



Experiment List

Sr. No.	Title	LO mapping	PO mapping
1	<p>1a: Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency</p> <p>1b: To understand the impact of following parameters on received signal strength</p> <ul style="list-style-type: none"> • Transmitter Power, • Pathloss exponent, • Carrier frequency, • Receiver antenna height, • Transmitter antenna height. 	2	1,2,4,5,12
2	To understand the concept of co-channel interference and hence SINR(full frame)	1	1,2,4,5,12
3	<p>To understand the cellular network frequency reuse concept fulfilling the following objectives:</p> <p>3a: Finding the co-channel cells for a particular cell.</p> <p>3b: Finding the cell clusters within certain geographic area.</p>	1	1,2,4,5,12
4	To simulate the handover mechanism	1	1,2,4,5,12
5	Write a program using WML to display user form with validation for WAP enabled phone	3	1,2,3,4,10,12
6	Write a program using WML to display calculator and calendar for android phone	3	1,2,3,4,10,12
7	Study and Installation of wire-shark. Analyze data packet using wire-shark	4	1,2,4,10,12
8	Study and Installation of NS2 and Implement Small Network Using NS2	5	1,2,4,10,12
9	Develop form and Perform Form Validation using Android Studio	6	1,2,3,4,10,12
10	Set up and configuration of wireless Access Point	4	1,2,4,10,12

Experiment No 1

PART A

➤ **Aim:** To understand path loss prediction formula

➤ **Objectives:**

1. Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency.
2. To understand the impact of following parameters on received signal strength :-
 - Transmitter Power,
 - Pathloss exponent,
 - Carrier frequency,
 - Receiver antenna height,
 - Transmitter antenna height.

➤ **Source to perform Experiment:**

Virtual Lab: Fading channel and mobile communication (Experiment no 1)

Link: <http://vlabs.iitkgp.ernet.in/fcmc/exp1/index.html#>

➤ **Theory:**

The design of a communication system involves selection of values for several parameters. **One of the important parameter is the transmit power.** Higher transmit power ensures large allowable separation distance between the transmitter (Tx) and receiver (Rx). Of course the loss in signal power per unit distance depends on the properties of the medium.

In case of wireless communication on one hand it is desired to have a **very large coverage** (large allowable separation between Tx and Rx) on the other hand it is also desired that **co-channel interference be as low as possible.**

An understanding of the large scale **propagation effects** is very important for design of suitable communication system. In terrestrial **mobile communication system, electro-magneticwave**

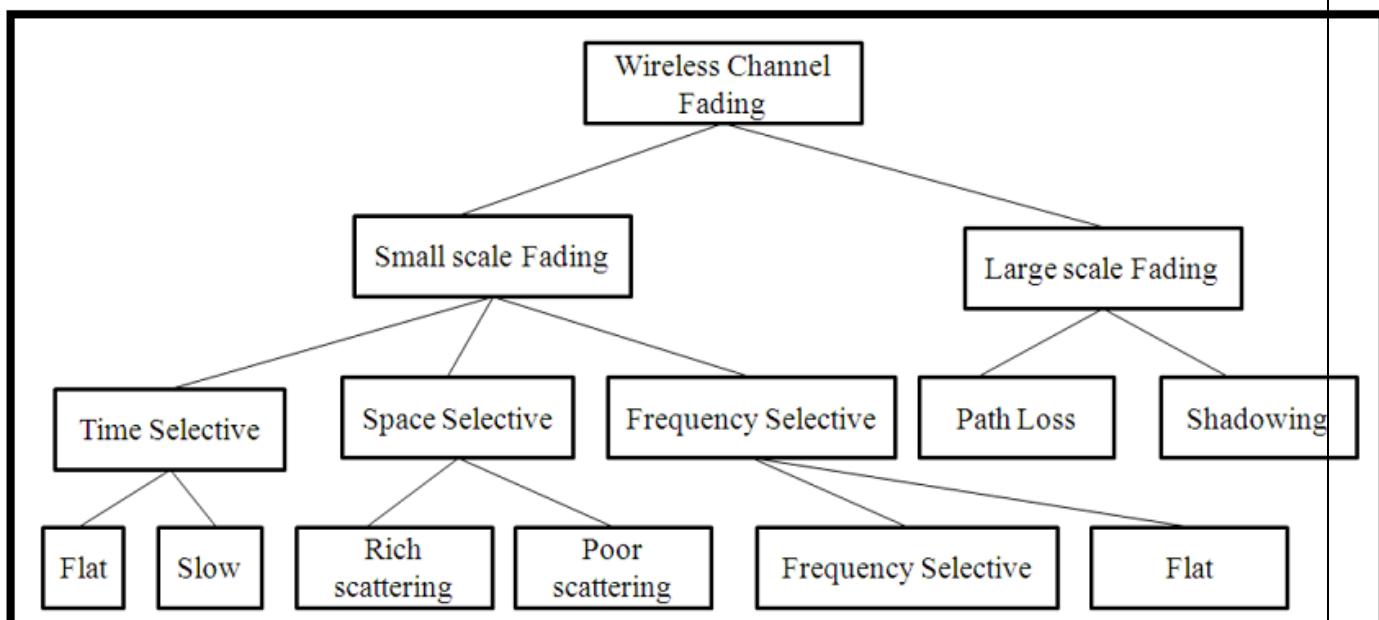
propagation is affected by reflection, diffraction and scattering. These lead to dynamic variation of signal strength as a function of time, frequency, distance of separation, antenna height, antenna configuration, local scattering environment etc. Propagation models are necessary in order to predict the received signal strength for a given set of parameters as mentioned above. These models can be broadly considered under:-

- Large scale Fading Model.
- Small Scale Fading Model.

1.1 Large Scale Fading:-

Large Scale Fading is dealt by propagation models that predict the mean **received signal strength** for an arbitrary transmitter receiver separation. The large scale fading model gives such an average with measurements across 4λ to 40λ , where λ is the wavelength. This is useful for estimating coverage area. Large Scale fading can be broadly classified as:

- Path Loss.
- Shadowing.



Large scale fading is heavily affected by power dissipation and effects of the propagation channels. The models assume some path loss at a given distance between Tx and Rx i.e. there is no shadowing. It is useful in getting a quick estimate of the average signal strength, hence the coverage. These models are used for prediction of signal variation across 100m-1000m.

There have been ray tracing methods which are complicated and are useful for static scenarios. In case of dynamic scenarios statistical models are used. A statistical model ensures that the statistical properties of the numbers generated using the model matches the recorded values.

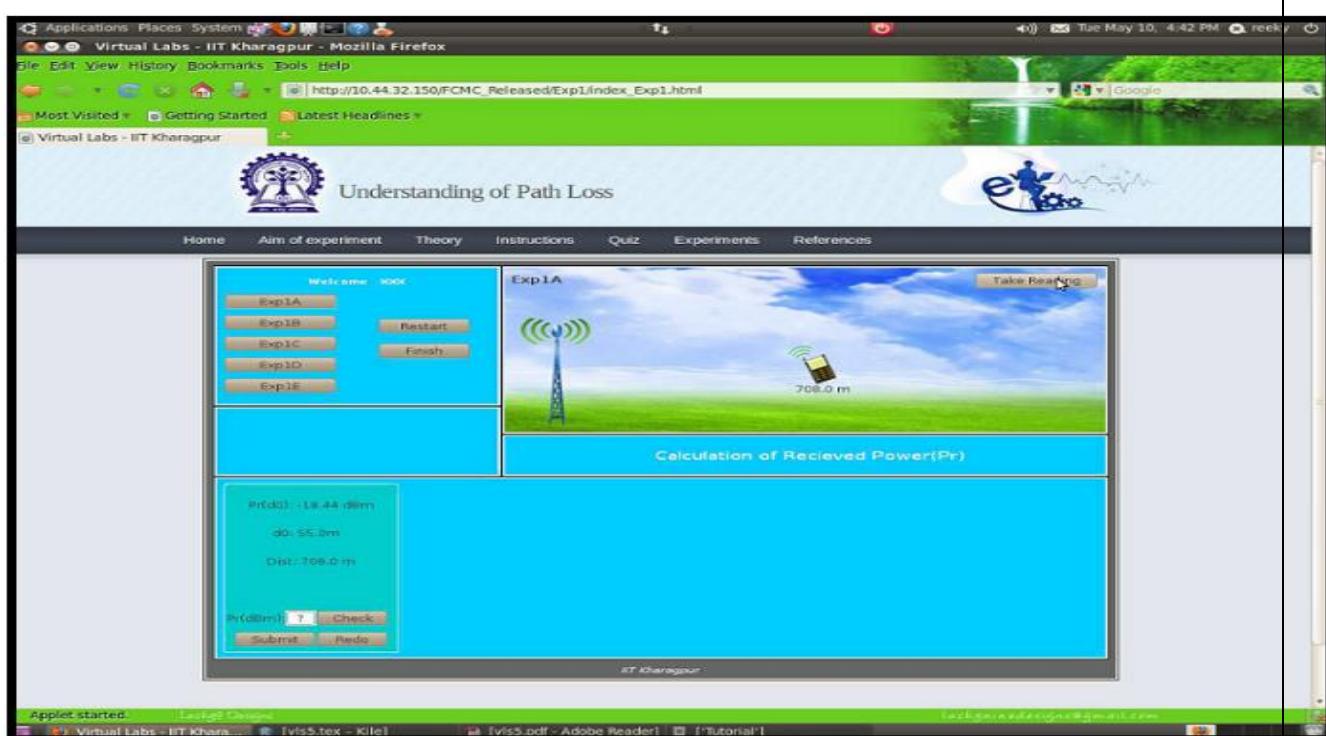
Path loss, or **path attenuation**, is the reduction in power density (attenuation) of an electromagnetic wave as it propagates through space. ... This term is commonly used in **wireless communications** and **signal propagation**.

Path loss models describe the signal attenuation between a transmit and a receive antenna as a function of the propagation distance and other parameters. Some models include many details of the terrain profile to estimate the signal attenuation, whereas others just consider carrier frequency and distance. Antenna heights are other critical parameters.

1A (Calculation of Received Power at a certain Tx-Rx separation distance) :-

Steps:

1. Drag the mobile by placing the cursor on it and place it at a certain distance from the base station tower.



- Now, Calculate the value of the unknown parameter (for e.g. $P_r(d)$) manually by using the formulas given in the theory section. For example:-

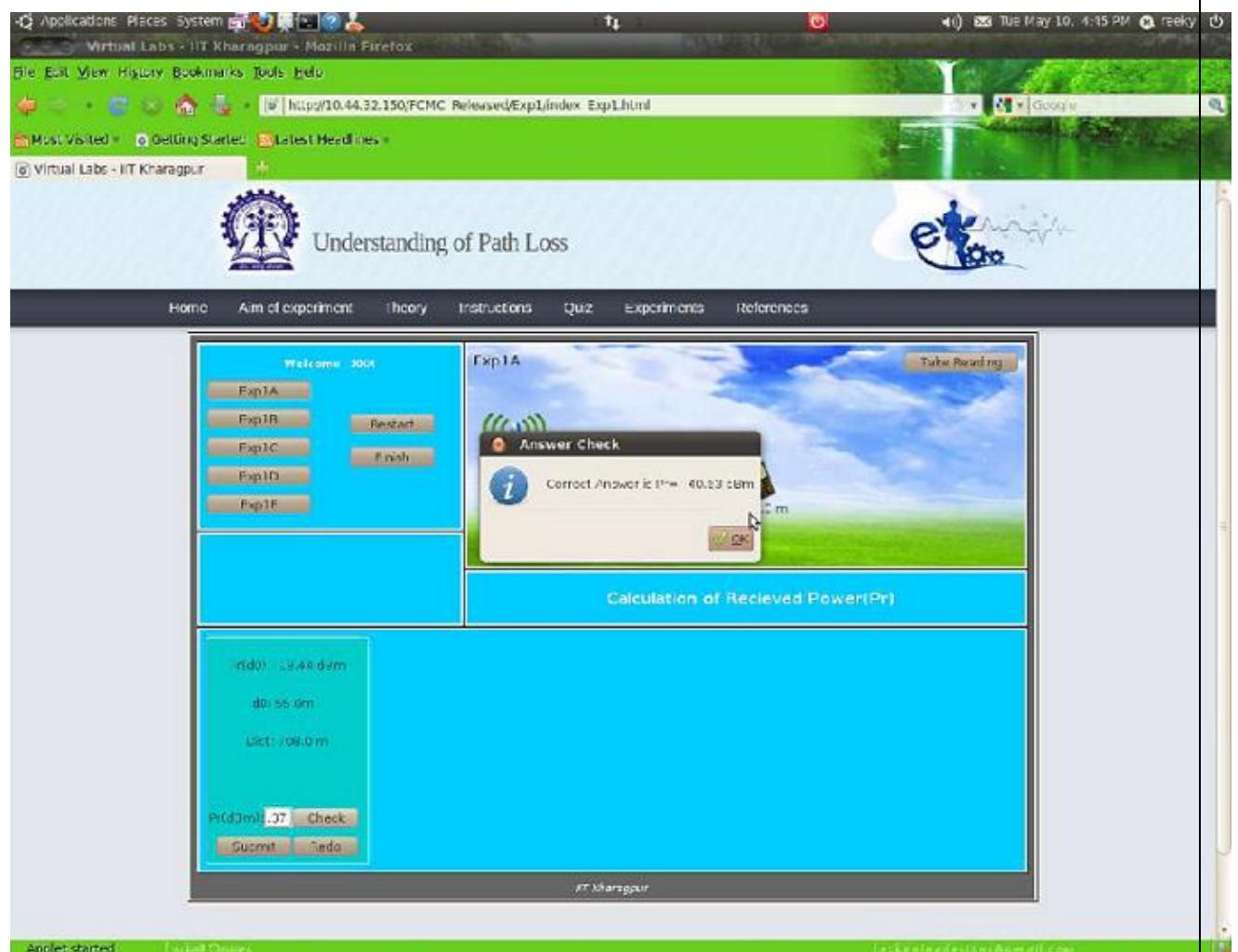
Given $P_r(d_0)=18.44\text{dB}$, Tx and Rx separation distance(d)= 708 m, $d_0=55\text{m}$. So, using this formula $P_r(d)=P_r(d_0)+20\log(d_0/d)$ you can find the value of $P_r(d)$,

$$P_r(d)=-18.44+20\log_{10}(55/708)=-40.37\text{dBm}.$$

- Now, enter your manually calculated value of the unknown parameter in the box provided in the page.



- Click on the button CHECK to verify whether your manually calculated value matches with the computed value of the unknown parameter.
- If your manually calculated value of the unknown parameter doesn't match with the computed value of the unknown parameter then a message box will appear with the message that your calculated value is wrong and it will return the exact value of the unknown parameter. If your calculated value of the unknown parameter is same as the computed value of the unknown parameter then the message box will let you know that your result is correct.



6. Now, click on the button SUBMIT to submit your results
7. You can redo the experiment by clicking on the button REDO.
8. Similarly, perform the expt1b, expt1c, expt1d and expt1e you can find the value of the unknown parameter for each of these experiments.

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screen shots.)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

1. Explain signal propagation
2. Explain Path loss effect

B.6 Attach the screen shot of Quiz attempted after performing Experiment.

Exp-2:- SINR

PART A

➤ **Aim**

To understand the concept of co-channel interference and hence SINR (full frame).

➤ **Objectives**

1. **Downlink:**

To calculate and plot SINR vs. distance at the MS for adaptation of the following parameters,

- (a) Shadowing effect
- (b) Vertical Beam Pattern
- (c) Tilt Angle variation

2. **Uplink:**

To calculate and plot SINR vs. distance at the base stations for different distance of two mobile stations from the base stations and different separation between them for adaptation of the following parameters,

- (a) Shadowing effect
- (b) Vertical Beam Pattern
- (c) Tilt Angle variation

➤ **Theory**

Uplink and **downlink**, also called upload and download, refers to the two-way **communication** between a **cell tower** and your phone. Most of us have experienced **cell** phone conversations when you can hear the other person but they can't hear you or vice versa.

Downlink definition – signal coming from a cell tower to your **cellular** device.

Uplink definition – signal leaving your **cellular** device and going back to a cell tower

- In a communication system especially while consider the physical layer are mainly concerned with signal to noise ratio.
- However when we look at a system with multipath users or multiple transmission going on simultaneously then usually we need to reuse the radio resource. This re-used radio resource causes co-channel interference to the undesired user.

- In cellular system offers the carrier frequency is re used in order to increase capacity. This is explained in details later. So, while one transmitter uses a frequency say and another transmitter which is physically far away from the first.
- Transmitter is assigned the same frequency for transmits information to the target. Thus which one pair of T_x and R_x from the desired link the often Tx act as co-channel interference.

In cellular communication a carrier frequency is re-used to support a high number of users. Re-use of frequency means that the same frequency may be used simultaneously in two different cells for supporting two different active users at the same time. As a result of the simultaneous transmission on the same carrier frequency, interference occurs.

1.1 Downlink(Link from Base station to mobile station) SINR:

If the Mobile Station (MS) is connected to the Base Station 1 (BS_1) and Base Station 2 (BS_2) is residing in co-channel cells, then, **BS₁-MS is the desired link** and **BS₂-MS is the interfering link** for downlink and vice-versa.

Considering the following,

1. P_{Tx1} is the transmitted signal power from BS_1 ,
2. P_{Tx2} is the transmitted signal power from BS_2 ,
3. P_{Rx1} is the received signal power by MS from BS_1 ,
4. P_{Rx2} is the received signal power by MS from BS_2 ,
5. P_{N1} is the received noise power by the MS when it is connected to BS_1 ,
6. P_{N2} is the received noise power by the MS when it is connected to BS_2

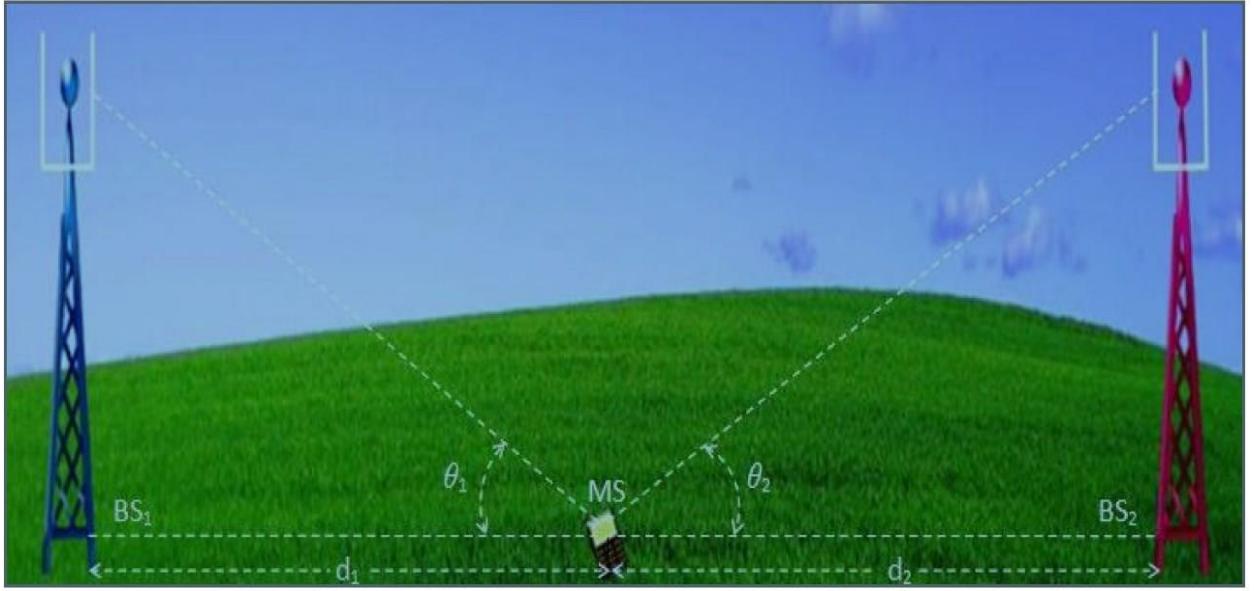


Figure1. Illustration of Downlink SINR:

- ✓ **d_1 is the straight line distance parallel to the earthcrust between MS and BS₁.**
- ✓ **d_2 is the straight line distance parallel to the earthcrust between MS and BS₂.**
- ✓ **θ_1 is the angle of the transmission line between MS and BS₁ with the straight line between MS and BS₁ parallel to the earthcrust.**
- ✓ **θ_2 is the angle of the transmission line between MS and BS₂ with the straight line between MS and BS₂ parallel to the earthcrust.**

Usually, P_{Rx1} , P_{Rx2} , P_{N1} and P_{N2} are given in dBm(Decibel-milliwatts)(30 dBm= 1 W). So, these parameters are converted into equivalent watt using the following formula:

$$|SINR|_{watt} = 0.001 * 10^{|SINR| \frac{dBm}{10}} \quad 5.1$$

After obtaining P_{Rx1} , P_{Rx2} , P_{N1} and P_{N2} parameters in watt, $|SINR_1|_{watt}$ and $|SINR_2|_{watt}$ are calculated using the following formula:

$$|SINR_1|_{watt} = \frac{P_{Rx1}}{[P_{Rx2} + P_{N1}]} \quad 5.2$$

$$|SINR_2|_{watt} = \frac{P_{Rx2}}{[P_{Rx1} + P_{N2}]} \quad 5.3$$

Then the corresponding $|SINR_1|_{dB}$ and $|SINR_2|_{dB}$ are calculated using the following formula:

$$|SINR_1|_{dB} = 10 \log_{10} SINR_1 \quad \text{and} \quad |SINR_2|_{dB} = 10 \log_{10} SINR_2 \quad 5.4$$

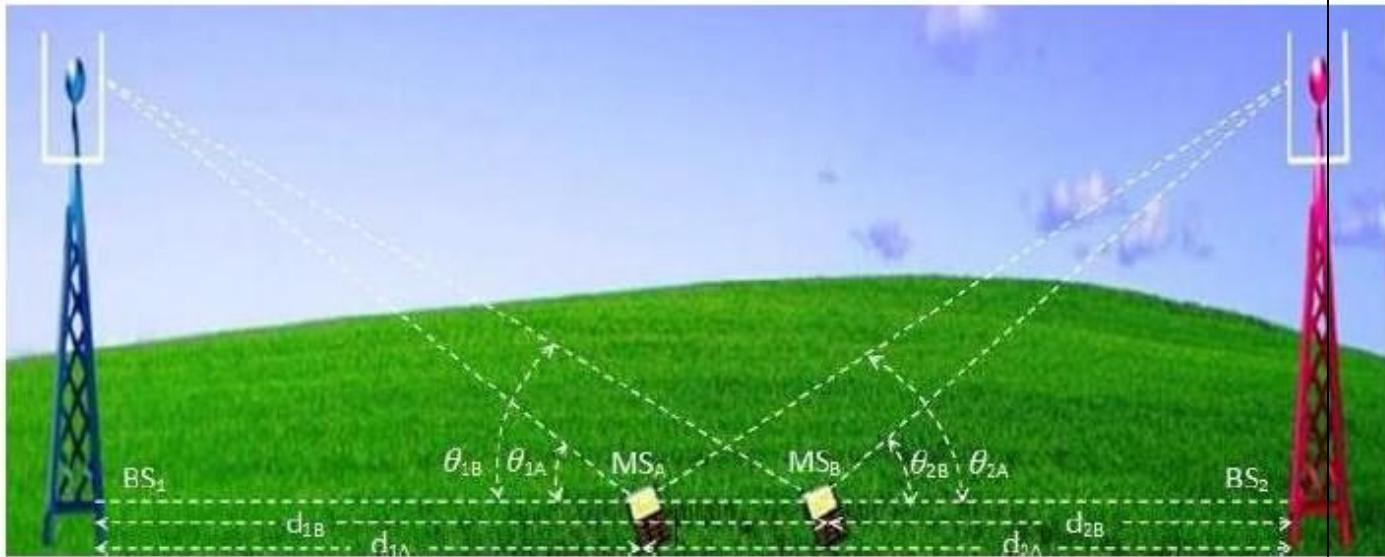
The above Downlink SINR calculation includes the effects of 2 Base Stations at the MS. Proceeding in a similar fashion, the effects of other Base Stations can be included in the Downlink SINR calculation for the MS as usually occur in practice for cellular architecture.

1.2 Uplink (Link from mobile station to Base station)SINR:

- If the Base Station 1 (BS₁) is connected to Mobile Station A (MS_A) and Base Station 2 (BS₂) is connected to Mobile Station B (MS_B) and **BS₁ and BS₂ are residing in co- channel cells** where MS_A and MS_B are operating on the same carrier frequency,
- **then, for Base Station 1**, MS_A-BS₁ is the desired link and MS_B-BS₁ is the interfering link in uplink
- **and for Base Station 2**, MS_B-BS₂ is the desired link and MS_A-BS₂ is the interfering link in uplink and vice-versa.

Considering the following,

1. P_{TxA} is the transmit signal power from MS_A,
 2. P_{TxB} is the transmit signal power from MS_B,
 3. P_{Rx1A} is the received signal power by BS₁ from MS_A,
 4. P_{Rx1B} is the received signal power by BS₁ from MS_B,
 5. P_{Rx2A} is the received signal power by BS₂ from MS_A,
 6. P_{Rx2B} is the received signal power by BS₂ from MS_B,
 7. P_{N1A} is the received noise power by BS₁ **when it is connected to MS_A**,
 8. P_{N2B} is the received noise power by BS₂ **when it is connected to MS_B**,
 9. P_{N1B} is the received noise power by BS₁ **when it is connected to MS_B**.
10. P_{N2A} is the received noise power by BS₂ **when it is connected to MS_A**,



3

Figure 2.Illustration of Uplink SINR:

- ✓ d_{1A} is the straight line distance parallel to the earthcrust between MS_A and BS_1 .
- ✓ d_{2A} is the straight line distance parallel to the earthcrustbetween MS_A and BS_2 .
- ✓ d_{1B} is the straight line distance parallel to the earthcrust between MS_A and BS_1 .
- ✓ d_{2B} is the straight line distance parallel to the earthcrust between MS_A and BS_2 .
- ✓ θ_{1A} is the angle of the transmission line between MS_A and BS_1 with the straight line between MS_A and BS_1 parallel to the earthcrust.
- ✓ θ_{2A} is the angle of the transmission line between MS_A and BS_2 with the straight line between MS_A and BS_2 parallel to the earthcrust.
- ✓ θ_{1B} is the angle of the transmission line between MS_B and BS_1 with the straight line between MS_B and BS_1 parallel to the earthcrust.
- ✓ θ_{2B} is the angle of the transmission line between MS_B and BS_2 with the straight line between MS_B and BS_2 parallel to the earthcrust.

Usually P_{Rx1A} , P_{Rx2A} , P_{Rx1B} , P_{Rx2B} , P_{N1A} and P_{N2B} are given in dBm. So, these parameters are converted into equivalent watt. After obtaining P_{Rx1A} , P_{Rx2A} , P_{Rx1B} , P_{Rx2B} , P_{N1A} and P_{N2B} parameters in watt, $|SINR_{1A}|_{watt}$, $|SINR_{1B}|_{watt}$, $|SINR_{2A}|_{watt}$ and $|SINR_{2B}|_{watt}$ are calculated using the following formula:

5.5

$$|SINR_{1A}|_{watt} = \left[\frac{P_{R_x1A}}{P_{R_x1B} + P_{N1A}} \right],$$

$$|SINR_{1B}|_{watt} = \left[\frac{P_{R_x1B}}{P_{R_x1A} + P_{N1B}} \right], \quad 5.6$$

$$|SINR_{2A}|_{watt} = \left[\frac{P_{R_x2A}}{P_{R_x2B} + P_{N2A}} \right],$$

$$|SINR_{2B}|_{watt} = \left[\frac{P_{R_x2B}}{P_{R_x2A} + P_{N2B}} \right]. \quad 5.7$$

Then the corresponding $|SINR_{1A}|_{dB}$, $|SINR_{1B}|_{dB}$, $|SINR_{2A}|_{dB}$ and $|SINR_{2B}|_{dB}$ are calculated.

The above Uplink SINR calculation includes the effects of 2 Mobile Stations at each BS. Proceeding in a similar fashion, the effects of other Mobile Stations can be included in the Uplink SINR calculation for each BS as usually occur in practice for cellular architecture.

➤ Steps to perform Virtual lab Experiment:(Exp No 5 A and 5B)

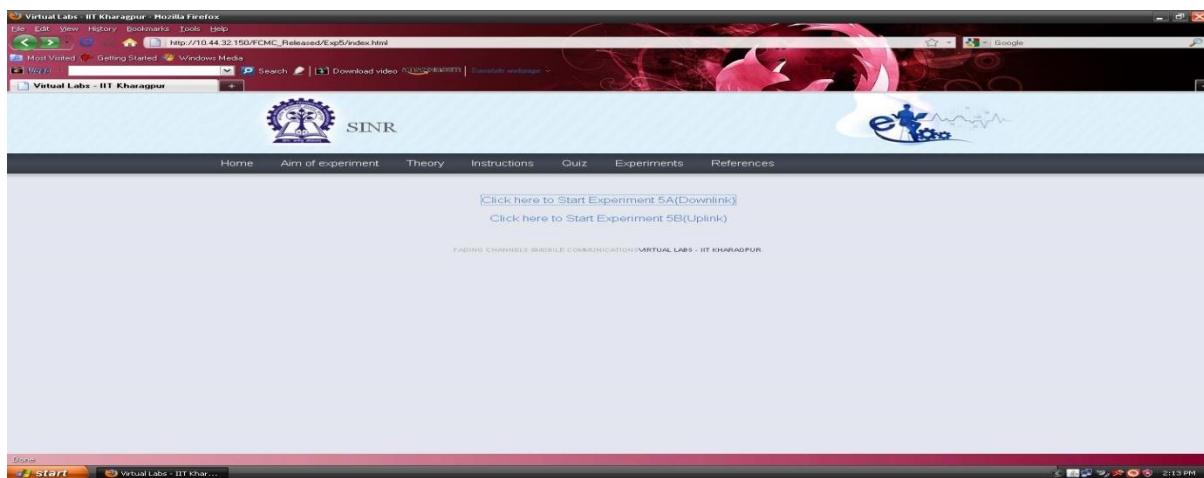
Virtual Lab: Fading channels and Mobile communications

Starting the Experiments:-

LINK:<http://vlabs.iitkgp.ernet.in/fcmc/index.html>

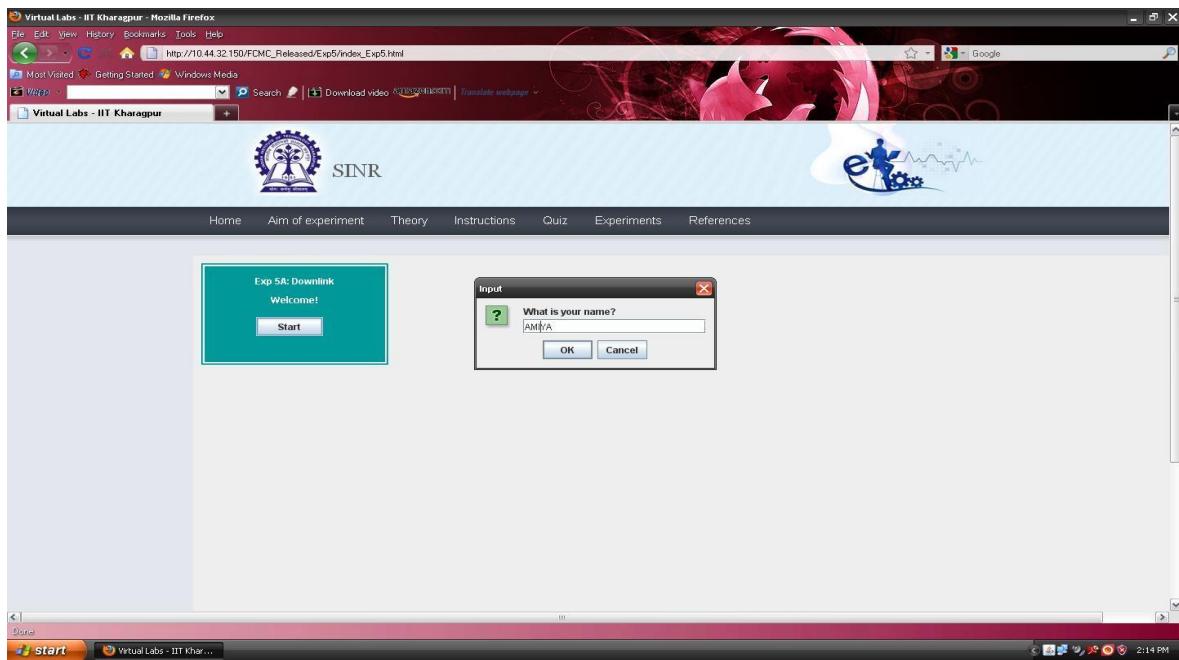
1.1 Starting the Experiments:-

- Step 1: Click on the experiment you want to do by clicking on either 'Click here to start Experiment 5A (Downlink)' or 'Click here to start Experiment 5B (Uplink)'.



1.2 Starting Experiment 5A:-

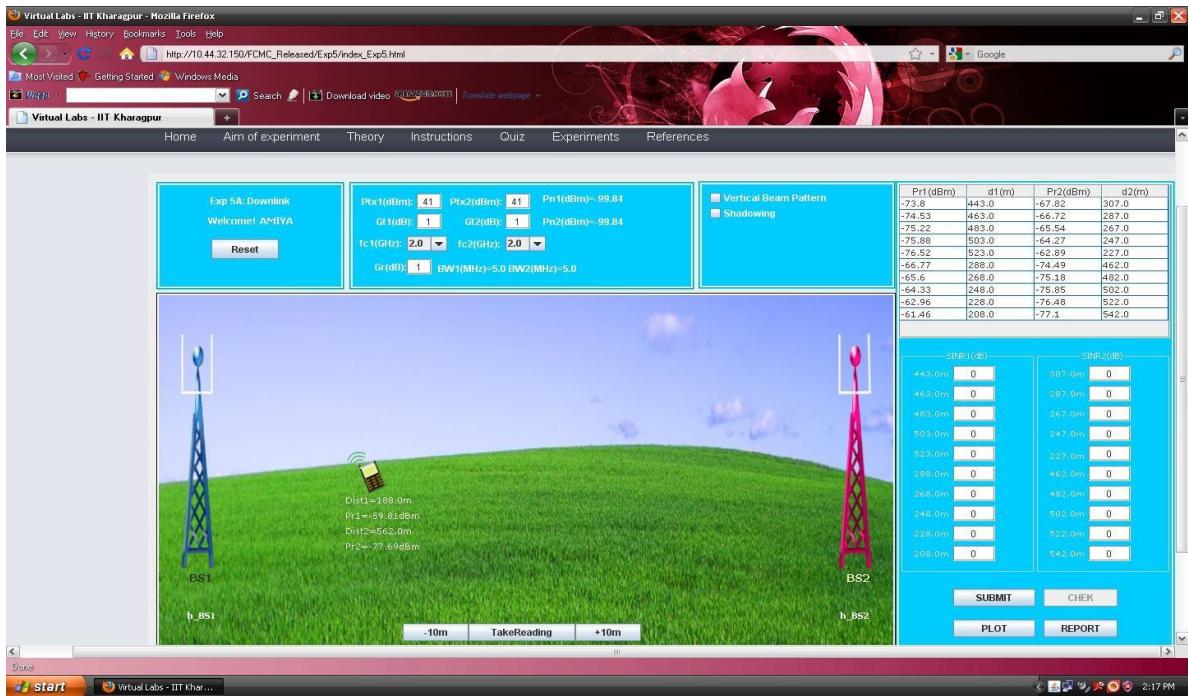
- Step 2: Let Experiment 5A (Downlink) is chosen. Click on the button START. A page appears with a dialogue box asking for your name. Enter your name and click OK.



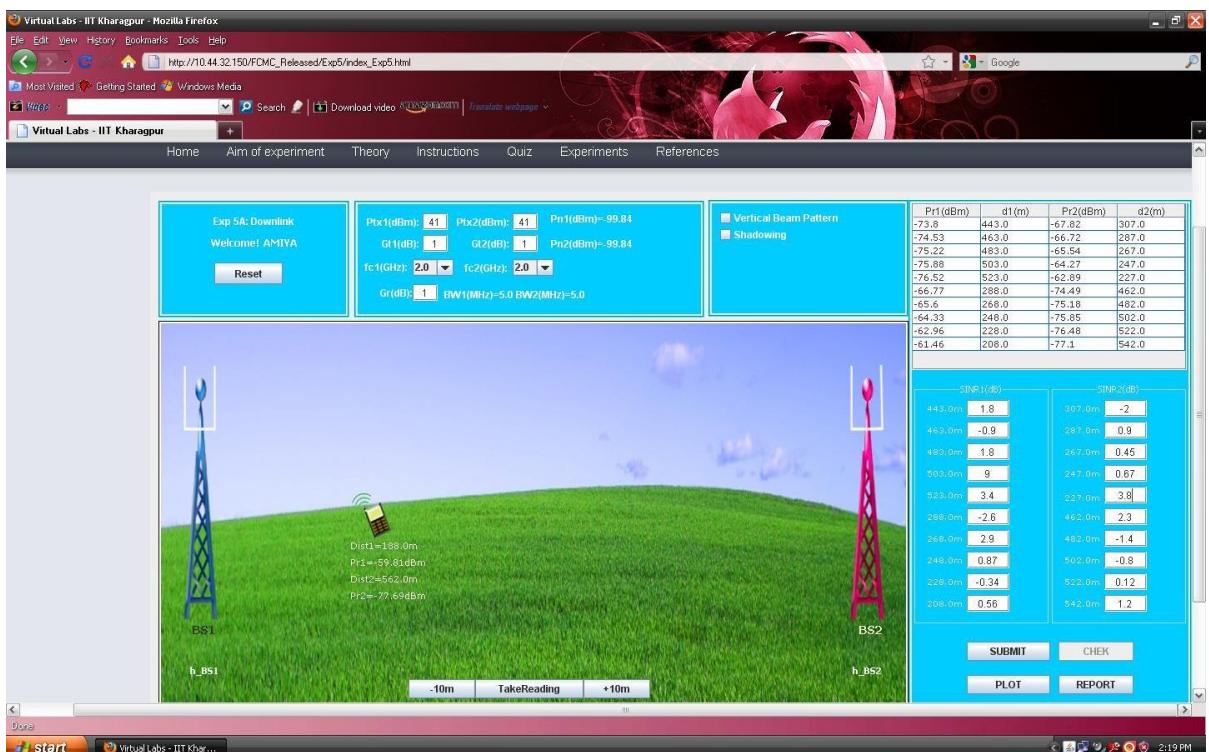
- Step 3: Drag the mobile and adjust its position from the base stations. You can also use + or - sign to adjust the position of your mobile. To do the experiment adding the effect of Vertical Beam Pattern with Tilt and Shadowing conditions click on the check boxes ‘Vertical Beam Pattern’ and ‘Shadowing’ selecting required Tilt.



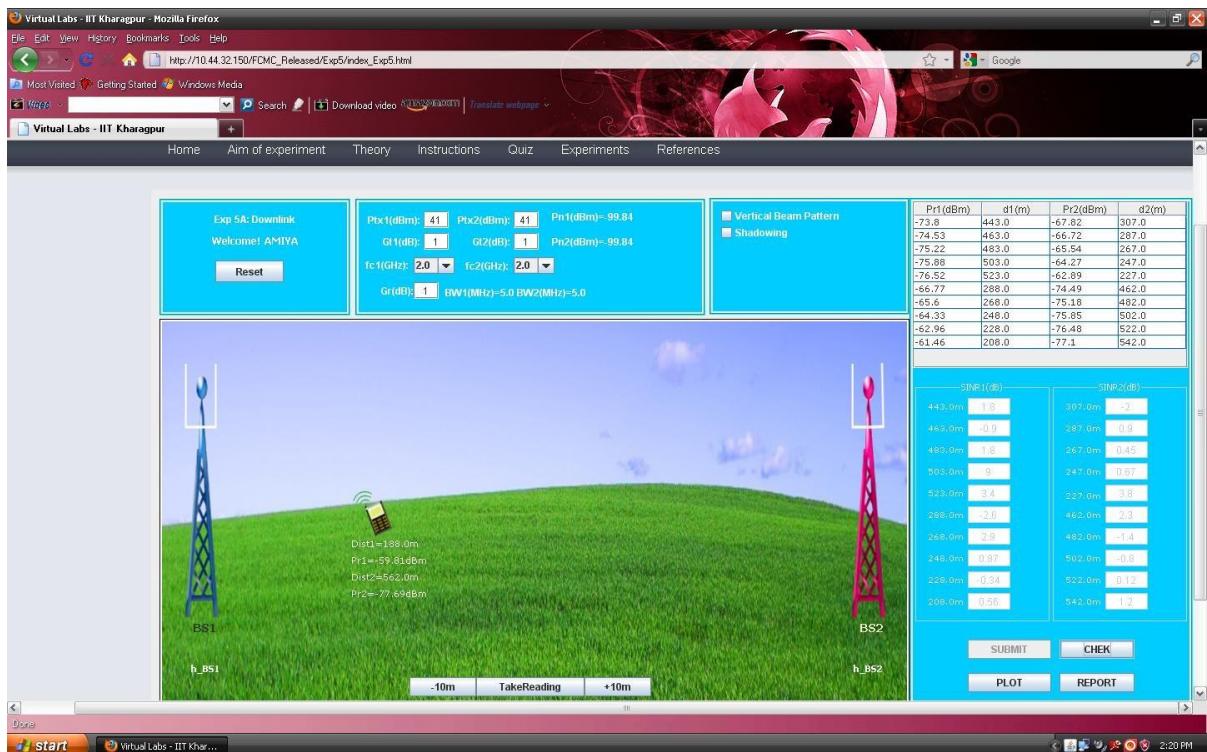
- Step 4: Click on the button TAKE READING to record the received power by the mobile at different distances from the base stations. Take 10 readings.



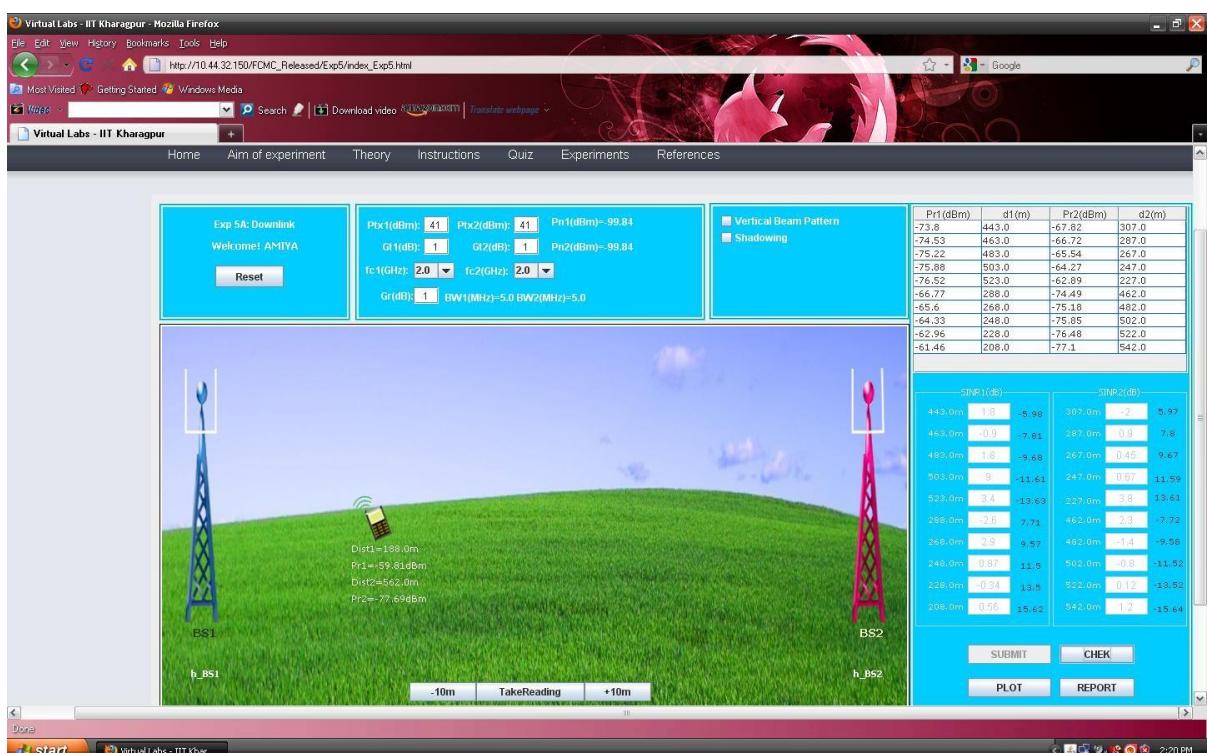
- Step 5: Calculate the values of SINR_1 and SINR_2 in dB from the formula given in theory section. Enter your values in the boxes provided in the RHS of the page.



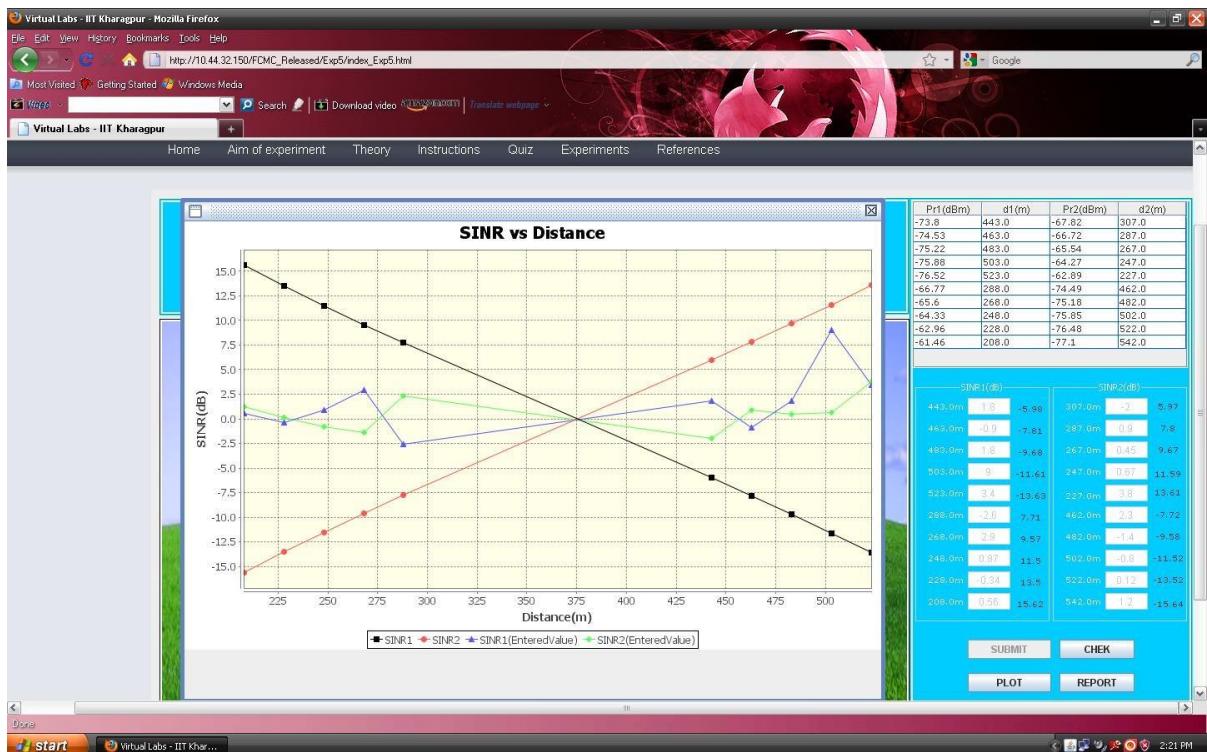
- Step 6: Click on the button SUBMIT to submit your calculated values.



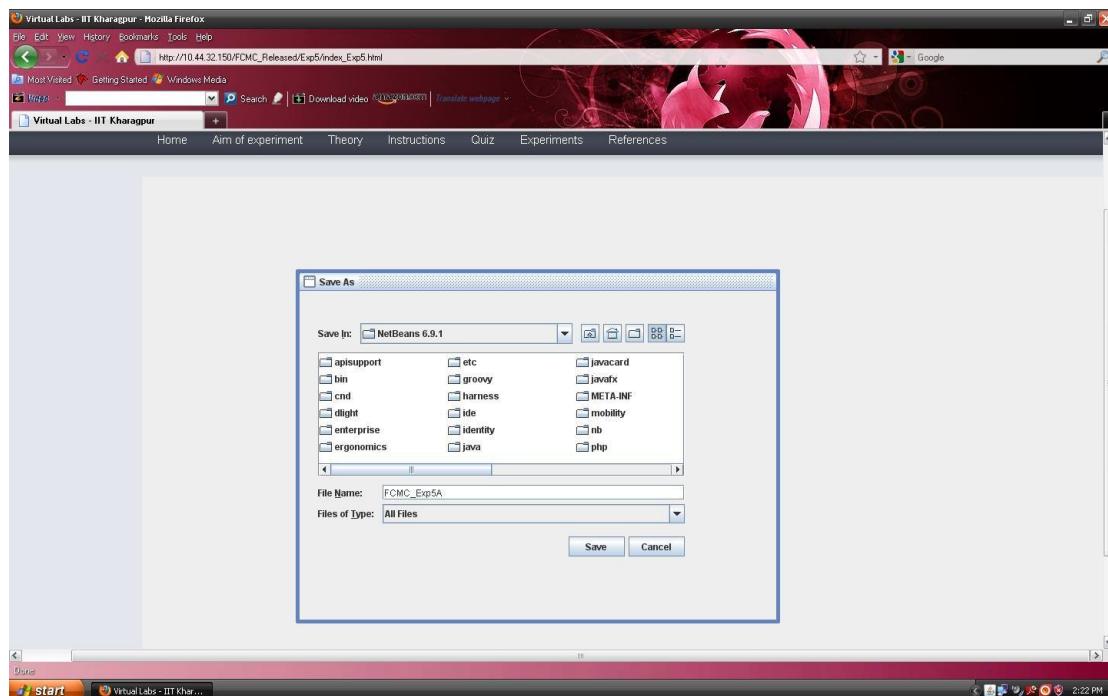
- Step 7: Click on the button CHECK to see whether your manually calculated values match with the computed values. If your manually calculated values do not match with the computed values then the correct values will be displayed in the RHS of the page.



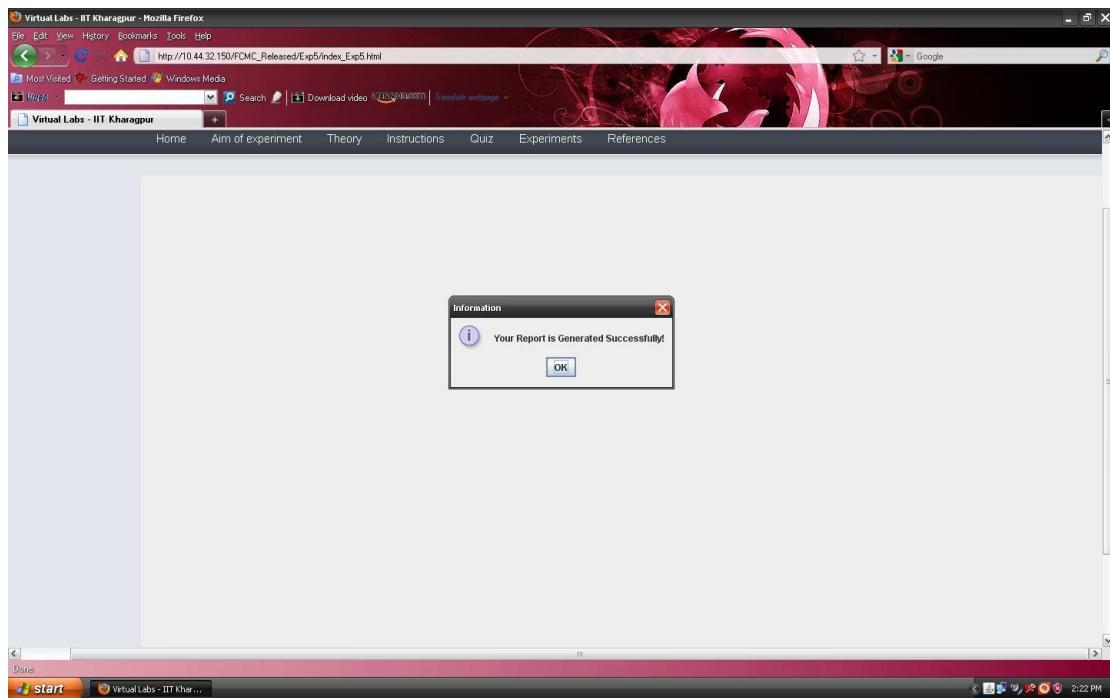
- Step 8: Click on the button PLOT to see the plot of SINR versus Distance.



- Step 9: Click on the button REPORT to generate the report of the experiment you have performed.
- Step 10: A dialogue box appears. Click on the button Save to save your report.



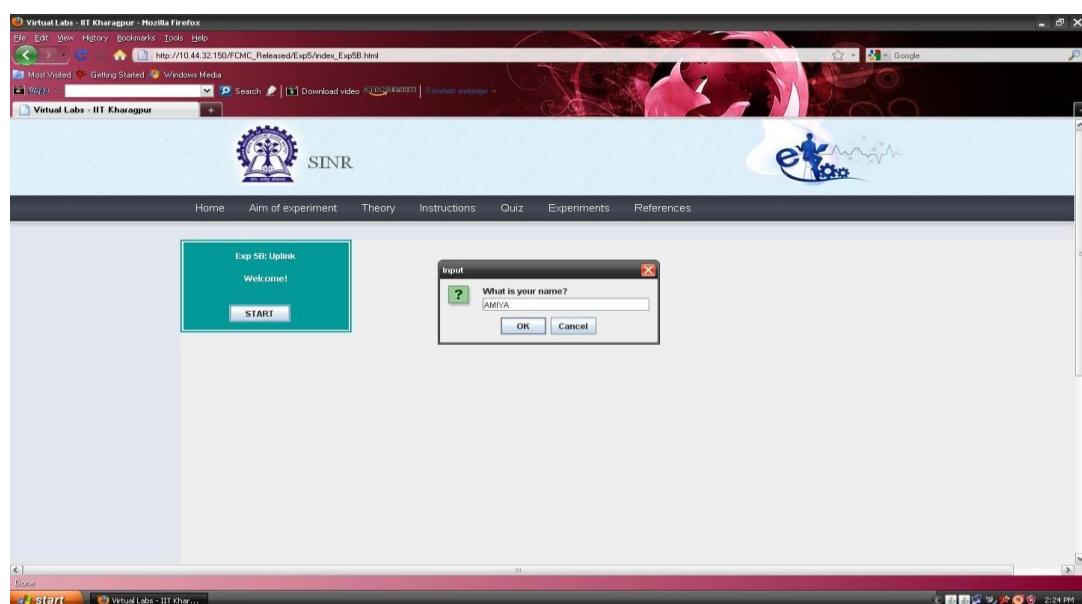
- Step 11: A dialogue box appears with the message that 'Your report has generated successfully'. Click on button OK in the dialogue box.



- Step 12: Now you can view the pdf report.
- Step 13: You can repeat the experiment by clicking the RESET button at the upper corner in the LHS of the page.

1.3 Starting Experiment 5B :-

• Step 14: Let Experiment 5B (Uplink) is chosen. Click on the button START. A page appears with a dialogue box asking for your name. Enter your name and click OK.



1.4 Performing Experiment 5B :-

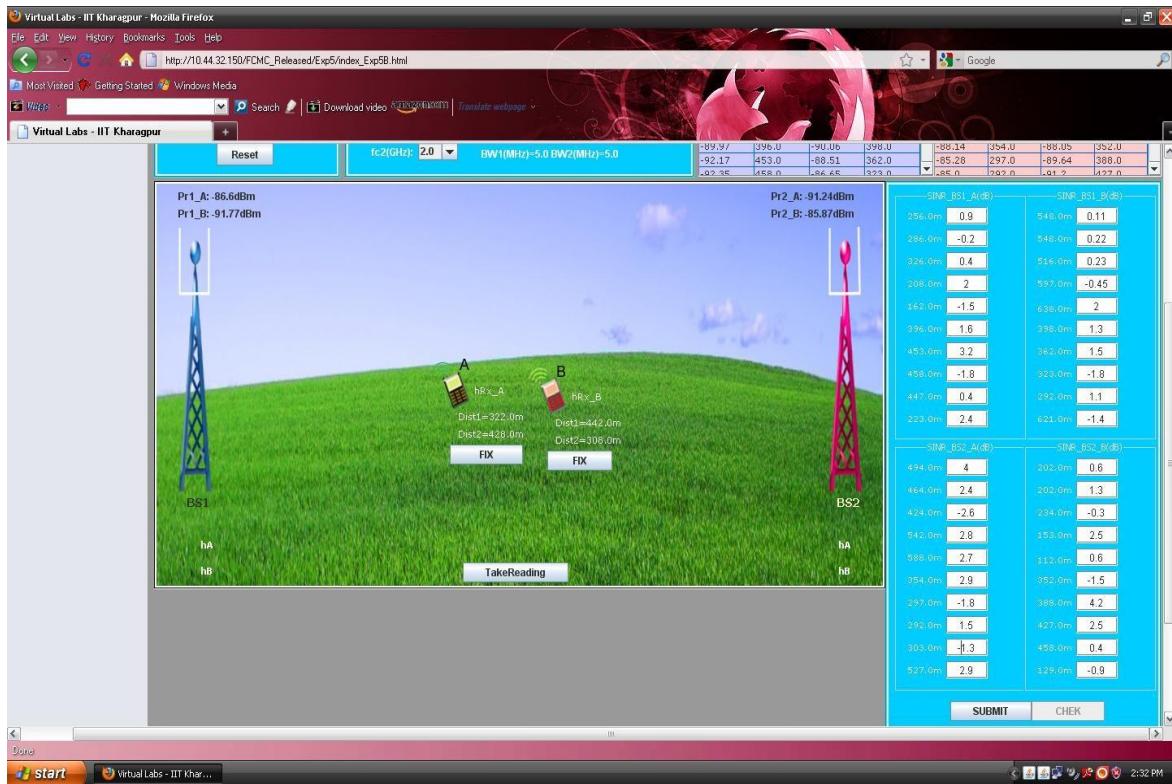
- Step 15: Drag the mobile A and mobile B to adjust their positions from the base stations. To do the experiment adding the effect of Vertical Beam Pattern with Tilt and Shadowing conditions click on the check boxes 'Vertical Beam Pattern' and 'Shadowing' selecting required Tilt. The experiment can also be done fixing any one mobile by clicking on the FIX button associated with that mobile.



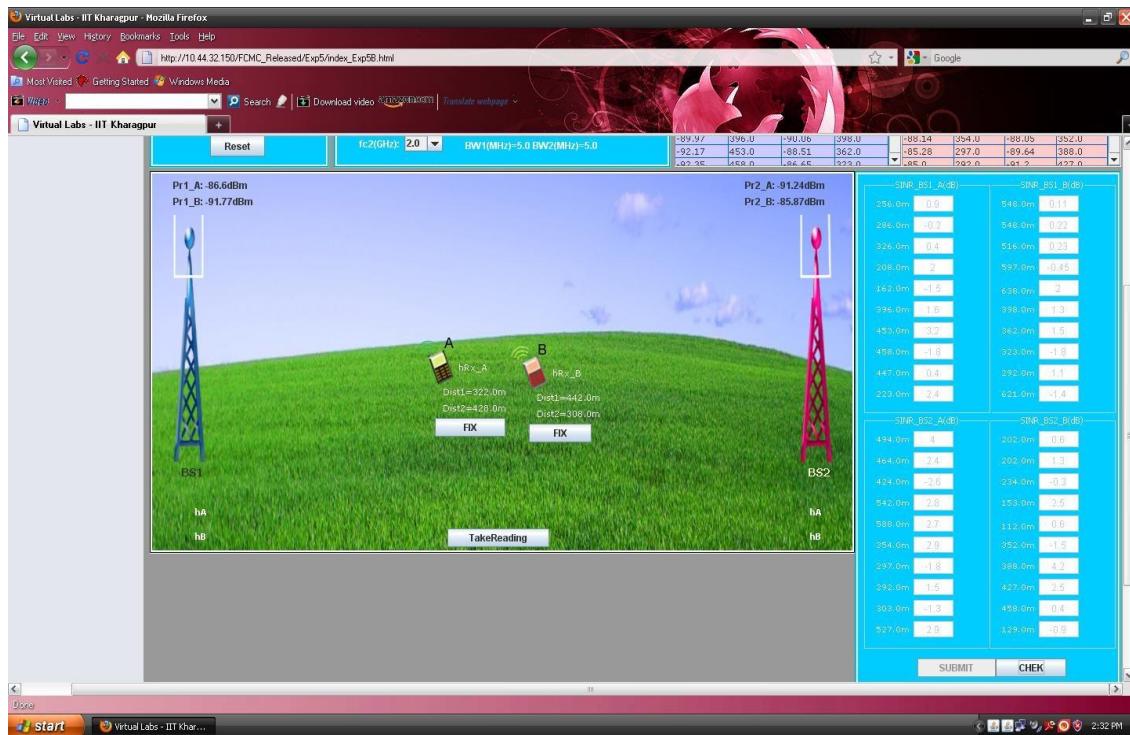
- Step 16: Click on the button TAKE READING to record the received power by mobile A and mobile B at different distances from the base stations. Take 10 readings.



- Step 17: Calculate the values of SINR_{1A} , SINR_{2A} , SINR_{1B} and SINR_{2B} in dB from the formula given in theory section. Enter your manually calculated values in the boxes provided for different SINR parameters in the RHS of the page.



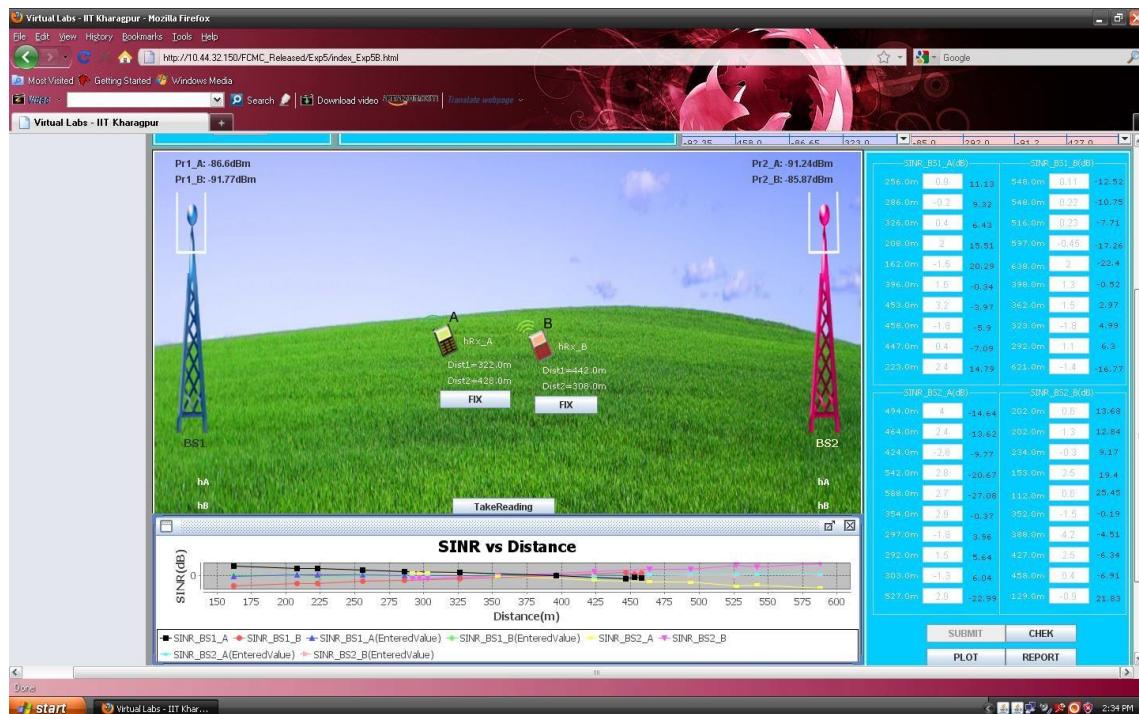
- Step 18: Click on the button SUBMIT to submit your calculated values.



- Step 19: Click on the button CHECK to see whether your manually calculated values match with the computed values. If your manually calculated values do not match with the computed values then the correct values will be displayed in the RHS of the page.

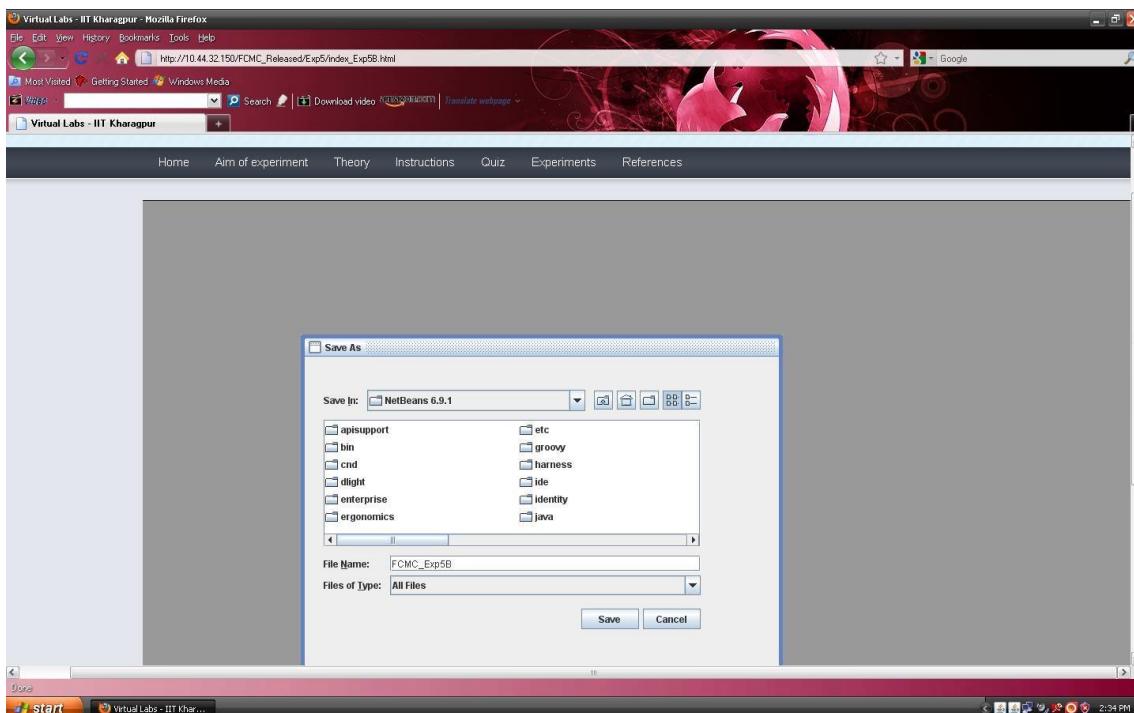


- Step 20: Click on the button PLOT to see the plot of SINR versus Distance.

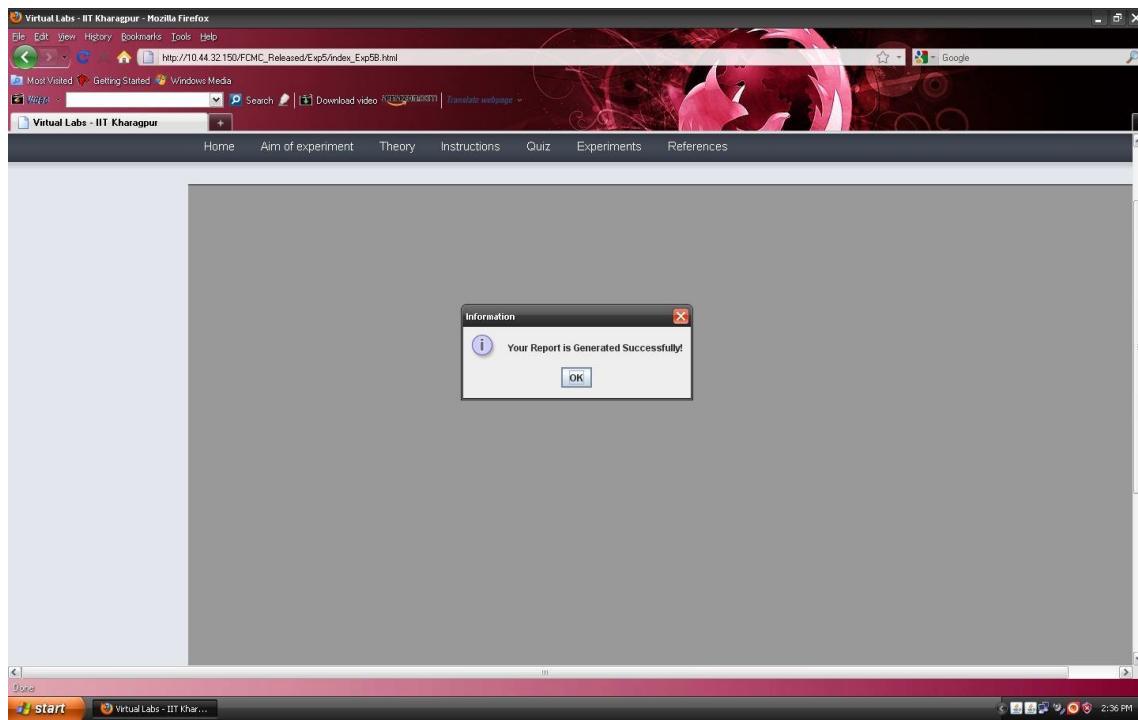


- Step 21: Click on the button REPORT to generate the report of the experiment you have performed.

- Step 22: A dialogue box appears. Click on the button Save to save your report.



- Step 23: A dialogue box appears with the message that 'Your report has generated successfully'. Click on button OK in the dialogue box.



- Step 24: Now you can view the pdf report.
- Step 25: You can repeat the experiment by clicking the RESET button at the upper corner in LHS of the page.

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app from screen shots.)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

- 1. Solve the quiz given in virtual lab related to this experiment and attached screen shots of the same.**

2. What is uplink and what is down link in mobile communication? Explain.

Experiment No-3:-Frequency reuse

PART A

➤ Aim

To understand the cellular network frequency reuse concept fulfilling the following objectives:

1. **Finding the co-channel cells for a particular cell.**
2. **Finding the cell clusters within certain geographic area.**

➤ Theory:

- In mobile communication systems a slot of a carrier frequency / code in a carrier frequency is a radio resource unit.
- This radio resource unit is assigned to a user in order to support a call/ session. The number of available such radio resources at a base station thus determines the number of users who can be supported in the call.
- Since in wireless channels a signal is "broadcast" i.e. received by all entities therefore one a resource is allocated to a user's it cannot be re-assigned until the user finished the call/ session. Thus the number of users who can be supported in a wireless system is highly limited.
- In order to support a large no. of users within a limited spectrum in a region the concept of frequency re-use is used.
- The signal radiated from the transmitter antenna gets attenuated with increasing distance. At a certain distance the signal strength falls below noise threshold and is no longer identifiable.
- In this region when the signal attenuates below noise floor the same radio resource may be used by another transmission to send different information.
- In term of cellular systems, the same radio resource (frequency) ***can use by two base stations which are sufficiently spaced apart.*** In this way ***the same frequency gets reused*** in a layer- geographic area ***by two or more different base stations*** different users simultaneously.
- ***Now what is important is to select the set of base stations which will use the same set of radio resources/ channel of frequencies or technically the co- channel cells.***
- In this context the minimum adjacent set cells which use different frequencies each is calls a cluster.

- The cellular concept is the major solution of the problem of spectral congestion and user capacity. Cellular radio rely on an intelligent allocation and channel reuse throughout a large geographical coverage region.

Cellular Frequency Reuse:

- Each cellular base station is allocated a **group of radio channels** to be used within a small geographic area called a cell.
- Base stations in adjacent cells are assigned channel groups which contain completely different channels than neighboring cells.
- Base station antennas are designed to achieve the desired coverage within a particular cell. **By limiting the coverage area within the boundaries of a cell, the same group of channels may be used to cover different cells that are separated from one another by geographic distances large enough to keep interference levels within tolerable limits.**
- **The design process of selecting and allocating channel groups for all cellular base stations within a system is called frequency reuse or frequency planning.**

Hexagonal Cell Structure:

In figure 1, cells labeled with the same letter use the same group of channels. The hexagonal cell shape is conceptual and is the simplistic model of the radio coverage for each base station. It has been universally adopted since the hexagon permits easy and manageable analysis of a cellular system. The actual radio coverage of a system is known as the footprint and is determined from old measurements and propagation prediction models. Although the real footprint is amorphous in nature, a regular cell shape is needed for systematic system design and adaptation for future growth.

If a circle is chosen to represent the coverage area of a base station, adjacent circles overlaid upon a map leave gaps or overlapping regions. A square, an equilateral triangle and a hexagon can cover the entire area without overlap and with equal area. A cell must serve the weakest mobiles typically located at the edge of the cell within the foot print. For a given

distance between the center of a polygon and its farthest perimeter points, the hexagon has the largest area of the three. Thus, with hexagon, the fewest number of cell scan cover a geographic region and close approximation of a circular radiation pattern that occurs for an omni directional base antenna and free space propagation is possible.

Base station transmitters are situated either at the center of the cell (center-excited cells) or at three of the six cell vertices (edge-excited cells). Normally, omnidirectional antennas are used in center-excited cells and sectored directional antennas are used in edge-excited cells. Practical system design considerations permit a base station to be positioned up to one-fourth the cell radius away from the ideal location.

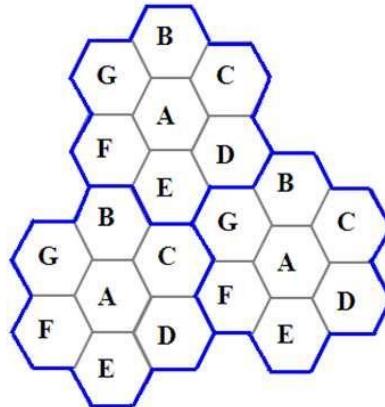
Cell Cluster:

Considering a cellular system that has a total of S duplex radio channels. If each cell is allocated a group of k channels ($k < S$) and if the S channels are divided among N cells into unique and disjoint channel groups of same number of channels, then,

$$S = kN. \quad 6.1$$

The N cells that collectively use the complete set of available frequencies is called a cluster. If a cluster is replicated M times within the system, the total number of duplex channels or capacity,

$$C = MkN = MS. \quad 6.2$$



Frequency reuse concept, Cells with the same letter use the same set of frequencies. A cell cluster is outline in blue color and replicated over the coverage area.

✓ **In this example,**

The cluster size $N = 7$ and the frequency reuse factor is $1/7$ since each cell contains one-seventh of the total number of available channels.

The capacity is directly proportional to M . The *factor N is called the cluster size and is typically 4, 7 or 12*. If the cluster size N is reduced while the cell size is kept constant, more clusters are required to cover a given area and hence more capacity is achieved from the

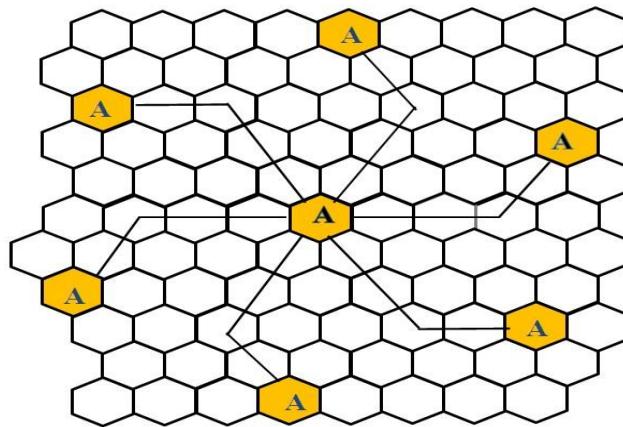
design viewpoint, the smallest possible value of N is desirable to maximize capacity over a given coverage area. The frequency reuse factor of a cellular system is $1/N$, since each cell within a cluster is assigned $1/N$ of the total available channels in the system.

 **Co-channel Cells:**

A larger cluster size causes the ratio between the cell radius and the distance between co-channel cells to decrease reducing co-channel interference. The value of N is a function of how much interference a mobile or base station can tolerate while maintaining a sufficient quality of communications. Since each hexagonal cell has six equidistant neighbors and the line joining the centers of any cell and each of its neighbors are separated by multiples of 60 degrees, only certain cluster sizes and cell layouts are possible. To connect without gaps between adjacent cells, the geometry of hexagons is such that the number of cells per cluster, N , can only have values that satisfy,

$$N = i^2 + ij + j^2,$$

6.3



Method of locating co-channel cells in a cellular system. In this figure, N=19(i.e, i =3, j=2).

In this example, N = 19 (i.e., i = 3, j = 2).

Where, i and j are non-negative integers.

To find the nearest co-channel neighbours of a particular cell, a. move i cells along any chain of hexagons then,

b. turn 60 degrees counter-clockwise and move j cells.

Follow the instructions given below to perform the experiments.

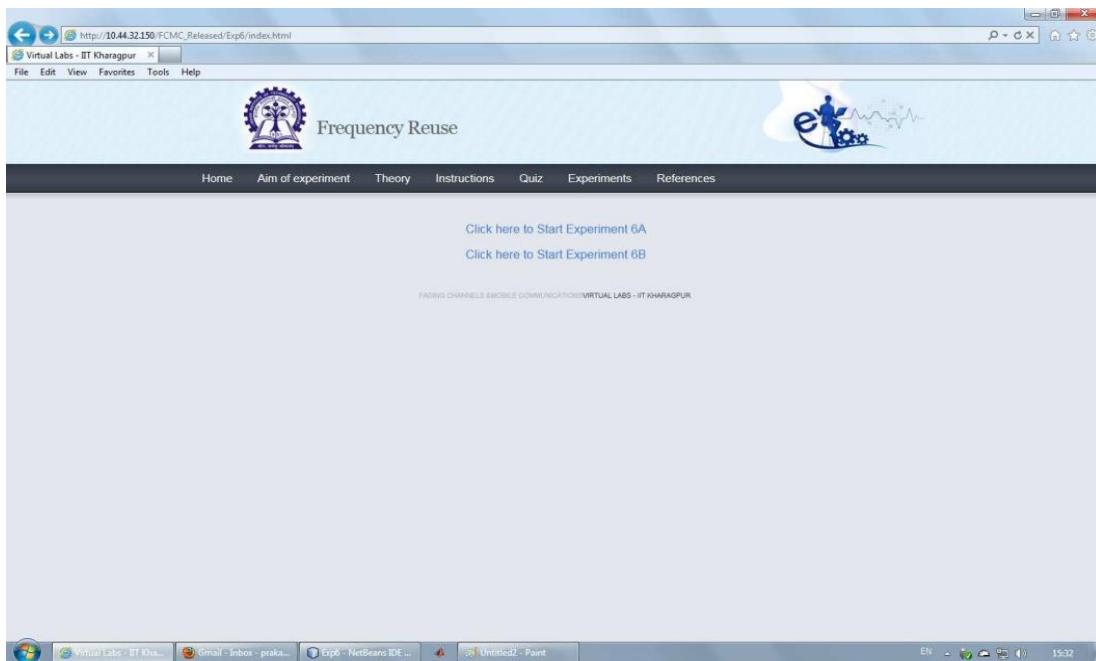
➤ **Steps to perform Virtual lab Experiment:**

Virtual Lab: Fading channels and Mobile communications

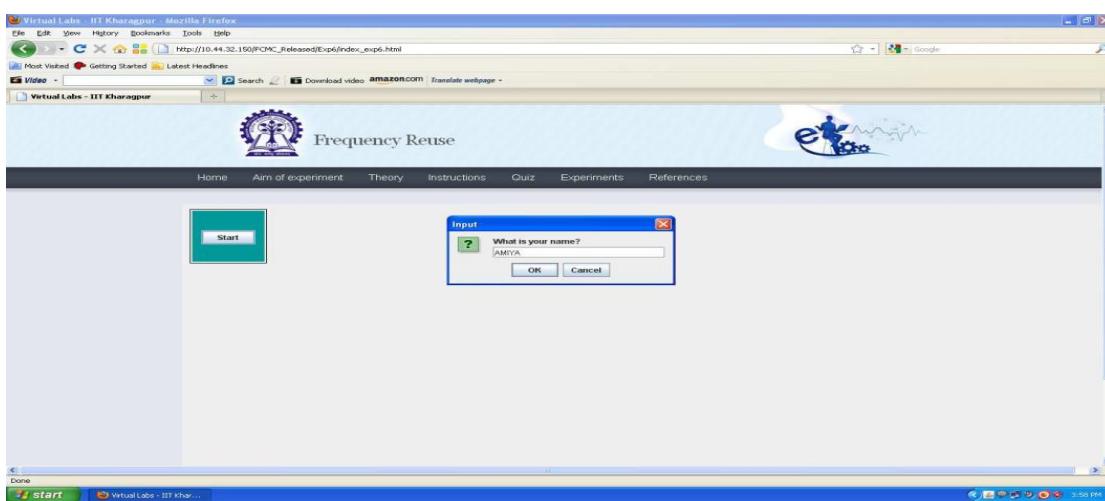
Starting the Experiments:-

LINK:<http://vlabs.iitkgp.ernet.in/fcmc/exp6/index.html#>

- Step 1: Click on the experiment you want to do by clicking on either 'Click here to start Experiment 6A (Co-channel cell)' or 'Click here to start Experiment 6B (Cellcluster)'



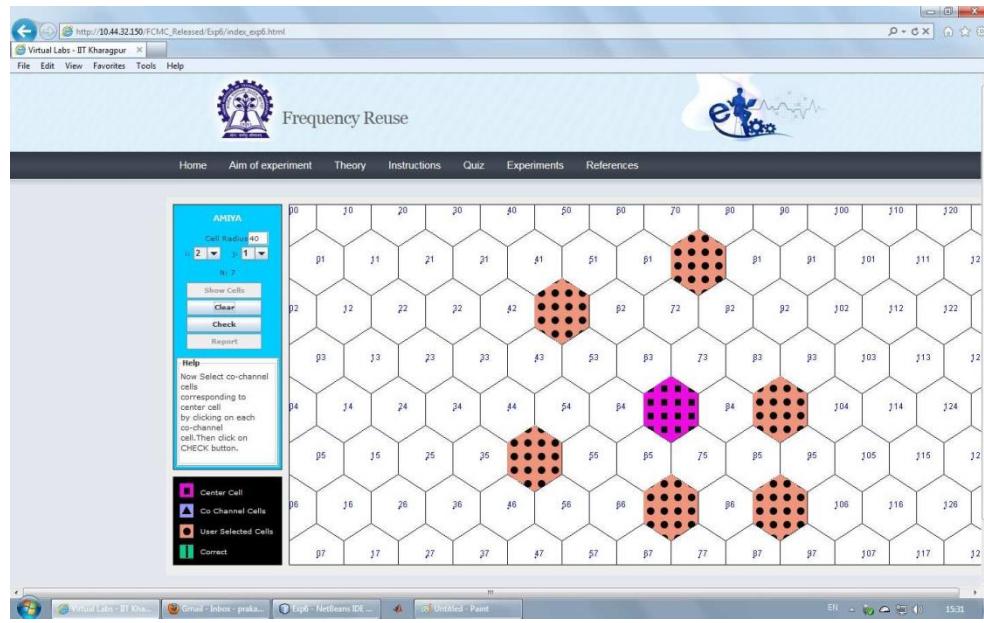
- **Performing Experiment 1A:-**
- Step 2: Let Experiment 6A (Co-channel cell) is chosen. Click on the button START. A page appears with a dialogue box asking for your name. Enter your name and clickOK.



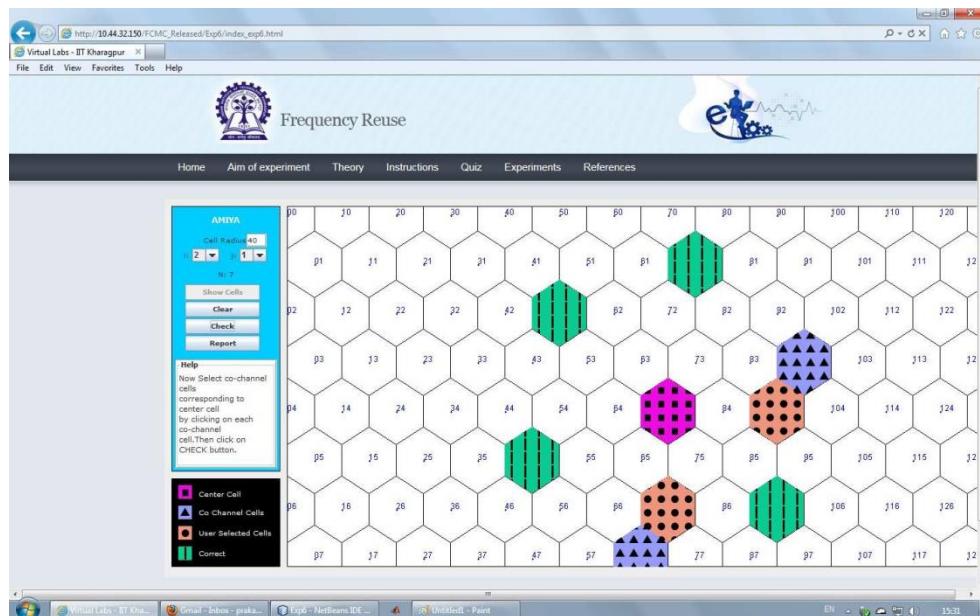
- Step 3: Choose the value of Cell Radius, iandj.
- Step 4: Click on the button Show Cells. For the given parameters, the value of Cluster-size N is shown in the LHS of the page and the generated cells are shown on the RHS of the page.



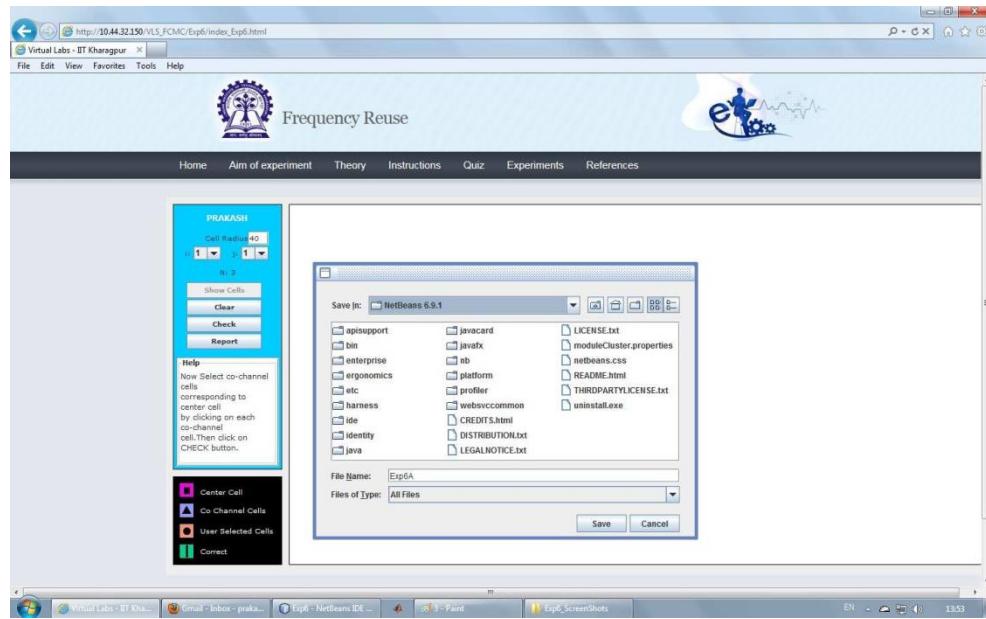
- Step 5: Within the generated cells the center cell is shown in pink colour. Select the Co-channel cells in orange colour for the center cell by finding the Co-channel cells from the formula given in the theorysection.



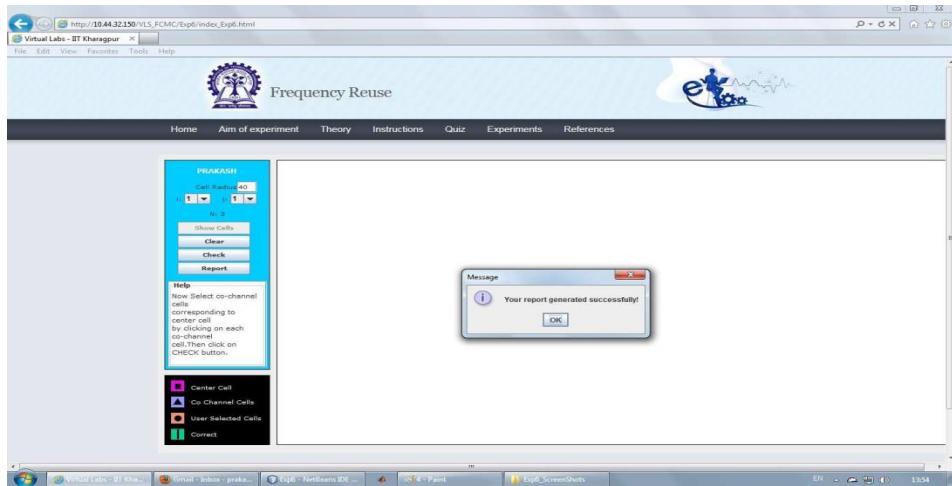
Step 6: Click on the button CHECK to see whether your manually selected Co-channel cells match with the correct Co-channel cells. If you've manually selected cells do not match with the correct Co-channel cells then the correct Co-channel cells are displayed in sky blue colour. If your manually selected Co-channel cells match with the correct Co-channel cells then the correct Co-channel cells are over-marked in green colour.



- Step 7: Click on the button REPORT to generate the report of the experiment you have performed.



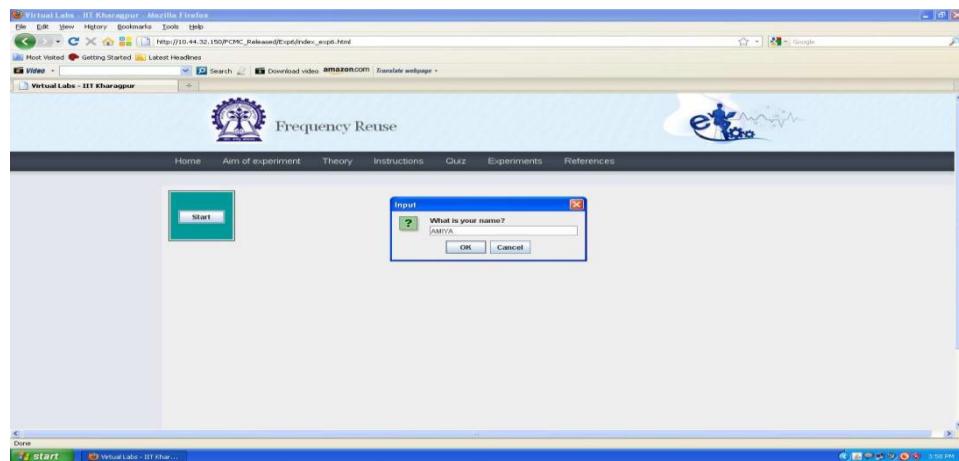
- Step 8: A dialogue box appears. Click on the button Save to save your report.
- Step 9: A dialogue box appears with the message that 'Your report has generated successfully'. Click on button OK in the dialogue box



- Step 10: Now you can view the pdfreport.
- Step 11: You can repeat the experiment by clicking the CLEAR button at the upper corner in the LHS of the page.

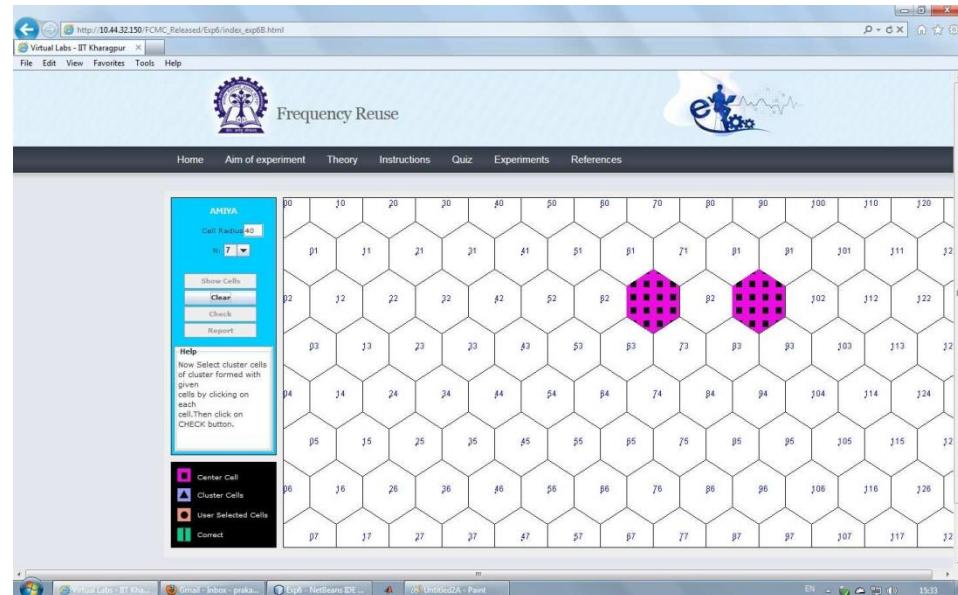
Performing Experiment 1B:-

- Step 12: Let Experiment 6B (Cell cluster) is chosen. Click on the button START. A page appears with a dialogue box asking for your name. Enter your name and click OK.

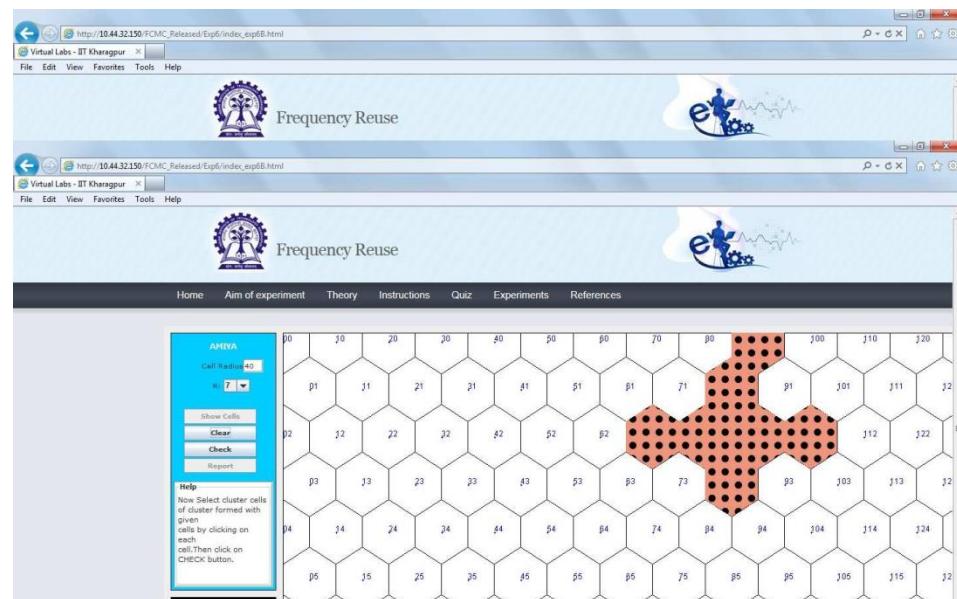


- Step 13: Choose the value of Cell Radius and CellCluster.

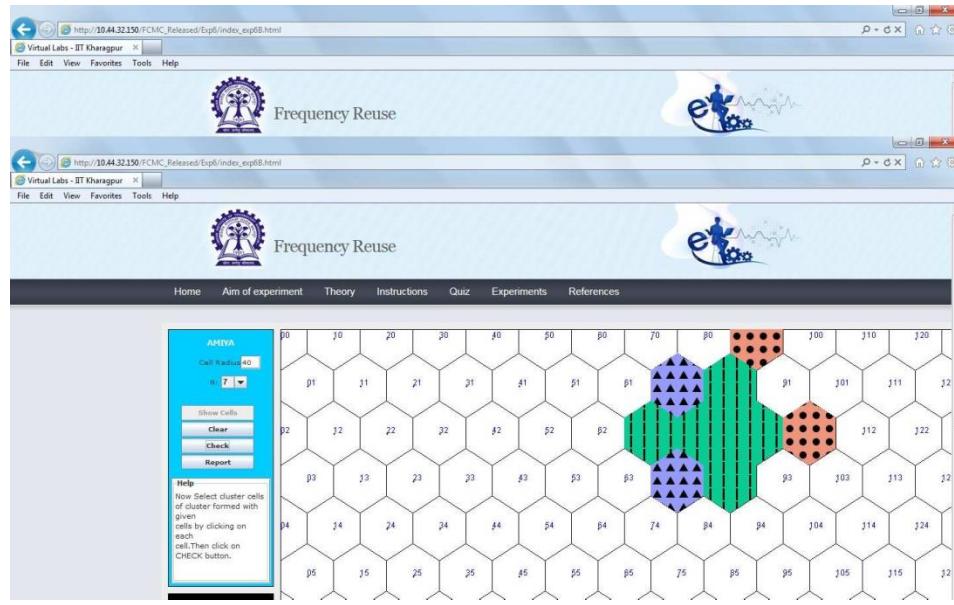
Step 14: Click on the button Show Cells. The generated cells are shown on the RHS of the page.



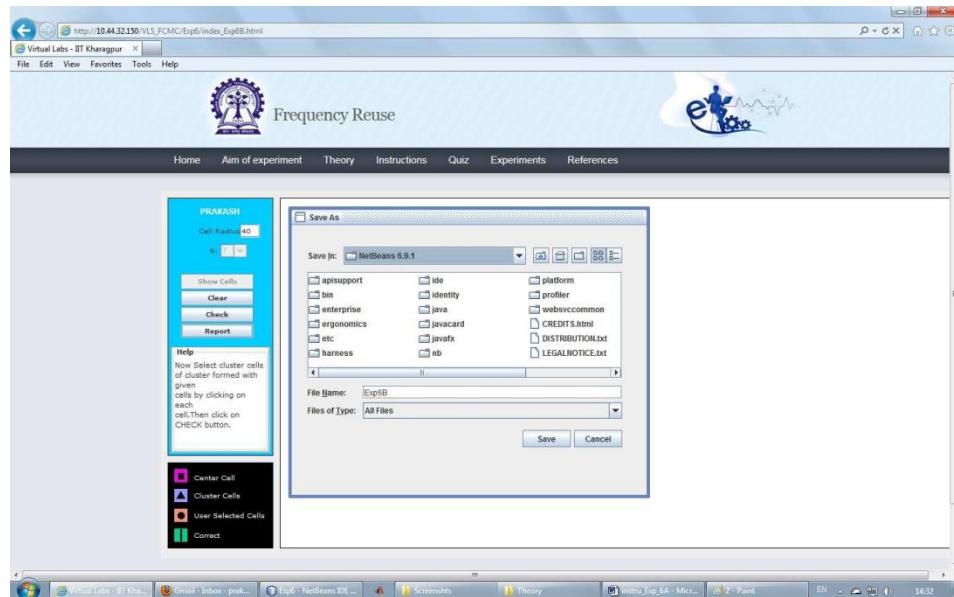
- Step 15: Within the generated cells the two extreme cells within the cell cluster is shown in pink colour. Select other cells within the cell cluster in orangecolour.



- Step 16: Click on the button CHECK to see whether your manually selected cluster cells match with the correct cells of the cluster. If your manually selected cells do not match with the correct cells of the cluster then the correct cells of the cluster are displayed in sky blue colour. If the manually selected cells of the cluster match with the correct cells of the cluster then the correct cells of the cluster are over-marked in greencolour.



- Step 17: Click on the button REPORT to generate the report of the experiment you have performed.



- Step 18: A dialogue box appears. Click on the button Save to save your report.
- Step 19: A dialogue box appears with the message that 'Your report has generated successfully'. Click on button OK in the dialogue box.



- Step 20: Now you can view the pdfreport.
- Step 21: You can repeat the experiment by clicking the CLEAR button at the upper corner in LHS of the page.

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screenshots.)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

1. With Example explain Co-channel cells
2. Explain working of cellular system.

Experiment No 4:- Handover Mechanism

Part A

- **Aim:** To understand the handover mechanism.
- **Objectives:** To study the effect of handover threshold and margin on SINR and call drop probability and handover probability.

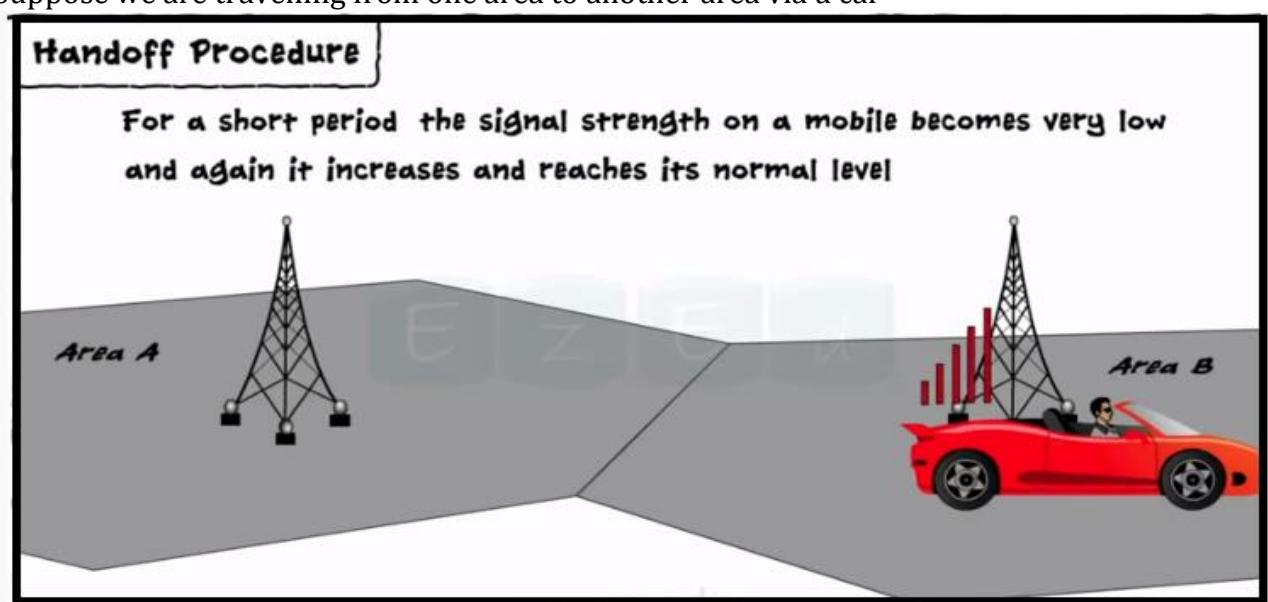
- **Source to perform Experiment:**

Virtual Lab: Fading channel and mobile communication (Experiment no 8)

Link: <http://vlabs.iitkgp.ernet.in/fcmc/exp8/index.html>

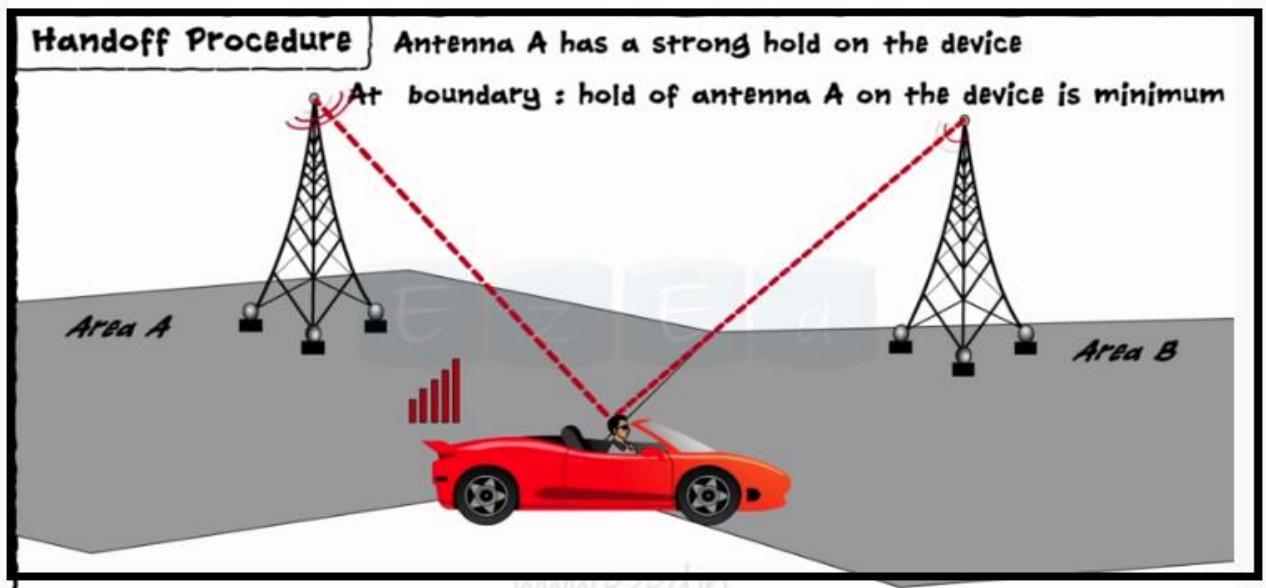
- **Theory**

- **Handover:** Process of transferring an ongoing call or data session from one cell to another cell.
Handover is required in to avoid call termination or call drop. Maximum handover duration is 60 ms.
- **Advantages:**
 - ✓ Load balancing
 - ✓ Moves out of range of BTS
- There are two types of handover **hard handover**(*two different radio channels are used that is two different frequencies*)and **Soft Handover** (*two different radio channels are used but same frequency*)
- Suppose we are travelling from one area to another area via a car

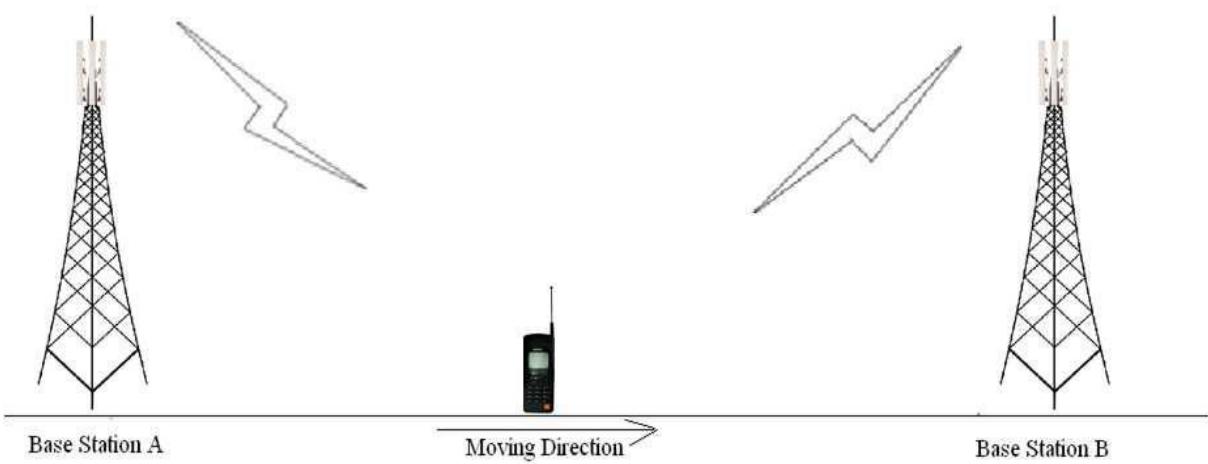


And answer to above question is handoff procedure, when someone is in area A ,mobile station receive a signal from base station A , that is antenna A has strong hold on the device , but as we move

away from antenna A, signal strength gradually decreases, at boundary of cell A, the hold of antenna A on device is minimum at the same time when device is to enter in cell B, base station B starts to take hold on device, thus at border of cell both antennas of cell A and cell B have equal amount of hold on device, as user crosses the area A and enter in to area B, strength of base station A very rapidly decreases and device receive a signal network from base station B, during this process call is still on and base station A handover this call to base station B without any effect on call and hence it is known as "Handoff Procedure".

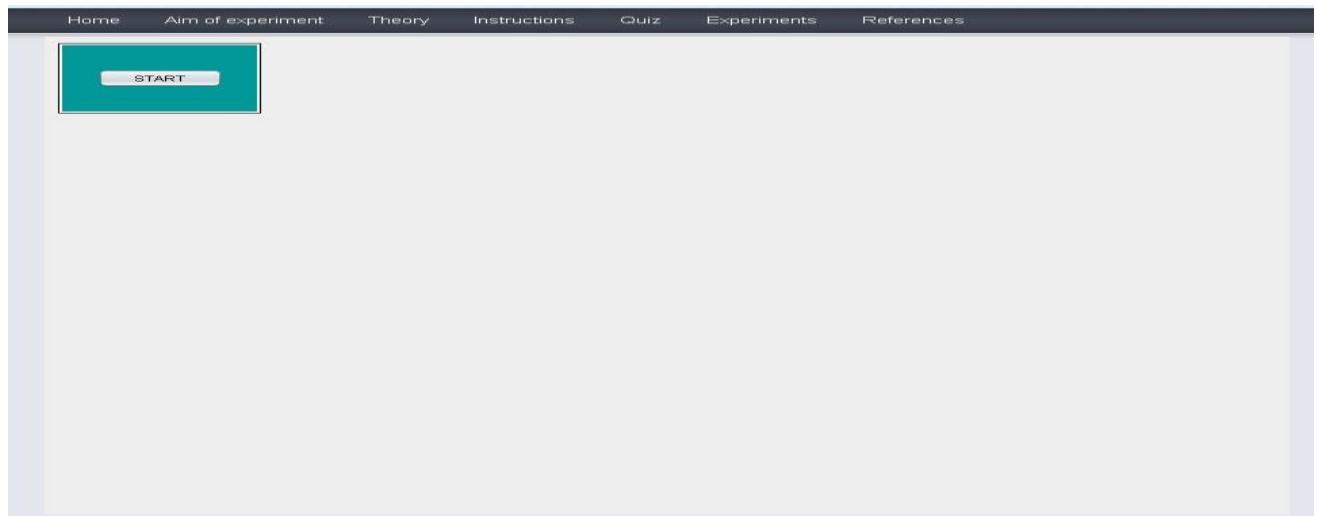


- **Example:** consider the figure below Initially say the mobile M is quite close to the base station A and hence

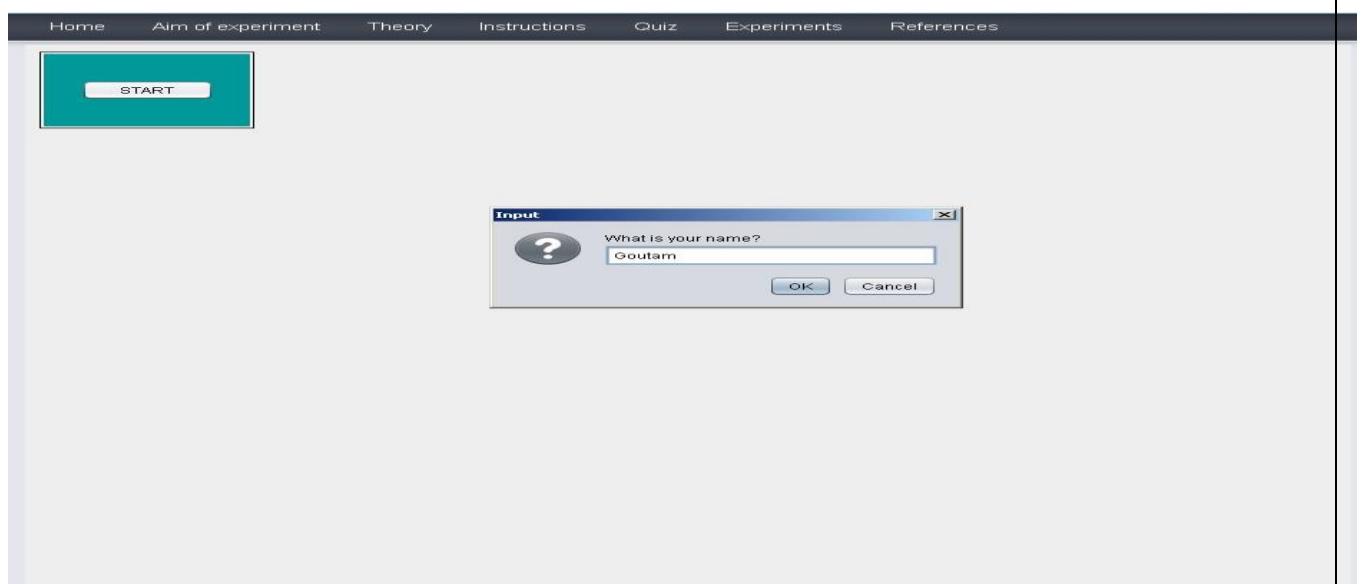


Receives signal strength from A $P_{rA} > P_{rB}$. As the mobile moves away from the base station A and goes towards B then the signal strength from A keeps falling(pathloss increases). Let there be a minimum sensibility level P_{r0} for the mobile,i.e. if the signal from the B.S.to which the mobile is connected falls below P_{r0} then the call drops. In order to prevent call drop the mobile monitors receivede signal strength from the neighboring 3-6B.S..These neighbouring 3-6 B.S.also monitor R_x signal strength from the M.S.

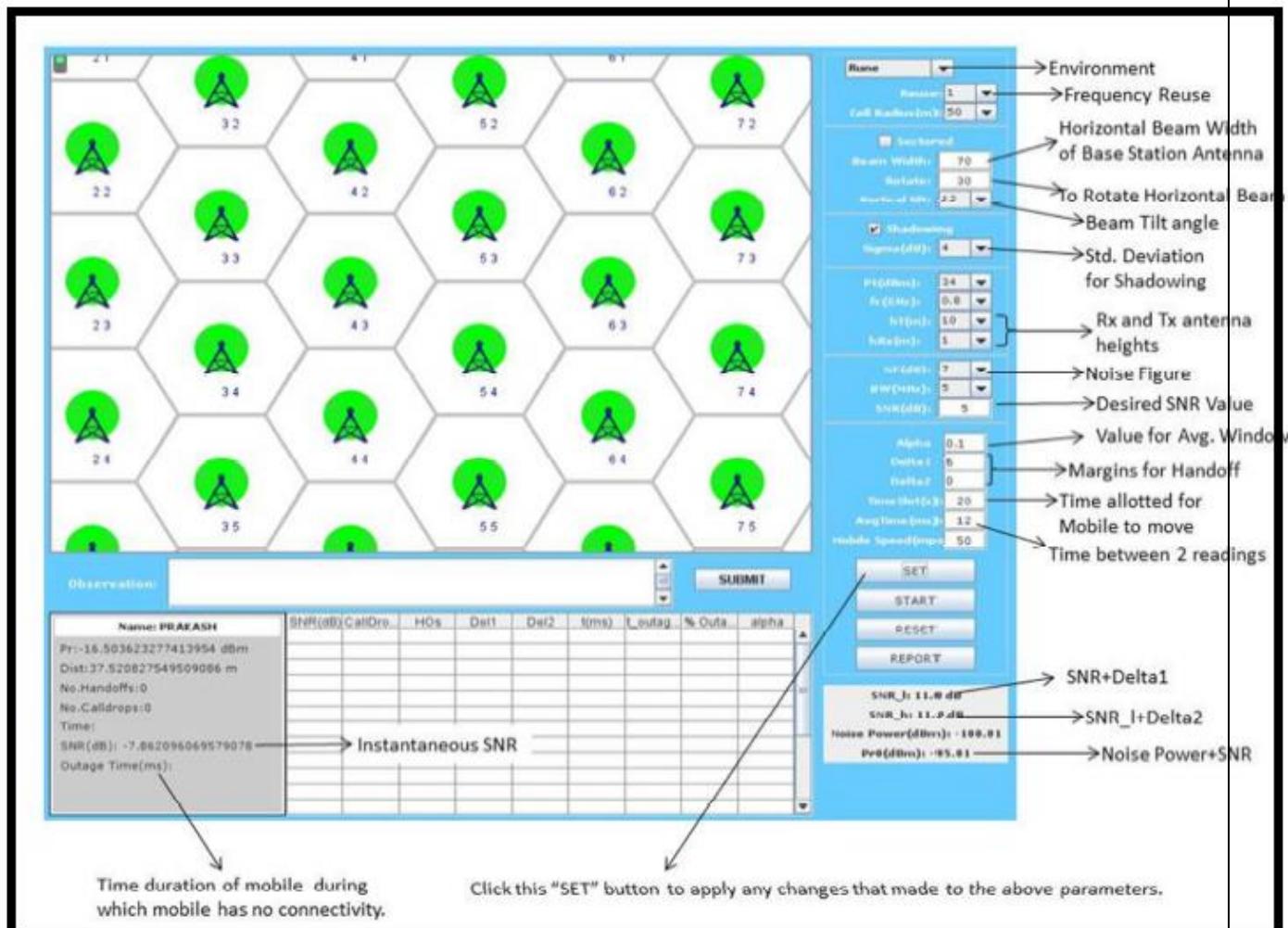
The mobile should get connected to B.S. which has the heighest signal strength. However if the M.S.continuouslyattaches itself to the B.S.with instantaneous height signal strength then the h/o rate may very high in server condition.



Step 2:- Enter your name then Click Ok.



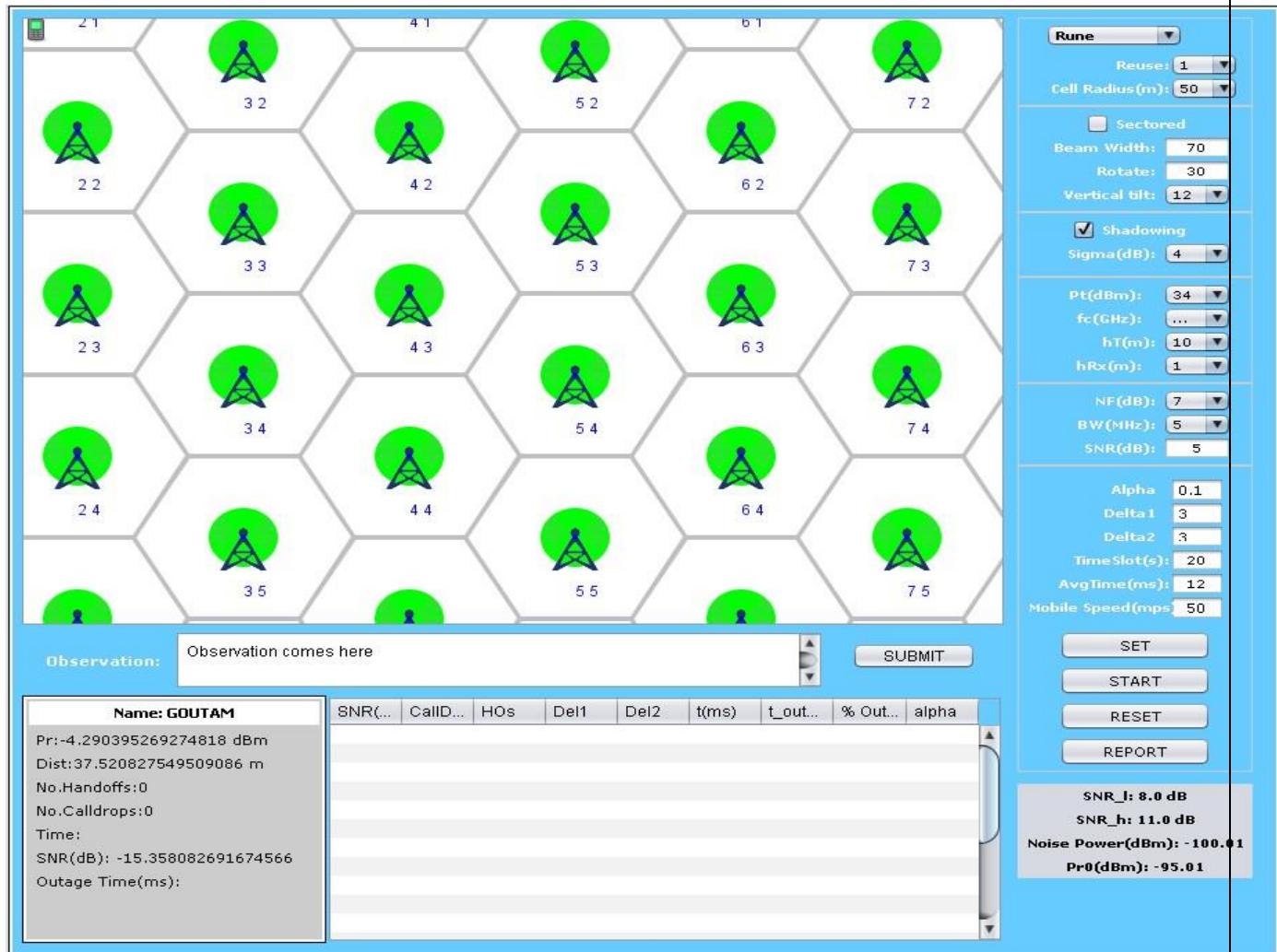
Step3:- Select the parameters (eg: Reuse ,Environment, Beamwidth, Carrier frequency etc) and enter your observation in the observation box.



Step 4: Click on start button and observe number of call drops and number of handover

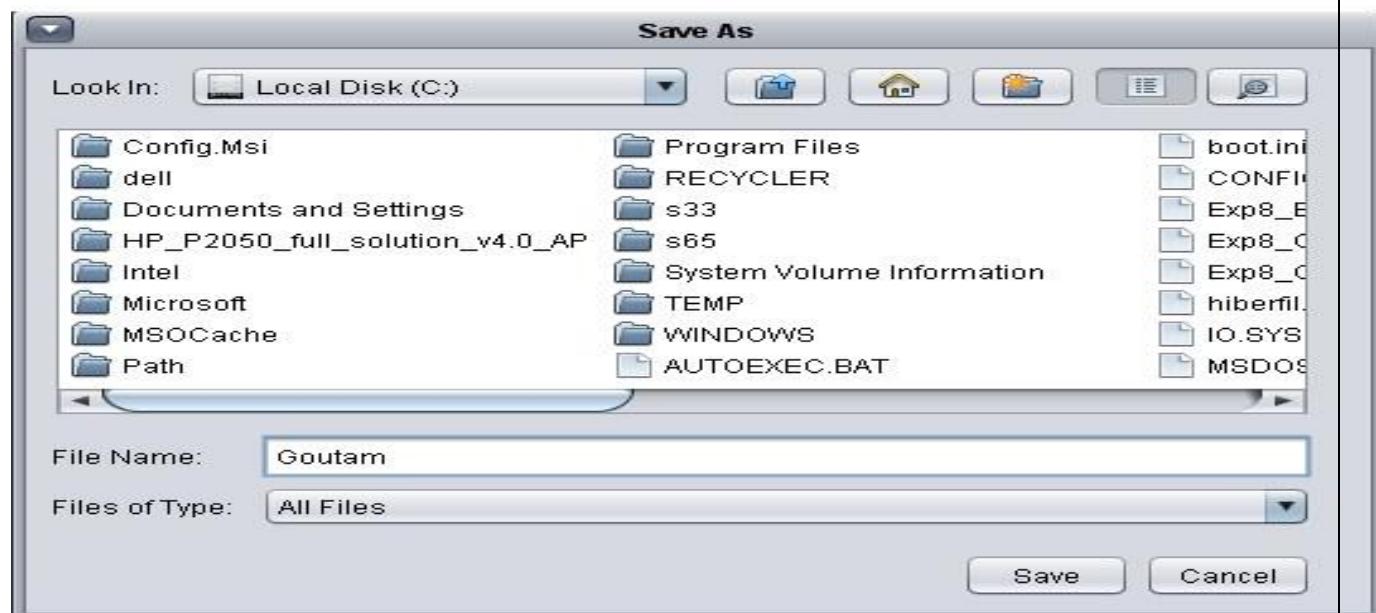


Step5:- Enter your observation in observation box and Click on The "SUBMIT" button.



Step6:- Change the Parameters and observed the call drops and no.of Hand Off.

Step7:- Click on the "Report" button to generate PDF report of the experiment.



Step8:-After generation of the Report you will get following message.



Step9 :- Click on the "Ok" and you will get your Report.

Exp 8: Handoff

Name: GOUTAM

Input Parameters	
Reuse: 1 , Model: Rnue	Pt(dBm): 34
f0(GHz): 0.8	Beam Width(deg): 70
Rotate(deg): 30	Cell Radius(m): 50
hT(m): 10	hM(m): 1
Sigma(dB): 4	Vertical Tilt(deg): 12
SNR(dB): 5	Band Width(MHz): 5
Noise Figure(dB): 7	Noise Power(dBm): -100.01
Pr0(dBm): -95.01	Time Slot(s): 20

Exp. Results								
SNR	No.Celldr ops	No.Hand offs	Delta1	Delta2	Reading Time(ms)	Outage Time(ms)	% Outage	Alpha
5.0	6.0	6.0	3.0	3.0	20016.0	11520.0	57.55	0.1
5.0	3.0	3.0	3.0	3.0	13104.0	8352.0	63.74	0.1
5.0	5.0	5.0	3.0	3.0	20016.0	11088.0	55.4	0.1
5.0	5.0	5.0	3.0	3.0	20016.0	9936.0	49.64	0.1
5.0	1.0	0.0	3.0	3.0	4176.0	2304.0	55.17	0.1
5.0	6.0	6.0	3.0	3.0	20016.0	9072.0	45.32	0.1
5.0	3.0	3.0	3.0	3.0	15264.0	8064.0	52.83	0.1

Observation
Observation comes here

(Signature of GOUTAM)

(Signature of Faculty)

Step10:- To Redo the experiment click on "RESET" button.

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screen shots and attach report after running experiment)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity:

- 1. Differentiate between hard and soft handover**

- 2. solves the quiz after executing this virtual lab experiment and attache the snapshot of the same**

Experiment No 5:- Display form Using WML

Part A

- **Aim:** Write a program using WML to display user form with validation for WAP enabled phone.
- **Objectives:** To study the WAP protocol and WML.
- **Outcomes:** After successful completion of this experiment students will be able to
 - To develop and demonstrate mobile applications using various tools
- **Theory:**

Wireless Application Protocol (WAP): WAP is a technical standard for accessing information over a mobile wireless network. A WAP browser is a web browser for mobile devices such as mobile phones that use the protocol.

WAP (Wireless Application Protocol) sites are also commonly referred to as **mobile sites**. Mobile sites are mini versions of a website that has been reconfigured so that the website layout is compatible with the smaller screens of wireless mobile devices.

Wireless application protocol (WAP) is an application environment and set of communication protocols for wireless devices designed to enable manufacturer-, vendor-, and technology-independent access to the Internet and advanced telephony services.

Wireless Application Protocol commonly known as WAP is used to enable the access of internet in the mobile phones or PDAs. WAP is an international standard for the devices that use the wireless communications. ... All we have to do is to carry a WAP enabled mobile phone or PDA.

Wireless Mark-up Language (WML)

- WML stands for wireless mark-up language, it is an application of xml, WML document have an extension .wml
- WML takes care of small screen and low transmission bandwidth
- WML is mark-up language defined in WAP specification
- WAP sites are written in WML and websites are written in HTML

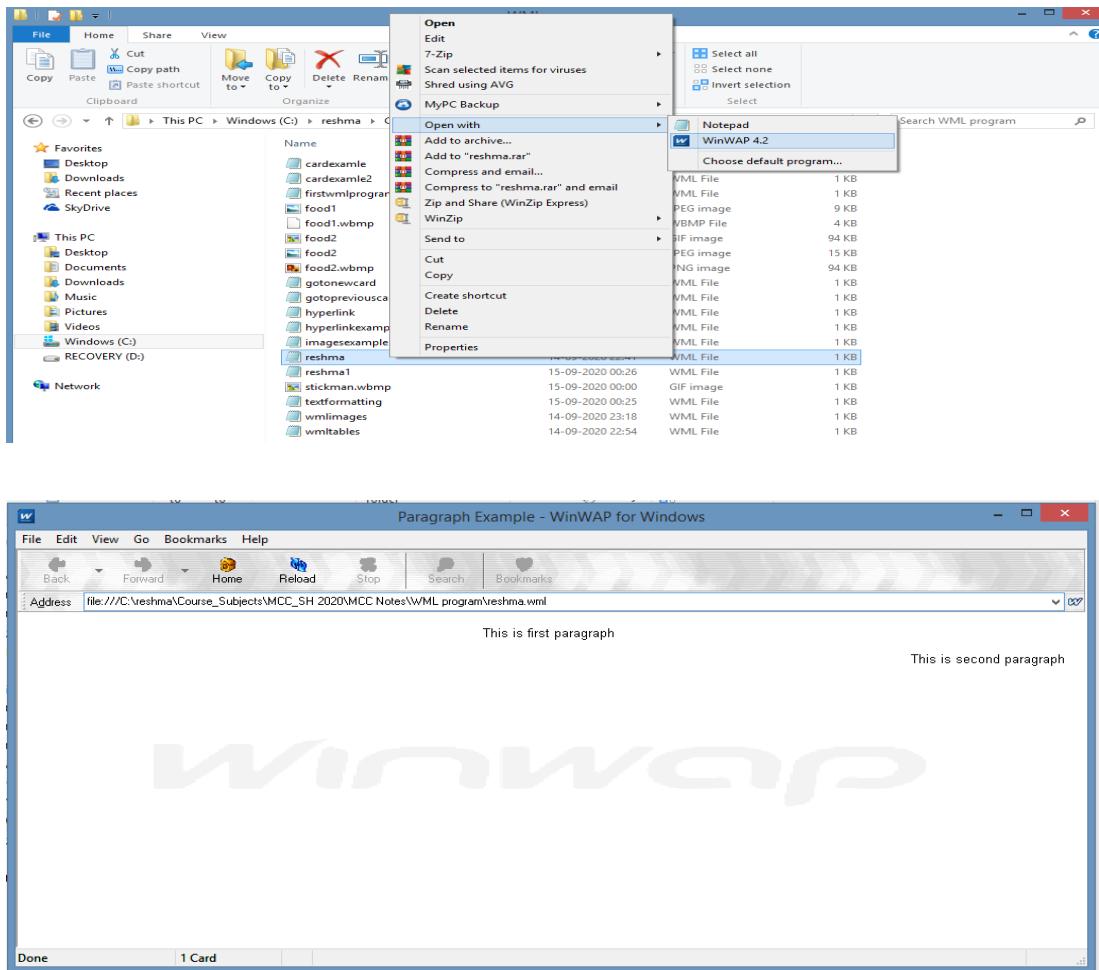
HTML VS WML

- The main difference between HTML and WML, in HTML basic unit of navigation is page and basic unit of navigation in WML is **deck and card**.
- WML pages are often called "decks". A **deck contains a set of cards**. A card element can contain text, mark-up, links, input-fields, tasks, images and more. Cards can be related to each other with links.
- When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server:

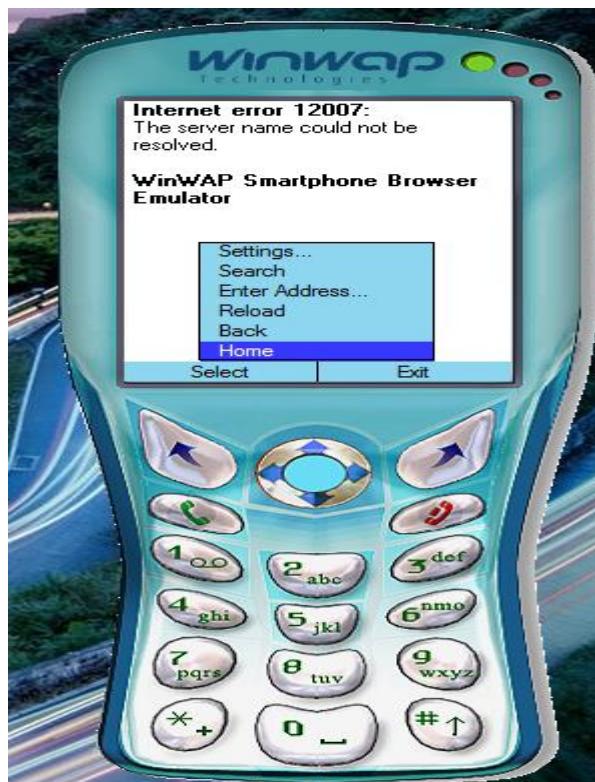
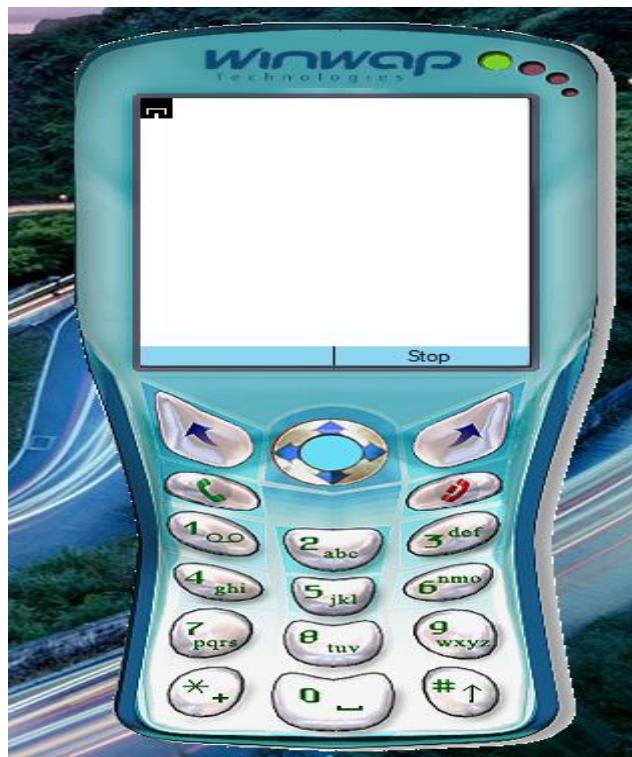
➤ **Steps to run WML program:**

Steps:

- 1) Write wml program in notepad and save it as filename.wml
- 2) To run wml program download; **winwap browser for window and Winwap** smartphone browser Emulator or any other emulator (to view how wap sites will look on mobile device)
- 3) To run the wml file double click the file ,or do right click and open with winwap browser and enter complete path of wml file in address bar.



- 4)** To run wml file on Winwap smartphone browser Emulator, follow the given steps







➤ Sample WML code

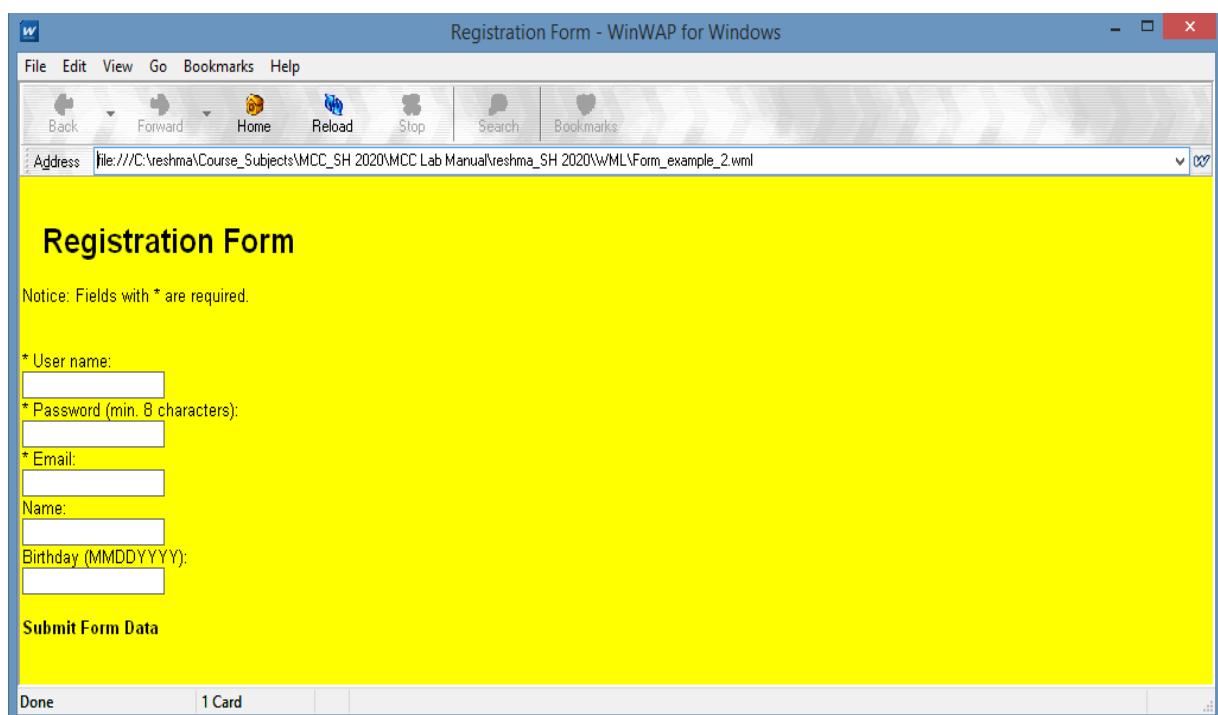
```
<?xml version="1.0"?>
<!DOCTYPEwml PUBLIC "-//WAPFORUM//DTD WML 1.2//EN"
"http://www.wapforum.org/DTD/wml12.dtd">

<wml>

<cardid="one"title="First Card">
<p>
This is the first card in the deck
</p>
</card>
```

```
<cardid="two"title="Second Card">  
<p>  
Ths is the second card in the deck  
</p>  
</card>  
  
</wml>
```

Output of form:



PART B

(PART B: TO BE COMPLETED BY STUDENTS)

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Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

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B.2 Input and Output:

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B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity:

- 1. Differentiate HTML and WML**
- 2. Explain the use of WML script.**

Experiment No 6:- Display Calculator Using WML

Part A

- **Aim:** Write a program using WML to display calculator and calendar for android phone.
- **Objectives:** To study the WAP protocol and WML.
- **Outcomes:** After successful completion of this experiment students will be able toTo develop and demonstrate mobile applications using various tools
- **Theory:**

Wireless Application Protocol (WAP): WAP is a technical standard for accessing information over a mobile wireless network. A WAP browser is a web browser for mobile devices such as mobile phones that use the protocol.

WAP (Wireless Application Protocol) sites are also commonly referred to as mobile sites. Mobile sites are mini versions of a website that has been reconfigured so that the website layout is compatible with the smaller screens of wireless mobile devices.

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Wireless Mark-up Language (WML)

- WML stands for wireless mark-up language, it is an application of xml, WML document have an extension .wml
- WML takes care of small screen and low transmission bandwidth
- WML is mark-up language defined in WAP specification
- WAP sites are written in WML and websites are written in HTML

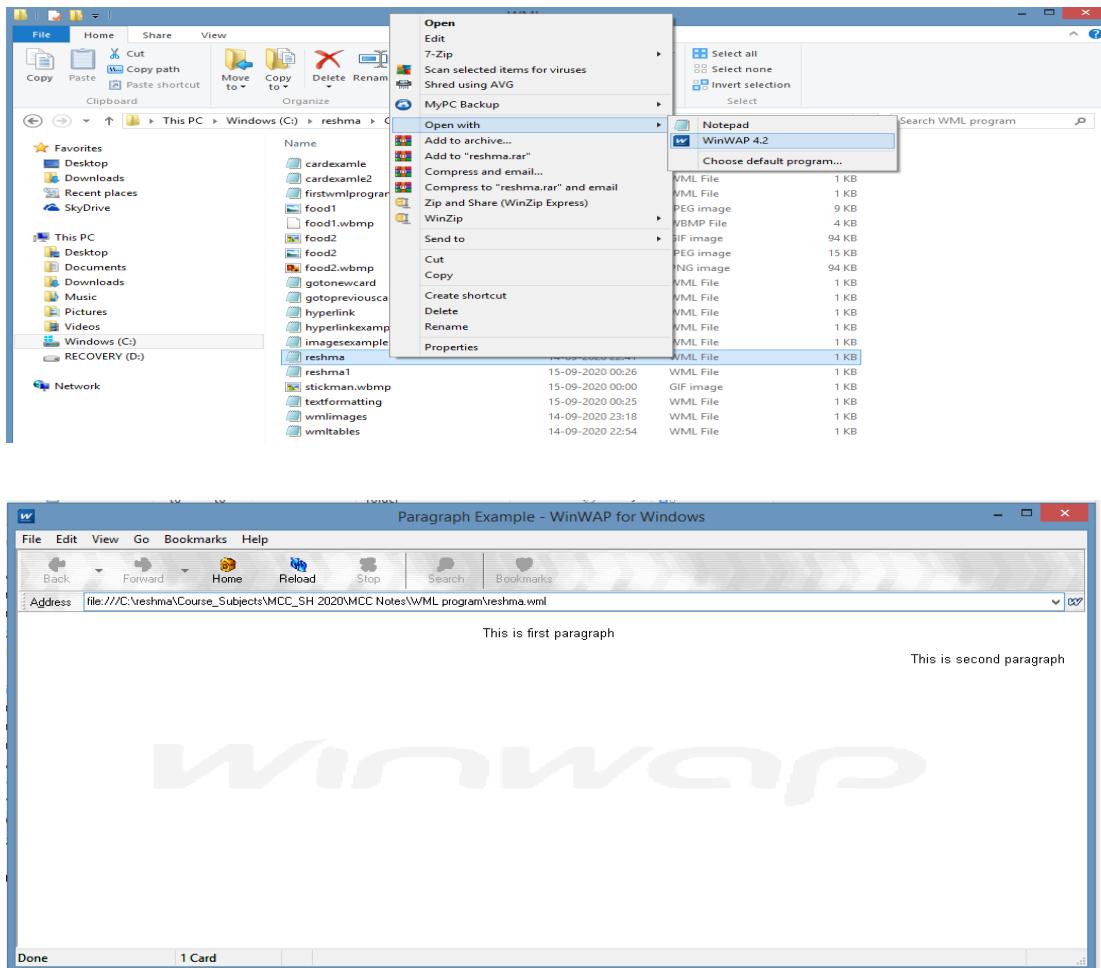
HTML VS WML

- The main difference between HTML and WML, in HTML basic unit of navigation is page and basic unit of navigation in WML is **deck and card**.
- WML pages are often called "decks". A **deck contains a set of cards**. A card element can contain text, mark-up, links, input-fields, tasks, images and more. Cards can be related to each other with links.
- When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server:

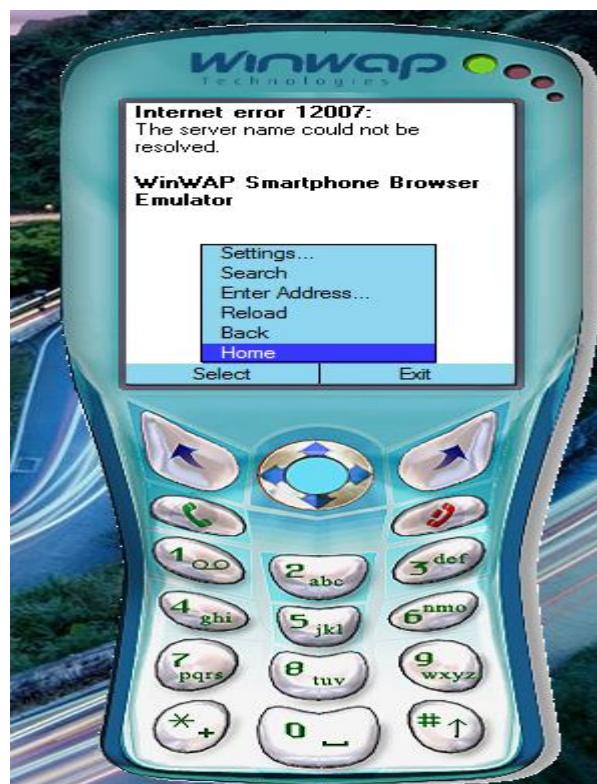
➤ **Steps to run WML program:**

Steps:

- 5) Write wml program in notepad and save it as filename.wml
- 6) To run wml program download; **winwap browser for window and Winwap smartphone browser Emulator** or any other emulator (to view how wap sites will look on mobile device)
- 7) To run the wml file double click the file ,or do right click and open with winwap browser and enter complete path of wml file in address bar.



- 8)** To run wml file on Winwap smartphone browser Emulator, follow the given steps







➤ **WML code**

Calc.wml

```
<?xml version="1.0"?>

<!DOCTYPEwml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">

<wml>

<card id="card1" title="Calculator" newcontext="true">

<p>

Value1: <br/><input format="N*M" name="amount1" title="First Amount:"/>

Operator :<br/><select name="operator" value="ADD" title="Operation:>

<option value="ADD">Addition</option>

<option value="SUB">Subtraction</option>
```

```

<option value="MULT">Multiplication</option>
<option value="DIV">Division</option>
</select>

Value2: <br/><input format="N*M" name="amount2" title="Second Amount:"/>

Result : = <b>$({answer}</b>
<do type="accept" label="Result">
<go
href="calc.wmls#operation('answer',$({amount1}),'${operator}',$({amount2}))"/>
</do>
</p>

</card>
</wml>

```

Calc.wmls

```

extern function operation(result,val1,operate,val2) {
varans=0;
if (operate=='ADD')
{
ans = val1 + val2;
}
else if (operate=='SUB')
{
ans=val1 - val2;
}

```

```
}

else if (operate=='MULT')

{

ans=val1 * val2;

}

else

{

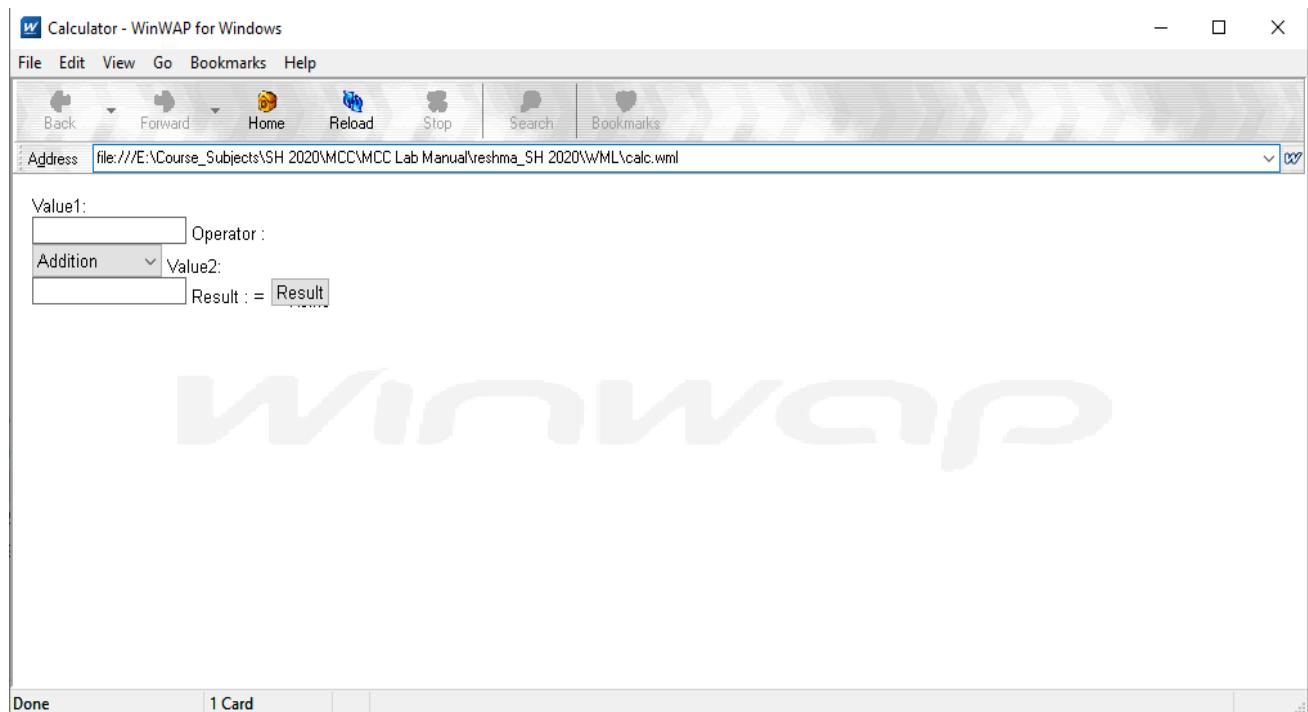
ans=val1 / val2;

}

WMLBrowser.setVar(result,ans);

WMLBrowser.refresh();

}
```



PART B**(PART B: TO BE COMPLETED BY STUDENTS)**

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screen shots and attach report after running experiment)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

1. Explain pros and cons of WML.

Experiment No 7:- Data Packet analyzing using wire-shark

Part A

- **Aim:**Analyze packets using wireshark.
- **Objectives:** To study the wireshark.
- **Outcomes:** After successful completion of this experiment students will be able to Installed wire shark and analyze packet using wireshark
- **Theory:**
 - **Wire shark is a network protocol analyzer**, formerly released under the name Ethereal (analyze data going and coming from Ethernet port of your device).
 - Wireshark is a free and open-source packet analyzer. It is used for network troubleshooting, analysis.
 - **Wireshark** is a network packet analyzer presents captured packet data in as much detail as possible. ... **Wireshark** is available for free, is open source, and is one of the best packet analyzers available today.
 - Wireshark is the world's leading network traffic analyzer, and an essential tool for any **security** professional or systems administrator. This free software lets **you analyze network traffic in real time**, and is often the best tool for troubleshooting issues on your network.
 - Sometimes **Wireshark** is called a network analyzer or a sniffer. **Wireshark** is a powerful tool and technically can be used for eavesdropping. ... **Wireshark** is legal to **use**, but it can become **illegal if cyber security professionals attempt to monitor a network that they do not have explicit authorization to monitor**.

- As a result of certain copyright restrictions, when the primary developer left his former company, Ethereal changed its name to Wireshark, but remains the same program and has many of the same core developers that worked on Ethereal.

This program is able to intercept packets transmitted over the network and **compile statistics about network usage**, allow the user to view content that is being accessed by other network users, and store usage information for offline access.

Wire-shark **allows the user to** view a list of captured packets, analyze data about each packet, **and view, in hexadecimal format, the data contained in that packet**. Wireshark has built-in color-coding features **that help the user to identify particular types of network traffic**, such as DNS in blue and HTTP in green.

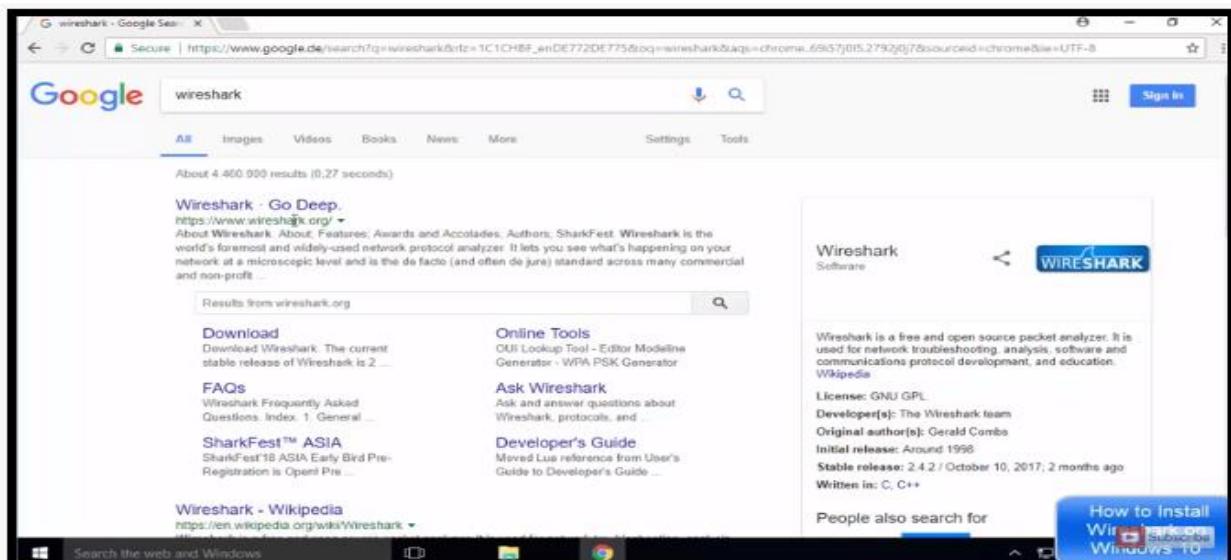
Most of the information displayed in the figure can be used to set up sorting filters, simplifying the process of analyzing data. Filters can often be set up to cover anything from protocol type to source or destination address, and even to focus on packets that lack certain data. The versatility of these filters makes sorting through the data much simpler, but the process still requires a keen understanding of what information is displayed and how to interpret it.

Wire-shark is an open-source program, with an active support and development community, and held its fourth Annual Developer and User Conference in June 2011 [1]. With the support of this community, Wireshark has expanded over the years to offer support on hundreds of network protocols, with more being added all the time. As a result, Wireshark has established itself as the standard among commercial and educational institutions for network analysis.

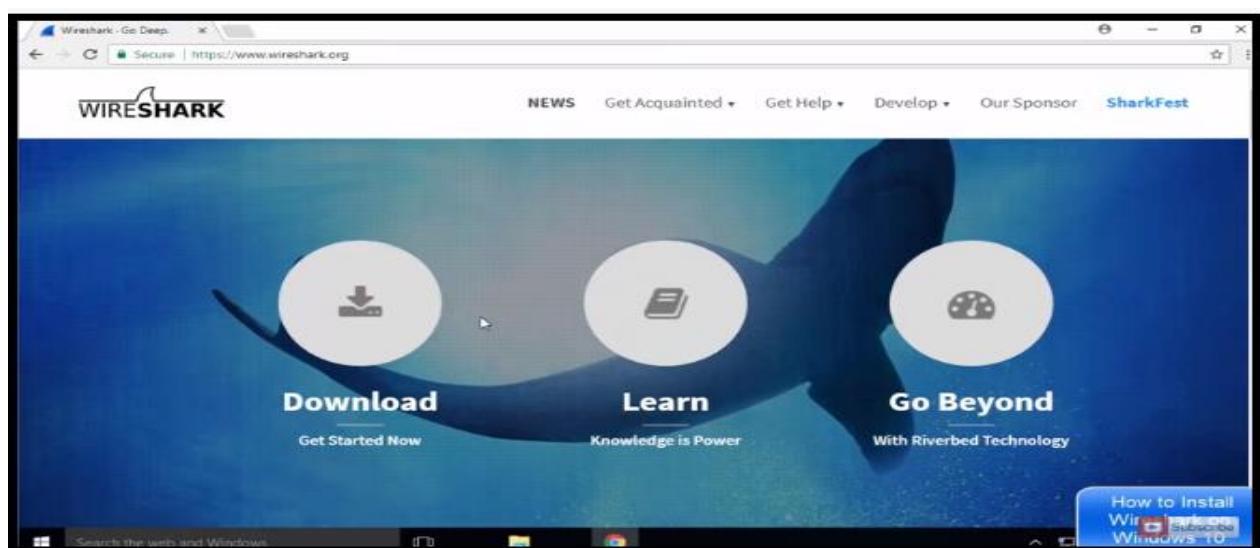
- **Installation Process: (How to install wire-shark on windows 10)**
- **You Tube installation link:**

<https://www.youtube.com/watch?v=fpeMCuCKgHA>

- 1) Search wireshark.org



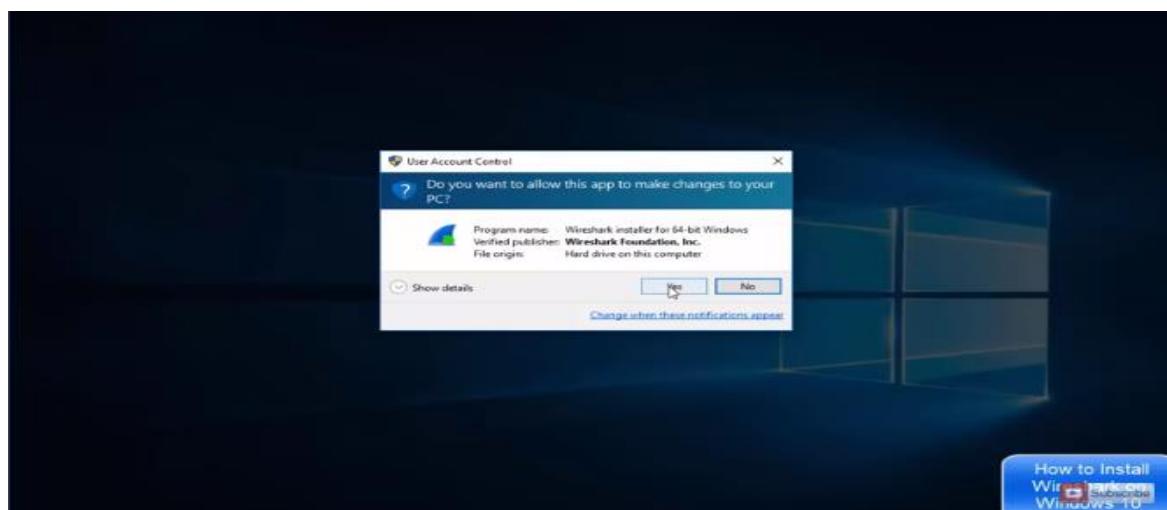
2) Click on download option

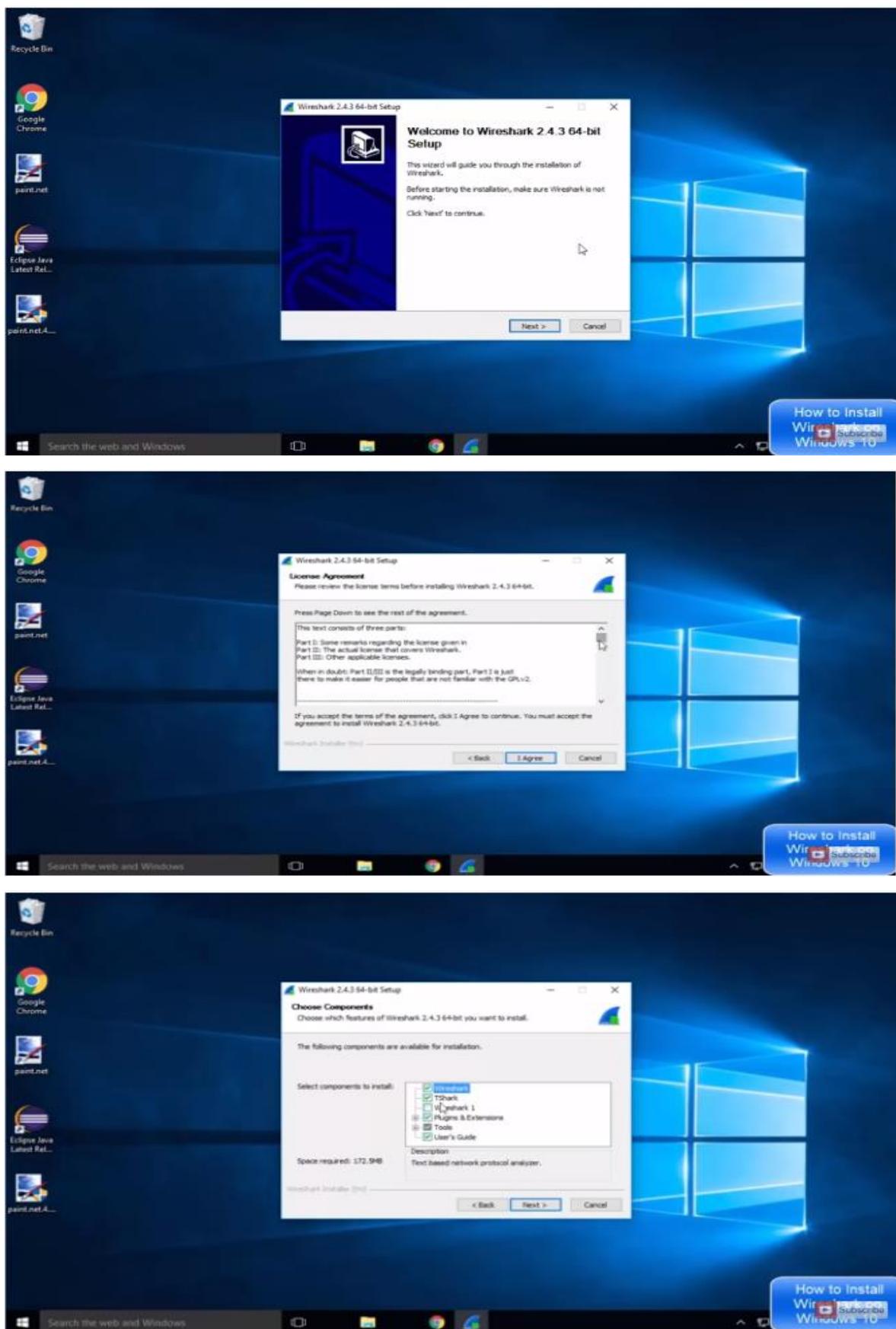


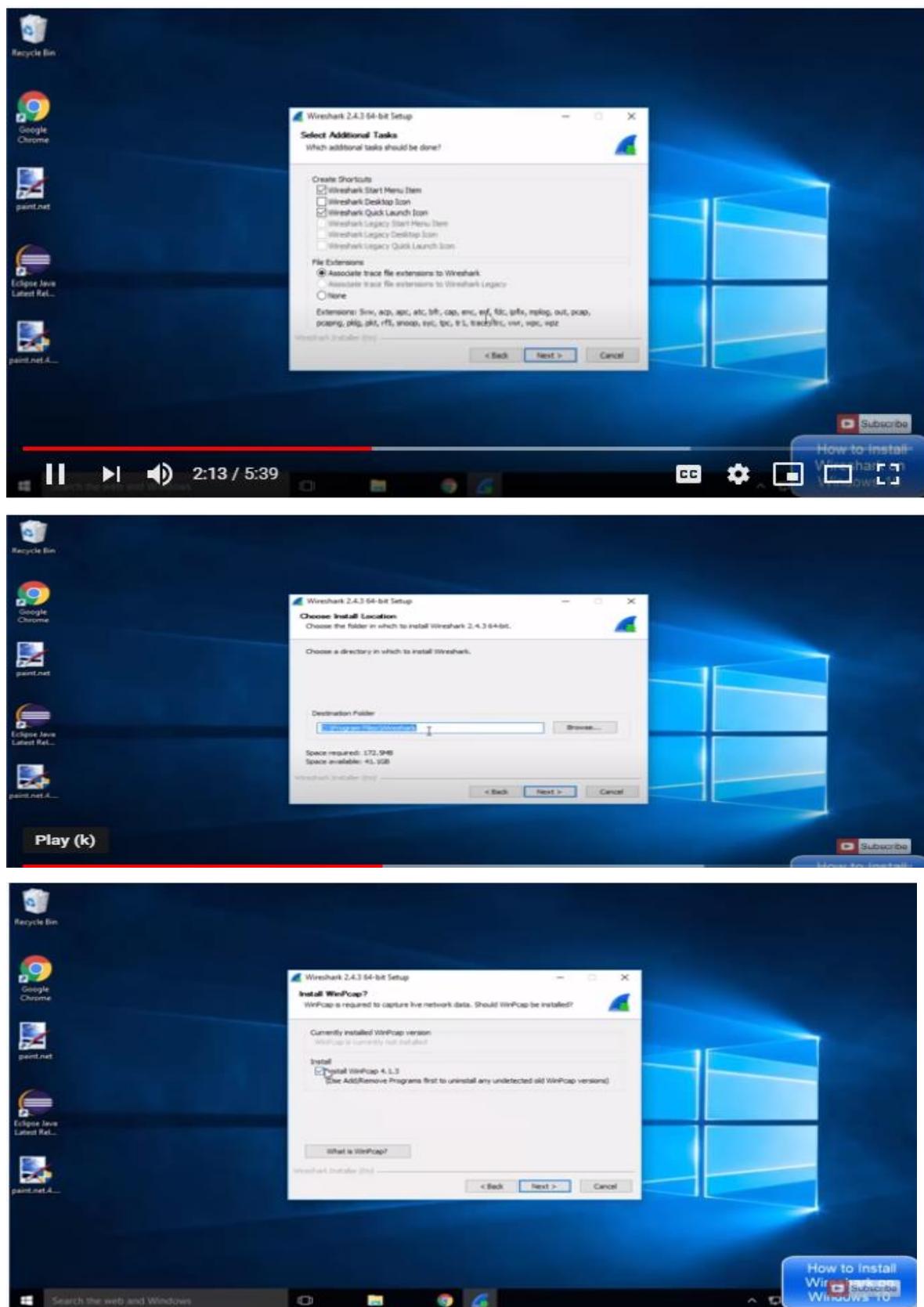
3) Following window appear.(select appropriate link)

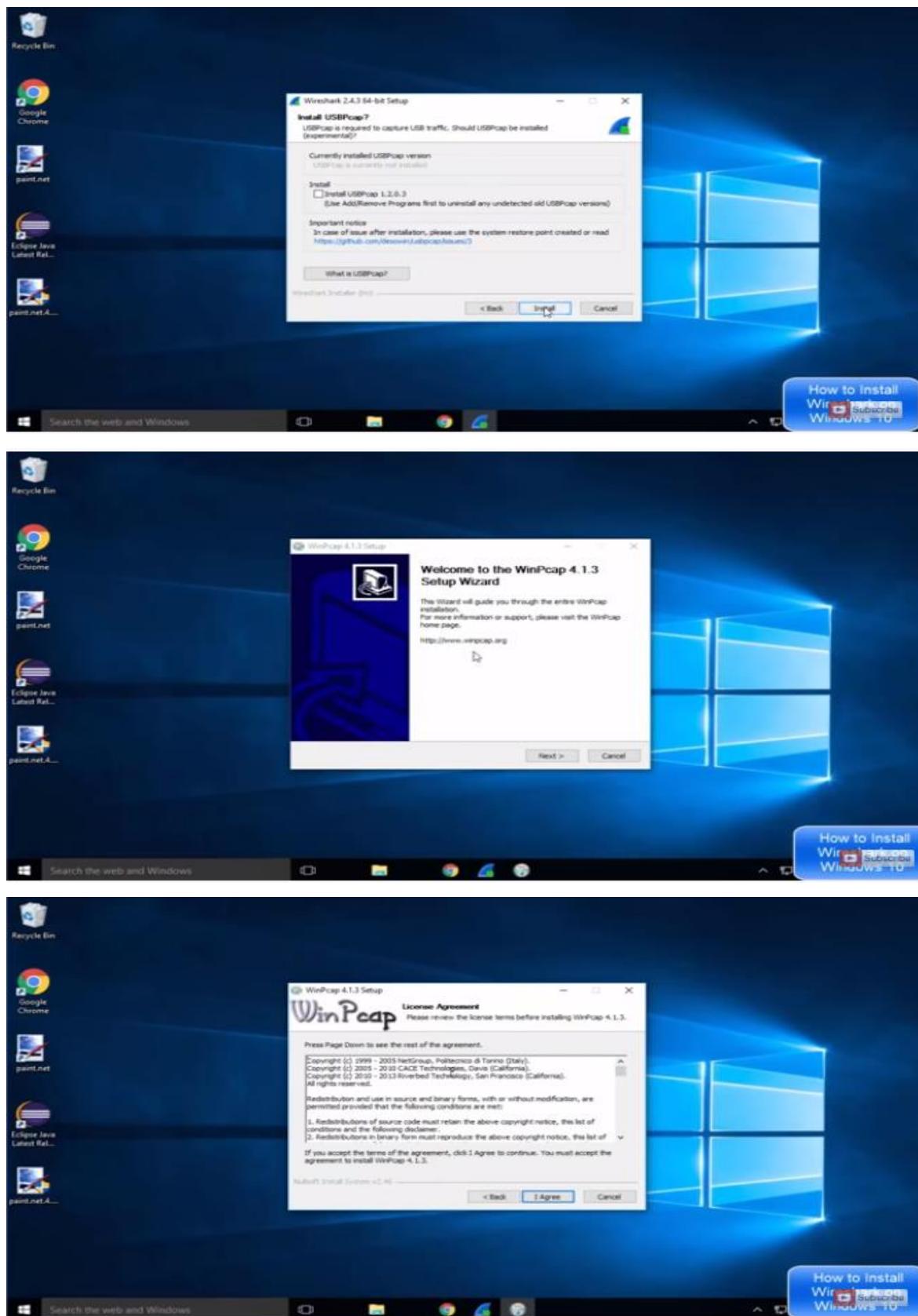


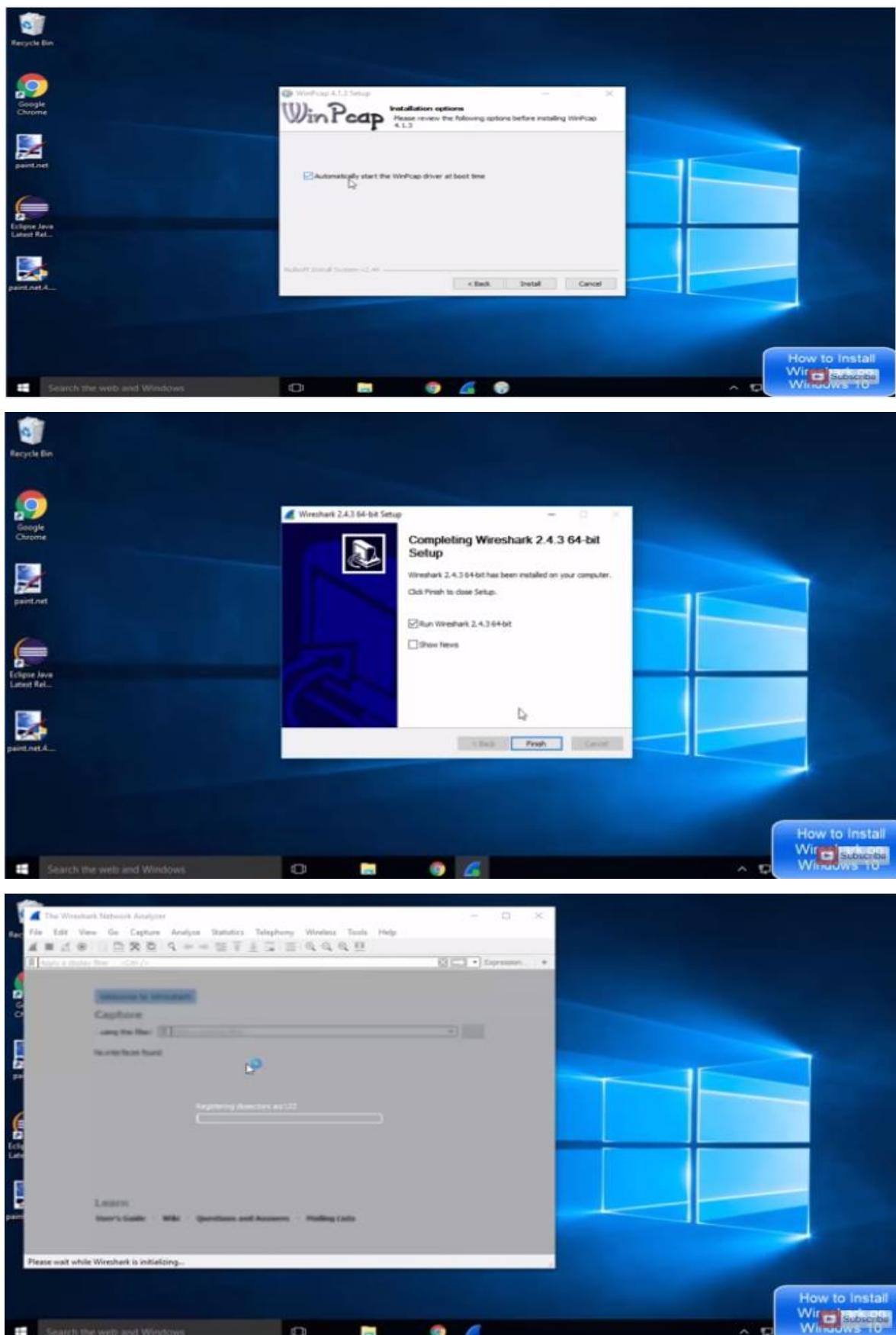
- 4) Downloading will start
- 5) Once downloading is completed , execute setup file.
- 6) Following window appear, click on yes. And then installation will start, click on next and so on

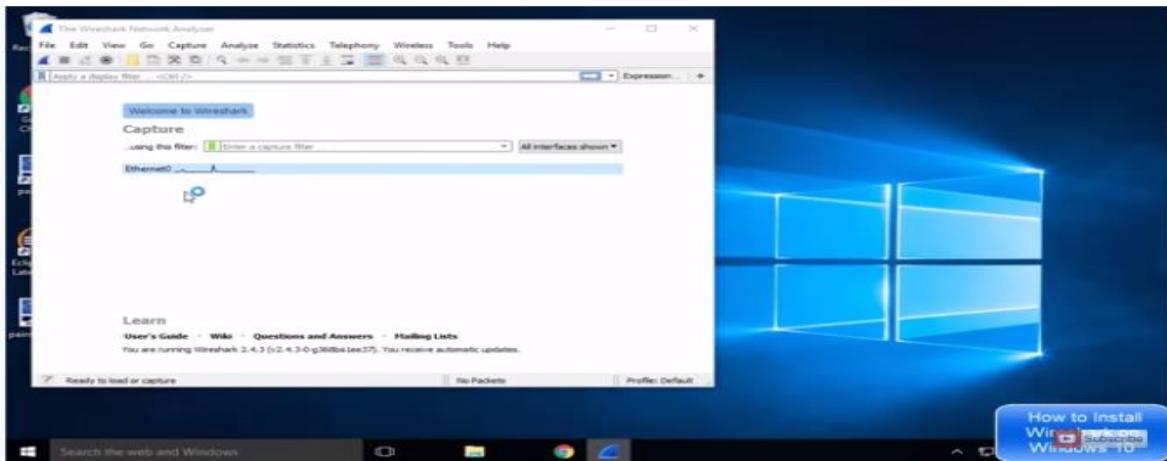




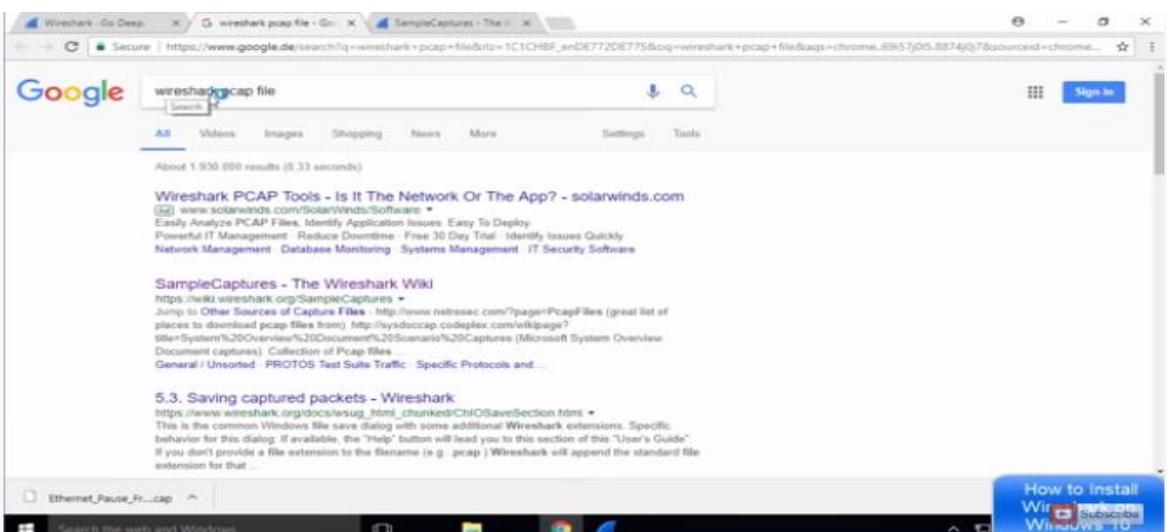




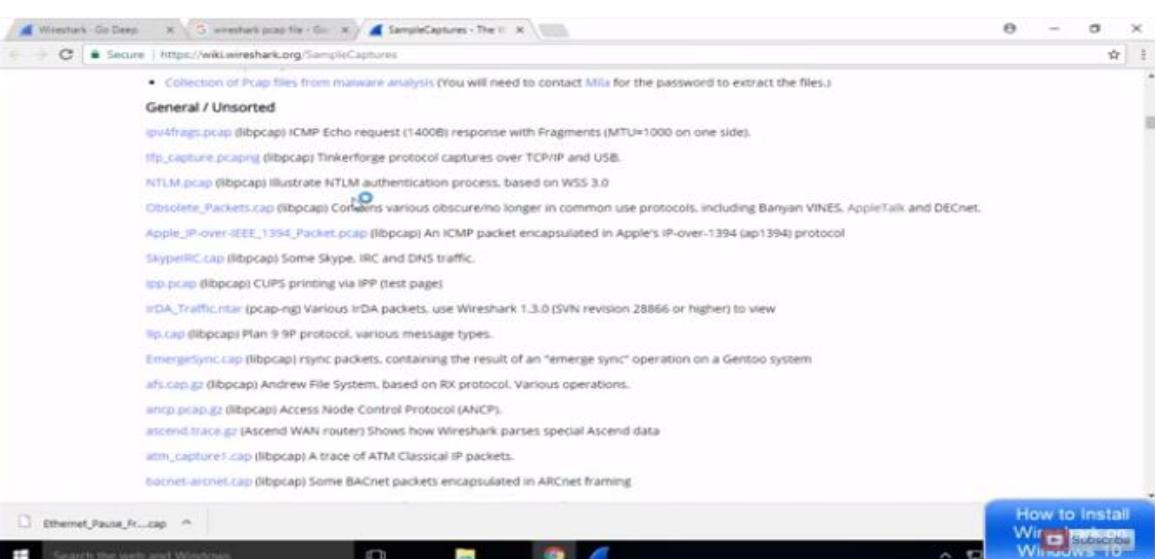




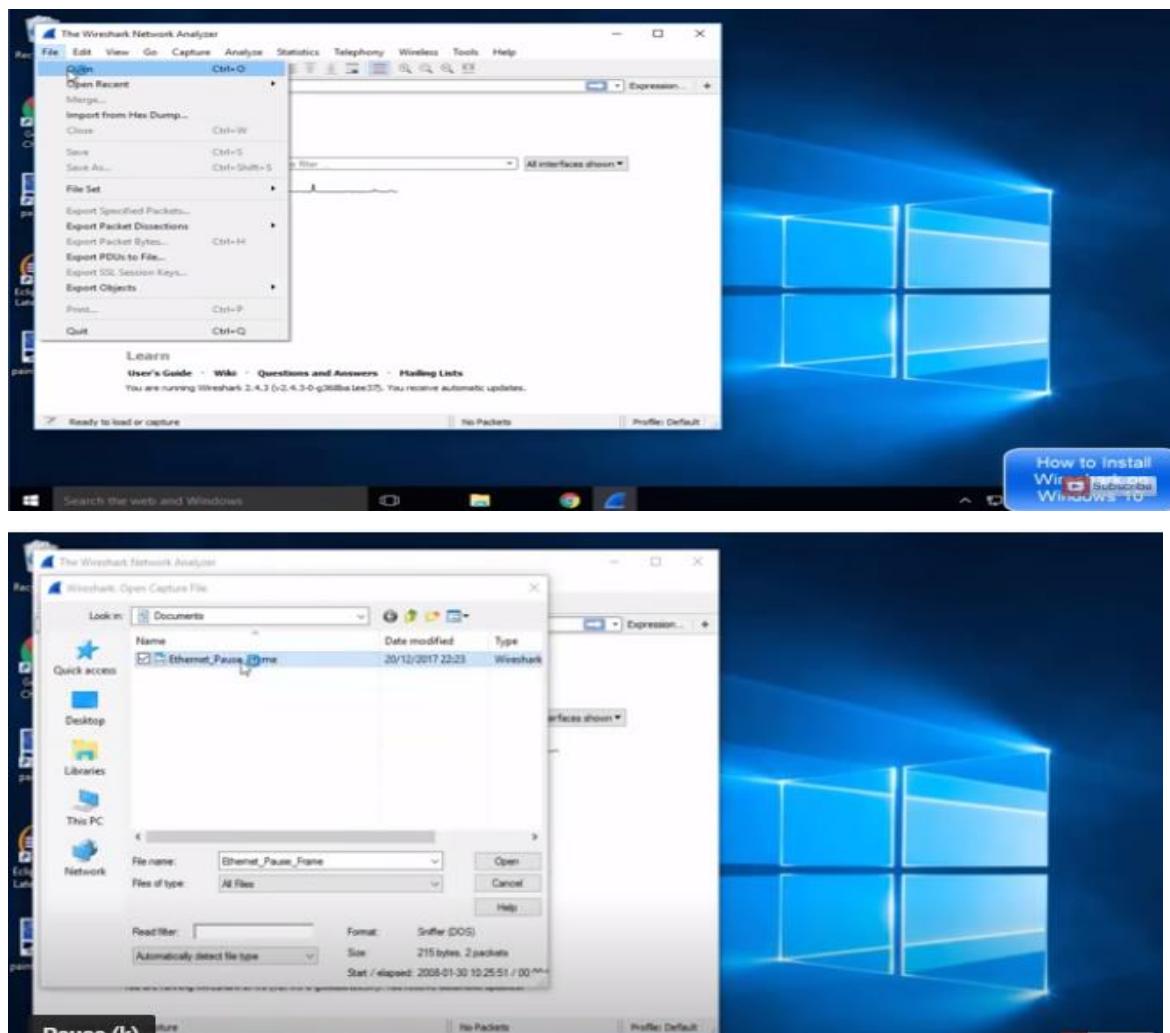
- 7) Once installation is done check whether it is working fine or not. So download any pcap file.



- 8) Click on wire shark wiki, and select any one pcap file and download it.



- 9) Now open wireshark , and open downloaded pcap file



10) You will get following window.

No.	Time	Source	Destination	Protocol	Length	Info
3	0.400000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
4	0.600000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
5	0.800000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
6	1.000000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
7	1.200000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
8	1.400000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,
9	1.600000	192.85.1.2	192.0.0.1	BFD Co...	79	Diag: No Diagnostic,

```

> Frame 1: 79 bytes on wire (632 bits), 79 bytes captured (632 bits)
> Ethernet II, Src: Performa_00:00:02 (00:10:94:00:00:02), Dst: Xerox_00:00:01 (00:00:01:00:00:01)
> Internet Protocol Version 4, Src: 192.85.1.2, Dst: 192.0.0.1
> User Datagram Protocol, Src Port: 1024, Dst Port: 3784
> BFD Control message

```

0000	00 00 01 00 00 01 00 10 94 00 00 02 08 00 45 00E-
0010	00 3d 00 00 00 00 0a 11 2f 58 c0 55 01 02 c0 00	=... /X-U...
0020	00 01 04 00 0e c8 00 29 72 31 20 44 05 21 00 00) r1 D!...
0030	00 01 00 00 00 00 00 0f 42 40 00 0f 42 40 00 00B@..B@..
0040	00 00 01 09 02 73 65 63 72 65 74 4e 0a 90 40sec retN..@

PART B
(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Add Wireshark installation snapshots

B.2 Analyze packets using wire shark:

(Paste your output results.)

B.3 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

Q1: procedure to capture packets.

Q2: which types of filter did you apply in wireshark, explain in detail ?

Experiment No 8:- Create Small Wireless network using NS2

Part A

- **Aim:**
 - a) Install Ubuntu in Virtual box and Install NS2 on Ubuntu
 - b) Create small wireless network (MANET) using NS2.
- **Prerequisite: Virtual Machine, NS2**

- **Outcome:**

After successful completion of this experiment students will be able to

Create small network of wireless nodes (mobile and laptop). This network should be created using network simulator NS2. `

- **Theory**

 NS2

- Ns2 is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.
- Ns is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy in this document), and a similar class hierarchy within the OTcl interpreter (also called the interpreted hierarchy in this document). The two hierarchies are closely related to each other; from the user's perspective, there is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compiled hierarchy.
- The root of this hierarchy is the class TclObject. Users create new simulator objects through the interpreter; these objects are instantiated within the interpreter, and are closely mirrored by a corresponding object in the

compiled hierarchy. The interpreted class hierarchy is automatically established through methods defined in the class `TclClass`. user instantiated objects are mirrored through methods defined in the class `TclObject`. There are other hierarchies in the C++ code and OTcl scripts; these other hierarchies are not mirrored in the manner of `TclObject`.

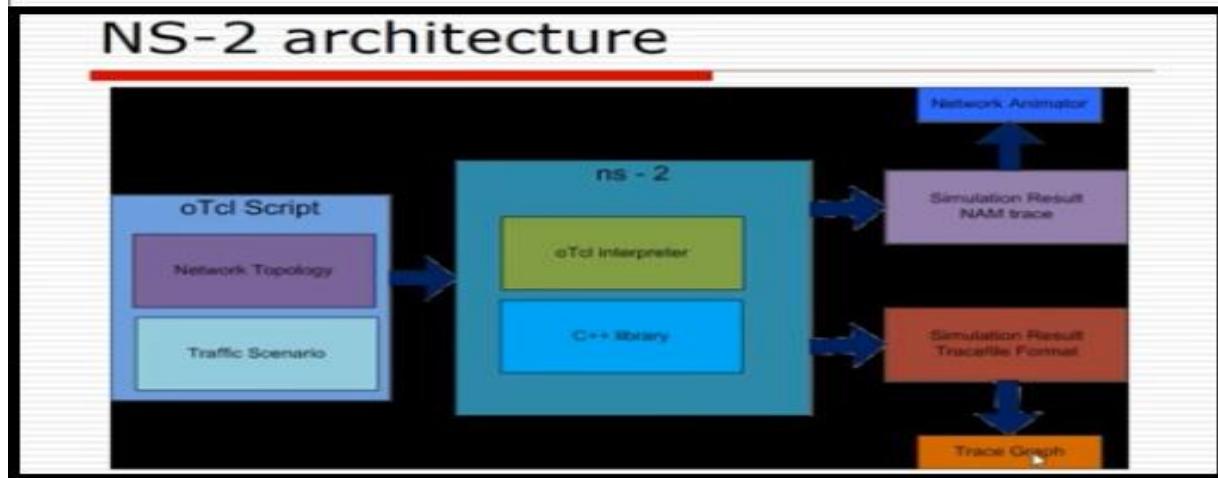


Figure: NS 2 Architecture

⊕ Steps to install NS 2 on Ubuntu Virtual Machine

- **To Install NS2**, first download and install Virtual box and **create Virtual machine (Ubuntu Virtual machine)** and to create virtual machine you need to download Ubuntu iso file.

Virtual Box is a general-purpose virtualization tool for x86 and x86-64 hardware, targeted at server, desktop, and embedded use, that allows users and administrators to easily run multiple guest operating systems on a single host.

- **Instructions to download and install Virtual box and ubuntu 16.04**

 1. Download Virtual Box from <https://www.virtualbox.org/>

The screenshot shows the official website for Oracle VM VirtualBox. At the top, there's a navigation bar with links for "About", "Screenshots", "Downloads", "Documentation", "End-user docs", "Technical docs", "Contribute", and "Community". Below the navigation is a large blue banner with the text "VirtualBox" and "Welcome to VirtualBox.org!". To the right of the banner is a "News Flash" section listing several recent releases. In the center, there's a prominent blue button with the text "Download VirtualBox 6.1". Below the button, there's a section titled "Hot picks:" with a list of links to pre-built virtual machines.

This screenshot shows the "Downloads" page of the VirtualBox website. It features a large blue banner with the text "VirtualBox" and "Download VirtualBox". Below the banner, there's a section titled "VirtualBox binaries" with a note about agreeing to terms and conditions. It also mentions discontinued versions (6.0 and 5.2) and their support status. A section titled "VirtualBox 6.1.16 platform packages" lists supported hosts. At the bottom, there's a note about the GPL license and a link to the changelog.

Click on download and select the link windows host, after downloading execute virtual box setup file.

2. Download ubuntu16.04.7 LTS iso file from <https://releases.ubuntu.com/16.04/> as shown below

SHA256SUMS.gpg	2020-08-13 16:09	833	
ubuntu-16.04.6-desktop-i386.iso	2019-02-27 10:16	1.6G	Ubuntu 16.04.7 LTS (Xenial Xerus)
ubuntu-16.04.6-desktop-i386.iso.torrent	2019-02-28 16:52	63K	Ubuntu 16.04.7 LTS (Xenial Xerus)
ubuntu-16.04.7-desktop-i386.iso.torrent	2019-02-28 16:52	2.4M	Ubuntu 16.04.7 LTS (Xenial Xerus)

Or

ubuntu 16.04 download

About 4,88,00,000 results (0.40 seconds)

releases.ubuntu.com › 16.04 › **Ubuntu 16.04.7 LTS (Xenial Xerus)**
The desktop image allows you to try **Ubuntu** without changing your computer at all, and at your option to **Install** it permanently later. This type of image is what ...

ubuntu.com › download › desktop › **Download Ubuntu Desktop | Download | Ubuntu**
Ubuntu 20.04.1 LTS. **Download** the latest LTS version of **Ubuntu**, for desktop PCs and laptops. LTS stands for long-term support — which means ...
Alternative downloads · How to burn a DVD on Ubuntu · WSL · Appliance

ubuntu.com › tutorials › install-ubuntu-desktop-1604 › **Install Ubuntu 16.04 desktop | Ubuntu**
It's also open source, secure, accessible and free to **download**. screenshot. In this tutorial, we're

Click on ubuntu.com (download ubuntu desktop)

3. **Follow instructions as per the video to start ubuntu on virtualbox or to install Ubuntu on virtual box (after steps 1 & 2)**

<https://www.youtube.com/watch?v=GGorVpzZQwA>

or

https://www.youtube.com/watch?v=VTY_fsY0m0c&t=335s

4. **After installing Ubuntu on virtualbox, install NS2**

5. Instructions to Install NS2

1. Start ubuntu on virtual box
2. You use this video as reference <https://www.youtube.com/watch?v=FQsaV3-X72s>

3. Follow the next set of instructions

NS-2.35 Installation on UBUNTU-16.04 || Step by Step guide to install the ns2
on LINUX/UBUNTU-16.04-LTS

Installation Instructions (Step by Step):

(first download ns-allinone-2.35.tar.gz file)

Step 1. Keep the setup file “ns-allinone-2.35.tar.gz” inside the home folder/directory

Step 2. open the terminal (\$)

Step 3. Extract the “ns-allinone-2.35” folder from the zipped folder by the following

command: \$ tar -xvzf ns-allinone-2.35.tar.gz

Step 4. Go to the linkstate folder inside the ns-allinone-2.35/ns-2.35 by typing the
following command in the terminal:

```
$ cd ns-allinone-2.35/ns-2.35/linkstate
```

Step 5. Inside this folder (linkstate) you need to make some changes in the file “ls.h”
in the line no. 137.

Use the following command: \$ geditls.h

Go to line no. 137 and replace

```
void eraseAll() { erase(baseMap::begin(), baseMap::end()); }
```

With

```
void eraseAll() { this->'GreaterThanSymbol'erase(baseMap::begin(), baseMap::end()); }
```

and save the file

note: now close replace window

Step6. Now go back to home directory in the terminal by typing the following command:

```
$ cd\
```

Step 7. you will require an active INTERNET connection now onwards. Type the following command in order to download some required updates:

```
$ sudo apt-get update  
Password: $ type here your root password
```

The system will take some time to install the updates

Step 8. Now type the following command to fetch some required files from the Internet:

```
$ sudo apt-get install build-essential autoconf automake libxmu-dev
```

This will install some required packages

Step 9. Now go to “ns-allinone-2.35” folder and type the following commands:

```
$ cd ns-allinone-2.35
```

```
$sudo apt-get install gcc-4.8 g++-4.8
```

```
$sudoexport CC=gcc-4.8 CXX=g++-4.8
```

```
$ sudo ./install
```

This command will start the installation process. It will take around 40 – 60 minutes (varies with certain systems)

Step 10. Now after the installation process you require to set the path in the “.bashrc” file . Open the “.bashrc” file with the following command:

```
$ sudogedit .bashrc
```

append the following PATH settings in the BASHRC file and SAVE the file

#Path SETTING

```
# LD_LIBRARY_PATH
OTCL_LIB=/home/Your-User-Name/ns-allinone-2.35/otcl-1.14
NS2_LIB=/home/Your-User-Name/ns-allinone-2.35/lib
X11_LIB=/usr/X11R6/lib
USR_LOCAL_LIB=/usr/local/lib
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:$OTCL_LIB:$NS2_LIB:$X11_LIB:$USR_
LOCAL_LIB
```

```
# TCL_LIBRARY
TCL_LIB=/home/Your-User-Name/ns-allinone-2.35/tcl8.5.10/library
USR_LIB=/usr/lib
export TCL_LIBRARY=$TCL_LIB:$USR_LIB
```

```
# PATH
XGRAPH=/home/Your-User-Name/ns-allinone-2.35/bin:/home/Your-User-Name/ns-
allinone-2.35/tcl8.5.10/unix:/home/Your-User-Name/ns-allinone-2.35/tk8.5.10/unix
```

#the above two lines beginning from xgraph and ending with unix should come on the same line

```
NS=/home/Your-User-Name/ns-allinone-2.35/ns-2.35/  
NAM=/home/Your-User-Name/ns-allinone-2.35/nam-1.15/  
PATH=$PATH:$XGRAPH:$NS:$NAM
```

NOTE: You must replace "Your-User-Name" in the above PATH settings with the USER-NAME mentioned in your own Computer/System. YOU CAN USE CTRL+H TO FIND AND REPLACE IN TEXT EDITER

Step 11. Save and close the BASHRC file. Type 'ns' in the terminal. If '%' sign appears, it indicates correct ns2 installation. You can also check for NAM window by just typing 'nam' in the terminal.

Now start working on NS2.

Or

NS2 INSTALLATION ON UBUNTU 16.04 (20.04)

1) Download 'ns-allinone-2.35' from :

<http://sourceforge.net/projects/nsnam/files/allinone/ns-allinone-2.35/ns-allinone-2.35.tar.gz/download>

2) Extract the downloaded zip file 'ns-allinone-2.35.tar.gz file' to desktop.

3) Now you need to download some essential packages for ns2, these packages can be downloaded by using the following commands

: applications>accessories>terminal or dashhome>terminal

then type the below lines one by one on the terminal window

"sudo apt-get update"

"sudo apt-get dist-upgrade"

"sudo apt-get update"

```
"sudo apt-get gcc"  
"sudo apt-get install build-essential autoconfautomake"  
"sudo apt-get install tcl8.5-dev tk8.5-dev"  
"sudo apt-get install perlgraphlibxt-dev libx11-dev libxmu-dev"
```

- 4)** Now change your directory(here i have already extracted the downloaded files to desktop,so my location is desktop) type the following codes in the command window to install NS2.

```
cd Desktop  
cd ns-allinone-2.35  
.install
```

The installation procedure will take a few minutes.....

- 5)** After compleating the installation type the following command in the command window

```
gedit ~/.bashrc
```

- 6)** Now an editor window appears,please copy and paste the follwing codes in the end of the text file (note that '/home/abhiram/Desktop/ns-allinone-2.35/octl-1.14' in each line in the below code should be replaced with your location where the 'ns-allinone-2.35.tar.gz'file is extracted)

```
# LD_LIBRARY_PATH  
OTCL_LIB=/home/abhiram/Desktop/ns-allinone-2.35/octl-1.14  
NS2_LIB=/home/abhiram/Desktop/ns-allinone-2.35/lib  
X11_LIB=/usr/X11R6/lib  
USR_LOCAL_LIB=/usr/local/lib  
export  
LD_LIBRARY_PATH=$LD_LIBRARY_PATH:$OTCL_LIB:$NS2_LIB:$X11_LIB:$USR_LOCAL_LIB  
  
# TCL_LIBRARY
```

```
TCL_LIB=/home/abhiram/Desktop/ns-allinone-2.35/tcl8.5.10/library  
USR_LIB=/usr/lib  
export TCL_LIBRARY=$TCL_LIB:$USR_LIB  
  
# PATH  
XGRAPH=/home/abhiram/Desktop/ns-allinone-2.35/bin:/home/abhiram/Desktop/ns-  
allinone-2.35/tcl8.5.10/unix:/home/abhiram/Desktop/ns-allinone-2.35/tk8.5.10/unix  
NS=/home/abhiram/Desktop/ns-allinone-2.35/ns-2.35/  
NAM=/home/abhiram/Desktop/ns-allinone-2.35/nam-1.15/  
PATH=$PATH:$XGRAPH:$NS:$NAM
```

7) Save and close the text editor and then type the following command on the terminal

```
source ~/.bashrc
```

8) Close the terminal window and start a new terminal window and now change the directory to ns-2.35 and validate ns-2.35 by executing the following command (it takes 30 to 45 minutes)

```
cd ns-2.35  
./validate
```

9) If the installation is successful, then you will be able to see % at the command prompt while typing the following command

```
ns
```

10) Now type

```
exit
```

Use this link to learn NS2

https://www.youtube.com/watch?v=LvT7wV_c05Q

<https://www.youtube.com/watch?v=2cGW055wgWU>

Link to enable Virtualization in bios of Windows 10

- To create Virtual Machine, Virtualization Technology need to be enable in your system(machine)

- And to check Virtualization Technology is enable in your machine or not, then

Open cmd prompt and type systeminfo.exe and hit enter, it will show whether VT is enable or disable

- To enable VT please go through below video

Link 1: <https://www.youtube.com/watch?v=MOuTxzfzCvMY>

- **But if UEFI setting is missing then use below link to enable virtualization**

Link 2: <https://www.youtube.com/watch?v=sL4WkfxEnZM&t=208s>

OR NETWORK SIMULATOR (NS2) AND UBUNTU INSTALLATION IN WINDOWS 10

<https://www.youtube.com/watch?v=D3A2ZNZIQ1Q&t=792s>

 **Tcl example 50 nodes (Create small network using NS2)**

Define the following options in TCL script.

Setval(chan) Channel/WirelessChannel

setval(prop) Propagation/TwoRayGround

setval(ant) Antenna/OmniAntenna

setval(ll) LL

```

setval(ifq) Queue/DropTail/PriQueue
setval(ifqlen) 50
setval(netif) Phy/WirelessPhy
setval(mac) Mac/802_11
setval(rp) DSDV
setval(nn) 50
setval(x) 2000
setval(y) 1000
setval(stop) 10
setval(traffic) cbr
setval(traffic) tcp

```

Next, we need to create an instance of Simulator using

```
set ns [new Simulator]
```

Then creating the trace file and nam file

```

set tracefd [open out.tr w]
$ns trace-all $tracefd
set namtrace [open out.nam w]
$ns namtrace-all-wireless $namtrace $val(x) $val(y)

```

Set up topology object and create object god

```

settopo [new Topography]
$topoloadd_flatgrid $val(x) $val(y)

```

set god_ [create-god \$val(nn)] //to create god object

Create Nodes:

First, we need to configure nodes, before creating it.

//To configure the nodes

```

$ns node-config -adhocRouting $val(rp) \
-llType $val(ll) \
-macType $val(mac) \
-ifqType $val(ifq) \

```

-ifqLen \$val(ifqlen) \

-antType \$val(ant) \

-propType \$val(prop) \

-phyType \$val(netif) \

-channelType \$val(chan) \

-topoInstance \$topo \

-agentTrace ON \

-routerTrace ON \

-macTrace OFF \

-movementTrace ON

//To create Wireless nodes[50 nodes]:

//Creating node objects

for {set i 0} {\$i< \$val(nn) } { incr i } {

set node_(\$i) [\$ns node]

}

//To define node initial position in nam

for {set i 0} {\$i< \$val(nn)} { incr i } {

30 defines the node size for nam

\$ns initial_node_pos \$node_(\$i) 30

}

//use of random mobility positions

proc destination {} {

global ns val node_

set time 1.0

set now [\$ns now]

for {set i 0} {\$i<\$val(nn)} {incr i} {

```

set xx [expr rand()*1600]
setyy [expr rand()*800]
$ns at $now "$node_($i) setdest $xx $yy 1000.0"
}

$ns at [expr $now+$time] "destination"
}

//To change node colors at the time of 1.0 , 2.0 , 3.0

for {set i 0} {$i< $val(nn) } {incr i} {

    $node_($i) color yellow
    $ns at 1.0 "$node_($i) color red"
}

for {set i 0} {$i< $val(nn) } {incr i} {
    $node_($i) color yellow
    $ns at 2.0 "$node_($i) color lightgreen"
}

for {set i 0} {$i< $val(nn) } {incr i} {
    $node_($i) color yellow
    $ns at 3.0 "$node_($i) color orange"
}

//To end nam and the simulation

$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "stop"
$ns at 10.5 "puts \"end simulation\" ; $ns halt"

// Execute the nam file

proc stop {} {
    global ns tracefd namtrace
    $ns flush-trace
}

```

```
close $tracefd  
close $namtrace  
execnamout.nam&  
}  
$ns run  
//To run program  
$ns filename.tcl
```

PART B

(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Installation Snapshots:

(Paste your Code snapshots of Virtual box, Ubuntu and NS2 installation here)

B.2 Snap shots of Code and Network created using NS2:

(Paste your output that you are getting after running app in from of screenshots.)

B.3 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above)

B.4 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

Q1: What is Virtualization? List out various virtualization Tools.

Q.2. what is NS2? Explain architecture of NS2

No 9- A program for android phone; display user form and its validation for android phone.

Part A

- **Aim:** Write a program for android phone display user form and its validation for android phone.
- **Objectives:** To study the Android Studio
- **Outcomes:** After successful completion of this experiment students will be able to; Create User form and its validation
NOTE: form will contain user info such as name, address, gender and telephone no etc.
On submission button form will be validated with appropriate messages.
- **Theory:**
 -  **What is Android?**
 - Android is a software package and Linux based operating system **for mobile devices such as tablet computers and smart phones.**
 - It is developed by Google and later the OHA (Open Handset Alliance). Java language is mainly used to write the android code even though other languages can be used.

- The goal of android project is to create a successful real-world product that improves the mobile experience for end users.
- **Android Studio** provides a unified environment where you can build apps for **Android** phones, tablets, **Android Wear**, **Android TV**, and **Android Auto**. Structured code modules allow you to divide your project into units of functionality that you can independently build, test, and debug

Features Of Android:

- 1) It is open-source.
- 2) Anyone can customize the Android Platform.
- 3) There are a lot of mobile applications that can be chosen by the consumer.
- 4) It provides many interesting features like weather details, opening screen, live RSS (Really Simple Syndication) feeds etc.
- 5) It provides support for messaging services(SMS and MMS), web browser, storage (SQLite), connectivity (GSM, CDMA, Blue Tooth, Wi-Fi etc.), media, handset layout etc.

AndroidManifest.xml

- Every application must have an `AndroidManifest.xml` file (with precisely that name) in its root directory.
- The manifest file provides essential information about your app to the Android system, which the system must have before it can run any of the app's code.
- It names the Java package for the application, which serves as a unique identifier for the application.
- It describes the components of the application, which include the activities, services, broadcast receivers, and content providers that compose the application.
- It also names the classes that implement each of the components and publishes their capabilities, such as the `Intent` messages that they can handle.

- These declarations inform the Android system of the components and the conditions in which they can be launched.
- It determines the processes that host the application components.
- It declares the permissions that the application must have in order to access protected parts of the API and interact with other applications. It also declares the permissions that others are required to have in order to interact with the application's components.
- It declares the minimum level of the Android API that the application requires.
- Ø It lists the libraries that the application must be linked against.

Layout XML File:

- It holds all the elements or the tools that you want to use in your application. Like the Text Views, buttons and other UI elements.
- Basically, All the UI and layout of your app is designed using xml.
- Apart from these, xml is also used for parsing data either from database or server into your android app.(Xml parsing).

Strings.xml

- This xml file is used to replace the hard coded strings with a single string, and you can refer to that string through your application.

Styles.xml

- This xml is used to define different styles and looks for the User Interface of application.

Drawable.xmls

- These are the xml files that are used to provide various graphics to the elements of application

MainActivity.java

- This is the actual application file which ultimately gets converted to a Dalvik executable and runs your application.
- Following is the default code generated by the application wizard for *Hello World!* Application:

```
package com.example.helloworld;
```

```
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;

public class MainActivity extends AppCompatActivity{
    @Override
    protected void onCreate(Bundle savedInstanceState){
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }
}
```

R.java:

- Android R.java is an auto-generated file by aapt (Android Asset Packaging Tool) that contains resource IDs for all the resources of res/ directory.
- If you create any component in the activity_main.xml file, id for the corresponding component is automatically created in this file. This id can be used in the activity source file to perform any action on the component.
- **Note:** If you delete R.jar file, android creates it automatically.

 **Functionalities Used In Code:**

1) Intent:

An Intent is a messaging object you can use to request an action from another app component. Although intents facilitate communication between components in several ways.

```
Intent I = new Intent();
```

2) StartActivity():

You can start a new instance of an Activity by passing an Intent to startActivity(). The Intent describes the activity to start and carries any necessary data. If you want to receive a result from the activity when it finishes, call startActivityForResult().

```
startActivity(i);
```

3) Thread Creation:

The Java Virtual Machine allows an application to have multiple threads of execution running concurrently.

```
Thread T=new Thread();
```

```
T.start();
```

4) Sleep():

The Sleep() method causes the currently executing thread to sleep for the specified number of milliseconds, subject to the precision and accuracy of system timers and schedulers.

```
Sleep(n);
```

5) ListView:

A view that shows items in a vertically scrolling list. The items come from the ListAdapter associated with this view.

```
ListView L = new ListView();
```

6) ArrayAdapter:

In Android development, any time we want to show a vertical list of scrollable items we will use a ListView which has data populated using an Adapter. The simplest adapter to use is called an ArrayAdapter because the adapter converts an ArrayList of objects into View items loaded into the ListView container.

Syntax:

```
ArrayAdapter A = new ArrayAdapter (Context context,intresource,objects)
```

Where, context=The Current Context

Resource= Count Constant To Display No. Of Item In A Row.

Objects=String Or Data To Be Set on ArrayAdapter.

7) SetAdapter():

This Method Is Used To Set ArrayAdapter Content To The ListView.

```
lv.setAdapter(adapter);
```

Where, lv=ListView Object

adapter= Name Of TheAdapter To be Set.

8) Bundle:

It is a collection of keys and its values, which are used to store some sort of data in it.

```
Bundle B = new Bundle();
```

9) Put & Get Data From Bundle:

To Put Primitive Data Into Bundle, ‘put<Primitive Data Type>(key,value)’ Method Is Used. Simillarly To Get Data From Bundle ‘get<Primitive Data Type>(key)’ Method Is Used.

E.g. B.putString("name","Bhavesh");

B.getString("name");

10) Put & Get Bundle From Intent:

To Put Bundle Into Intent, 'putExtras(<Bundle Object>)' Method Is Used.

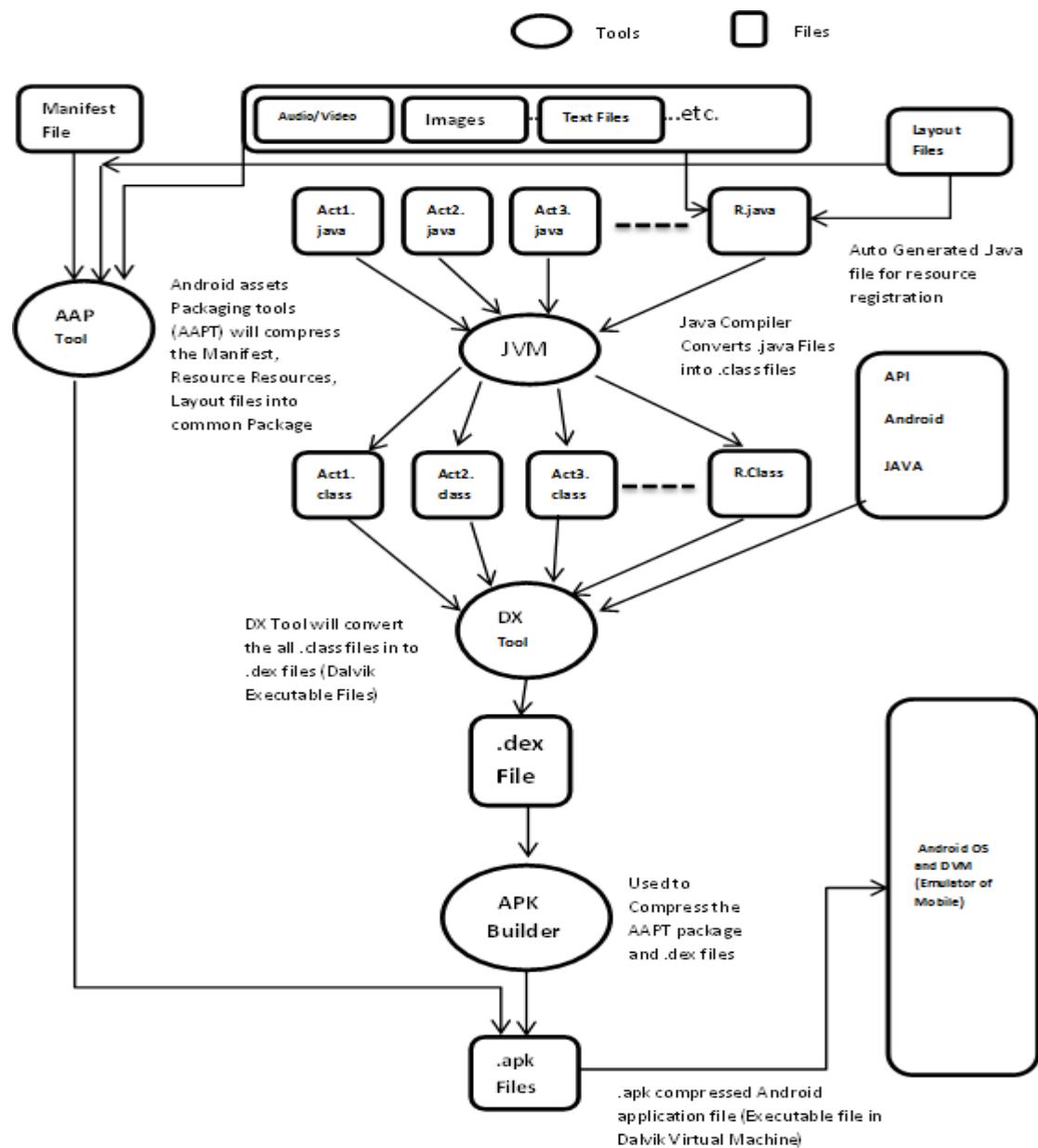
To Get Bundle From Intent, 'getExtras()' Method Is Used.

E.g. I.putExtras(B);

I.getExtras();

11) setText:

To Set Text On TextView, 'setText()' Method Is Used.



PART B**(PART B: TO BE COMPLETED BY STUDENTS)**

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student:

(Paste your Code script related to android mini project)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screen shots.)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

Q1: what are the Android app components?

Q2: Explain in detail android run time components

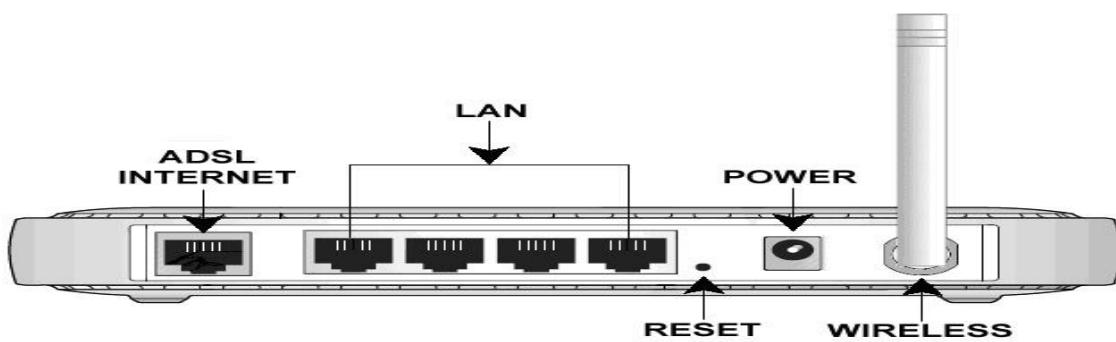
Experiment 10: Setup and configuration of wireless access point (AP).

PART A

- **Aim:** Set up and configuration of wireless Access Point
- **Prerequisite:** Netgearwi fi AP /TP link
- **Outcome:**
After successful completion of this experiment students will be able to Set up and configure access point and use it to access internet
- **Theory:**

Access point is a device used to connect Wireless LAN with internet. Access point is used in wireless LAN which might be having standard either IEEE standard or HIPERLAN. It will also be called as router since it works in network layer. Wireless LAN means each computer/laptop connected with each other wirelessly. there are two kinds of LAN possible I) adhoc wireless and ii) infrastructure based Access point configuration is done in such way that it is able to transfer and receive all packets of LAN securely if firewall is installed in that AP.

Access point is will be used here is wifi (D LINK) shown in diagram1 In diagram it is shown that DSL pin where DSL connection will be done where as other port will be used to connect any desktop computer. Following diagram2 will give idea about how access point is seen in wireless LAN Diagram 1



Note: Configuration of AP requires physical connection with internet via ADSL port then start WIFI then Update parameters of AP as per user requirement such as password /LAN name by visiting WIFI router page via internet explorer.

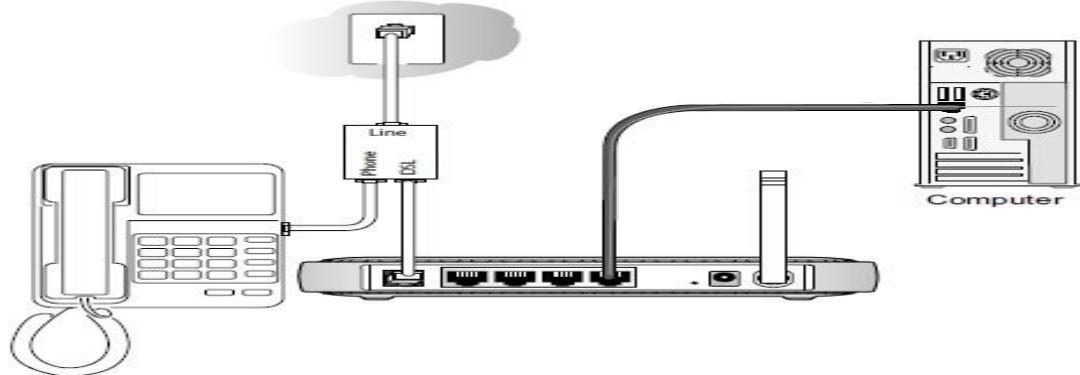
- **Wireless Access Point (WAP):** A **wireless access point (WAP)** is a networking hardware device that allows wireless devices to connect to a wired network using Wi-Fi, or related standards. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself. An AP is differentiated from a hotspot, which is the physical space where the wireless service is provided.



- **Steps for configuration of WAP:**

1. Connect the DSL port of the NETGEAR modem router to the phone line, via the DSL Microfilter, as shown in the diagram. Use an Ethernet cable to connect the computer to any of the four LAN ports as shown in the diagram. Connect the NETGEAR DSL modem router to its power supply unit (PSU) (Not shown in the

diagram) and wait about a minute for it to boot up.



2. Open an Internet Explorer browser and type the router IP address which would be either **http://192.168.0.1** or **http://192.168.1.1** in the address bar and press Enter.
 - o The Login window will prompt for the router configuration username and password.
 - o The default username is **admin** and the default password is **password**
 - o The username and password are case sensitive.
 - o If the default username and password is not working, you might have changed the password. Please try other passwords that you might have changed to. Otherwise, a factory reset is needed to restore the router to factory defaults. To perform a factory reset, see Restoring a NETGEAR home router to the factory default settings.



3. Click **Setup Wizard** on the top left corner, Select **Yes** for the Setup Wizard to detect the type of Internet connection and click **Next**.

• Setup Wizard

Setup Wizard

Select Country and Language

Country: English

Auto-Detect Connection Type

This Setup Wizard can Detect the type of Internet Connection you have.
Do You Want The Smart Setup Wizard To Try And Detect The Connection Type Now?

Yes.

No. I Want To Configure The Gateway Myself.

- The Setup Wizard will report which connection type it has discovered, and then display the appropriate configuration page. Please follow the steps under the connection type detected by your router:

Note: If the Setup Wizard finds no connection, please check the physical connection of your devices, and make sure that your ISP has already activated your DSL account.

Wizard Detected PPPoE Login Account Setup

PPPoE

Login

Password

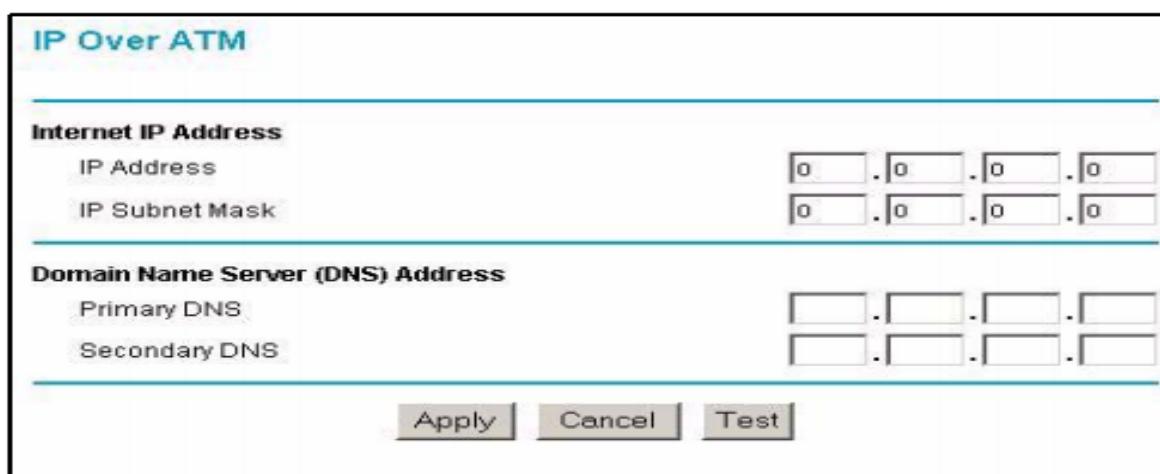
Enter the PPPoE login user name and password. These fields are case sensitive. This information should have been provided to you by your ISP.

Wizard Detected Dynamic IP Account Setup



Click **Apply** to set Dynamic IP as the connection method.

Wizard Detected IP over ATM Account Setup



1. Enter your assigned IP Address and Subnet Mask. This information should have been provided to you by your ISP.
2. Enter the IP address of your ISP's Primary DNS Server. If a Secondary DNS Server address is available, enter it also.
3. Click **Apply** to save the settings.
4. Click **Test** to test your internet connection.

5. Wizard Detected Fixed IP (Static) Account Setup

Fixed IP	
Account Name (If Required)	<input type="text"/>
Domain Name (If Required)	<input type="text"/>
Internet IP Address	
<input checked="" type="radio"/> Use Static IP Address	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
IP Address	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
IP Subnet Mask	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
Gateway IP Address	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
<input type="radio"/> Use IP Over ATM (IPoA)	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
IP Address	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
IP Subnet Mask	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
Gateway IP Address	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
Domain Name Server (DNS) Address	
Primary DNS	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
Secondary DNS	<input type="text"/> . <input type="text"/> . <input type="text"/> . <input type="text"/>
<input type="button" value="Apply"/> <input type="button" value="Cancel"/> <input type="button" value="Test"/>	

1. If required, enter the **Account Name** and **Domain Name** from your ISP.
2. Choose **Use Static IP Address** or **Use IP Over ATM (IPoA-RFC1483 Routed)** according to the information from your ISP.

If you choose IPoA, the router will be able to detect the gateway IP address but you still need to provide the router IP address.

3. Enter your assigned **IP Address**, **Subnet Mask**, and the **IP Address** of your ISP's gateway router.

This information should have been provided to you by your ISP.

4. Enter the IP address of your ISP's Primary DNS Server. If a Secondary DNS Server address is available, enter it also.

5. Click **Apply** to save the settings.
6. Click **Test** to test your internet connection.

6. The router will now save these settings. When complete, you can verify whether you are connected to the internet from the **Router Status** under **Maintenance** menu.

NETGEAR® SMARTWIZARD®

router manager
RangeMax Dual Band Wireless-N Modem Router model DGND3300

Router Status

Account Name	V1.00.12_1.00.12
Firmware Version	
ADSL Port	
MAC Address	00:22:3F:53:D5:AD
IP Address	99.55.163.140
NETWORK Type	PPPOA
IP Subnet Mask	255.255.255.255
Gateway IP Address	99.55.163.254
Domain Name Server	68.94.156.1 68.94.157.1
LAN Port	
MAC Address	00:22:3F:53:D5:AC
IP Address	192.168.0.1
DHCP	On
IP Subnet Mask	255.255.255.0
Modem	
ADSL Firmware Version	A2pB023k.d20k_rc2
Modem Status	Connected
Down Stream Connection Speed	1536 kbps
UpStream Connection Speed	384 kbps
VPI	8
VCI	35
Wireless Port	
Name (11N SSID)	NETGEAR-DualBand-N
Name (11G SSID)	NETGEAR-2.4-G
Region	Europe
11N Channel	36
11G Channel	11
Mode	Up to 130Mbps at 5GHz & 54Mbps at 2.4
Wireless AP	Enabled
Broadcast Name	Enabled

Show Statistics **Connection Status**

Router Status

You can use the Router Status screen to view basic statistics for your router. This screen is useful if you need to check something needs to be changed.

Account Name: Wizard or Basic Setup

Firmware Version: Change if you upgrade the firmware.

ADSL Port: These are the basic settings for the ADSL port.

- MAC Address - the Internet MAC address.
- IP Address - the IP address assigned by the Internet provider.
- Network Type - on the ADSL port.
- IP Subnet Mask - the subnet mask assigned by the Internet provider.
- Gateway IP Address - the gateway IP address assigned by the Internet provider.
- Domain Name Server - the DNS servers assigned by the Internet provider.

LAN Port: These are the basic settings for the local LAN port.

- MAC Address - the local LAN MAC address.
- IP Address - the IP address assigned by the router.
- DHCP - indicates whether devices on the LAN can obtain IP addresses from the router.
- IP Subnet Mask - the subnet mask assigned by the router.

Modem: The current connection status of the ADSL modem.

- ADSL Firmware Version - the ADSL firmware version.
- Modem Status - the current connection status of the modem.
- DownStream Connection Speed - the maximum downstream connection speed.
- UpStream Connection Speed - the maximum upstream connection speed.
- VPI - the Virtual Path Identifier.
- VCI - the Virtual Channel Identifier.

Wireless Port: The current connection status of the wireless port.

Verify that you have a valid IP address (not blank or 0.0.0.0) on the Internet or ADSL Port.

PART B
(PART B: TO BE COMPLETED BY STUDENTS)

(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)

Roll. No.	Name:
Class	Batch:
Date of Experiment:	Date of Submission:
Grade:	

B.1 Software Code written by student/steps:

(Paste your Code script related to your case study completed during the 2 hours of practical in the lab here)

B.2 Input and Output:

(Paste your output that you are getting after running app in from of screenshots.)

B.3 Observations and learning:

(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)

B.4 Conclusion:

(Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)

B.5 Question of Curiosity

(To be answered by student based on the practical performed and learning/observations)

Questions

- 1) How to Perform configuration of wireless access point
- 2) Check out/make use of connection with your mobile
- 3) what is IEEE standard is used for AP
- 4) How adhoc Wireless LAN will be created?
- 5) What is difference between WLAN and WiMax ?