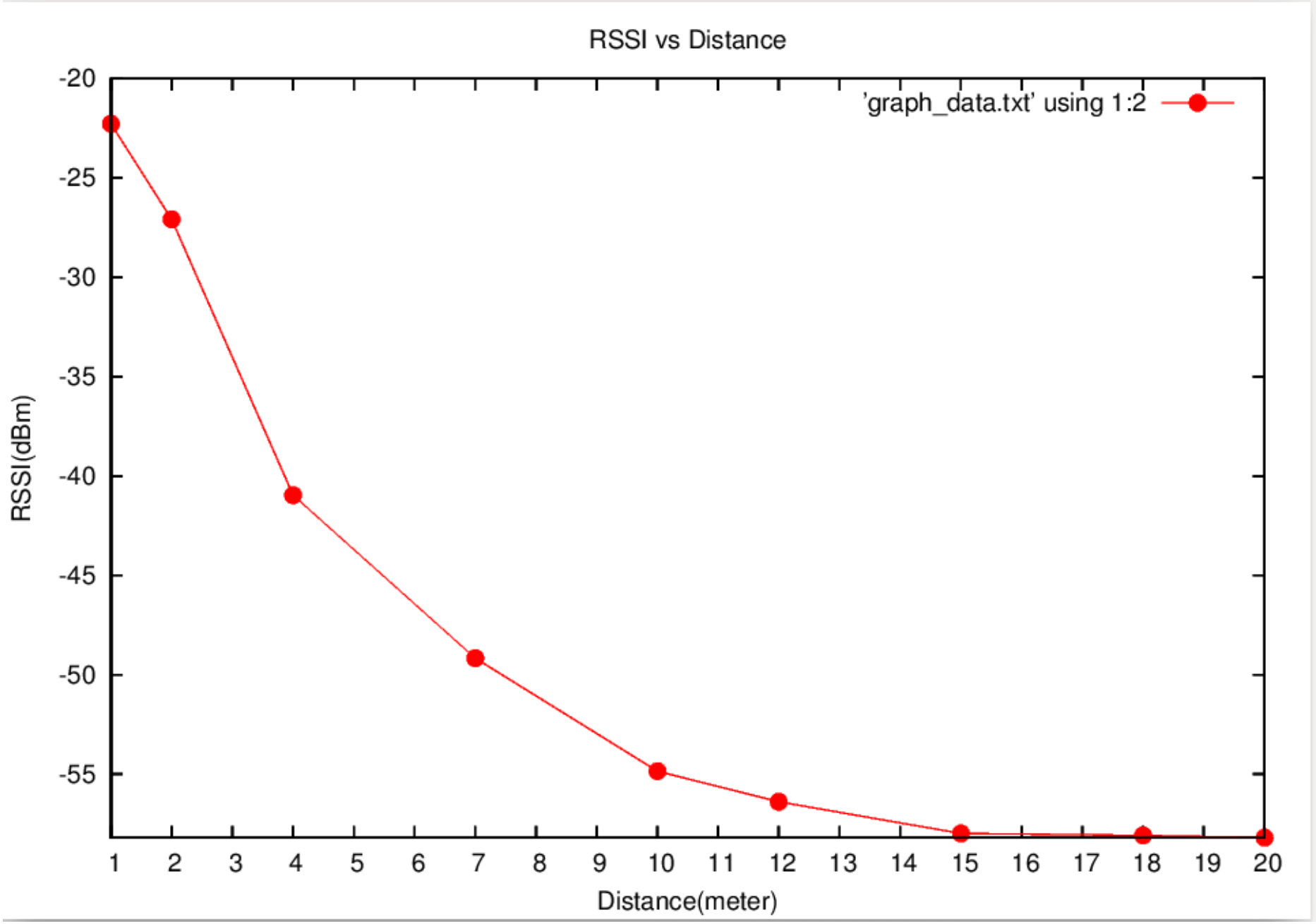
- Now We got 'output' files containing the Received Signal Strength corresponding to every captured pcap file.
- An Awk script 'awks.awk' was executed on every 'output' to get average Received Signal Strength at different distances :

```
BEGIN{sum=0; c=0;avg=0;}
 { sum=sum+$1;c=c+1;}
END{avg=sum/c; print avg;}
```

Result of Experiment

Distance(Meters)	Received Signal Strength(in dBm)
1	-22.2722
2	-27.0757
4	-40.9587
7	-49.1674
10	-54.8534
12	-56.3859
15	-57.98
18	-58.0825
20	-58.1932

Plot of Measurements Taken



Calculation based on experiments

- According to simplified path loss model:

$$P_r = P_t K(d/d_0)^Y$$

where,

P_r : Received Power

P_t : Transmitter Power

K: path Gain

d : distance between transmitter and receiver

d_0 : reference distance, i.e. 1 meter

Calculation based on experiments

- $K=P_r(dBm) – P_t(dBm)$

  so we can calculate K at $d=d_0=1m$

  P_r (at 1 m)= -22.2722 dBm

  P_t = 15 dBm

  so K = -37.2722 dBm
- For Received Power in dBm

$$P_r(dBm)=P_t(dBm)+K- 10Y\log_{10}(d/d_0)$$

Calculation based on experiments

Sno.	Distance (m)	RSSI(dBm)	Observed P_r-P_t	Calculated P_r-P_t (in terms of Y)
1	1	-22.2722	-37.2722	-37.2722 + 0.000Y
2	2	-27.0757	-42.0752	-37.2722 - 3.01Y
3	4	-40.9587	-55.9587	-37.2722 - 6.02Y
4	7	-49.1674	-64.1674	-37.2722 - 8.45Y
5	10	-54.8534	-69.8534	-37.2722 - 10Y
6	12	-56.3859	-71.3859	-37.2722 - 10.791Y
7	15	-57.98	-72.98	-37.2722 - 11.76Y
8	18	-58.0825	-73.0825	-37.2722 - 12.55Y
9	20	-58.1932	-73.1932	-37.2722 -13.01Y

Calculation based on experiments

- In order to calculate Y value we will take mean sqaure Error.

  Error = Observed – Calculated

  MSE is:

  $(7168.6271 + 798.2088Y^2 – 4769.6278Y)/10$

  Y is calculated by differentiating this value w.r.t.

  Y, which is 2.9877.