An Effective Approach for Improving Jamming Technique by Employing PDR

A Dissertation submitted

By

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Under the guidanceof

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3. Distributed estimation and detection in WSN's.

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Signature of Supervisor

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APPROVAL OF PAC CHAIRPERSON: Signature: Date: 19/9/14

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CERTIFICATE

This is to certify that Shubham sharma (11012947) has completed M.Tech Dissertation-II proposal titled "**An effective approach for improving jamming technique by employing PDR**" under my guidance and supervision. To the best of myknowledge, the present work is the result of his original investigation and study. No partof the dissertation proposal has ever been submitted for any other degree or diploma.
The dissertation proposal is fit for the submission and partial fulfilment of the conditionsfor the award of M.Tech Computer Science and Engineering.

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ABSTRACT

In this paper a technique has been presented for jamming the mobile device. In previous work the jamming is very power consuming so there arises a need for a jamming technique which conserves power. In this paper focused has been put on the aspects of jamming and their various performance issues. The technique of packet delivery ratio (PDR) has been used. Two technique have been proposed. In the first technique calculation of the PDR value is done and that value is send to the neighbouring nodes for updating. In Second technique threshold PDR value is calculated for each node within their coverage area. After calculating the required PDR value the nodes are put into sleep mode and then the energy is calculated. Moreover the relay nodes have also been used to facilitate the communication between the end systems.

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All praises to the almighty GOD who showered his blessing on me. I am grateful the number of people who helped me in the completion of my work. I am always in debt to them for their advice and valuable suggestion. My special thanks goes to my advisor Miss Himanshu Sharma for helping me in every phase of my work.

I am really thankful to my parents for helping me in my thesis by motivating me in a graceful way. Hence I dedicated this thesis to them. Their prayers have always been with me.

I am thankful to one of my friends Nimisha, Hannan for their valuable suggestion.

At last I thank all of my friends whose names are not mentioned here.

DECLARATION

Iherebydeclarethatthedissertation proposal entitled "**An effective approach for improving jamming technique by employing PDR**" submitted forthe M.Tech Degree is entirely my original work and all ideas and referenceshavebeendulyacknowledged.Itdoesnotcontainanyworkfor theawardofanyotherdegreeordiploma.

Date:————————

Shubham Sharma
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CHAPTER-1
INTRODUCTION

Network is basically a word which purely describes about the communication, a communication from one device to another or from one person to another. We can find network everywhere in our daily life like whether we are connected by telephone line, communication cable or connected with radio waves. But the network are of different type one in which is Wireless sensor network. We all get irritated by using a network through which contains lot of wires coming out of device like computer or any hardware device wires are all over the walls, make the condition quite complex. So to get rid out of this process, the wireless sensor network came through in new generation. To get rid of wire and then communicate with the radio waves, infra-red, microwaves and many other, we use the wireless sensor network. Wireless sensor network is a system which contains a combination of micro (small) sensor nodes. Sensors are the device with a low cost, low maintenance and that small device used for sensing and communicating .It helps in making communication at a far off places. It is based on the event detection on the sink side that depends on the information of the sensor source nodes. By using it, we can make access of all things by setting at a very large distance [2].

1.1 Sensor, sensor nodes, sensor network

- Sensor is basically a transducer that convert the physical phenomena like heat, light, vibration, and sound into an electric signal.
- Sensor node is basically a unit in sensor network. It contains many technical parts like transceiver, power supply, processor and memory.
- Numerous no of sensors are present in a sensor node and that to form a communication between each other that forms a network that we call sensor network.

1.2 Important components of sensor

- **Mobilizer** It is used to provide mobility to sensor nodes when specific tasks are required to be carried out.

- **Power unit** It is one of the basic components of WSN. The primary source of power is battery, although other energy sources are also available.
- **Power generator** It is used for the additional power for the sensor nodes.
- **Transceiver** It is used to transmit and receive the signal, and perform the operation.

1.3 Various application where we can use wireless sensor network

Military application Fast development of sensors, self-organization and fault tolerance makes the sensor node very useful in the military operation. The chief areas of application include the monitoring of military secret places. The attacks due to biological or nuclear attacks are covered in the applications of WSN [6].

Environment application sensor network in environment is like tracking the movements of small animals, birds, insects, water animals, etc. Also used in monitoring the environmental (climatic) condition for helping the growth of crops and livestock. It helps in monitoring of forest fires, analysis of external conditions.

Health application in health sector, the primary application area is that for critical patients. Diagnoses the diseases and keeping the track of medicines and drugs used.

Home and office application in home, sensor are used daily, that is, we use the sensor for cleaning the house, and we call it as vacuum cleaner. For cooking purpose, we use microwave oven. For security, we use it to track which is outside the door, in office, it is being used for making the connection with each other and with the external network via the internet or satellite. To allow end user to manage home devices, using the remote control access.

Commercial uses these underline various control mechanism to stabilize the environment inside various buildings. Interactive museums where sensor control the visitor selection and guidance towards their interests, etc. Special sensors are available for monitoring the displacement and illegal undertaking of vehicles.

1.4 Factor influencing Wireless sensor network

Every kind of network has its limitation. Few limitation are

Power Life of sensor depends on battery lifetime. Failure can cause the topology change. Some sensor consume lot of power in a network.

Environment The sensors are working at a very high pressure in the very deep ocean. In the very deadly environment, such as in a battle field also under extreme hot and cold situation such as in the nozzle of an aircraft engine or in active region where the temperature rises at a very high rate and also in an extremely noisy environment which can cause harm to the sensor devices.

Production cost for the development of large number of sensor, we need to justify the overall cost, and for this purpose the cost should be minimal.

1.5 Performance of Wireless sensor network

Quantifiable parameters are used to measure the performance of sensor network [4]. Few are-
Latency It is defined as the time taken for transferring of data from the source node to the sink node.
Data accuracy it means that at the sink side, to determine the target location and estimate its demand.
Network lifetime of all the nodes working effectively together. Until it's one of the nodes loses its energy and getting low.
Throughput It measures the data that can be easily conveyed over the medium within a specific time whether it large or small.
Number of hop it tells us that the how much energy each node will consume and also it give the estimation of cost of path.

1.6 Working of Wireless sensor network

Wireless sensor network is collection of the motes (used to consume less energy). These motes used to communicate with each other in a network where they are deployed. Every child mote is used to collect the data and the information about the related task and it send (transfer) to the parent mote that can be our device like PDA, laptop, computer that tells the child mote that what task is to be performed because wireless sensor network changes. According to the situation condition changes like temperature, moisture that effects the

broadcast abilities of motes. Wireless sensor network it set off alarm and set start recording the data as well all these actions performed get effect the other motes because they all are connected to Wireless sensor network [4].

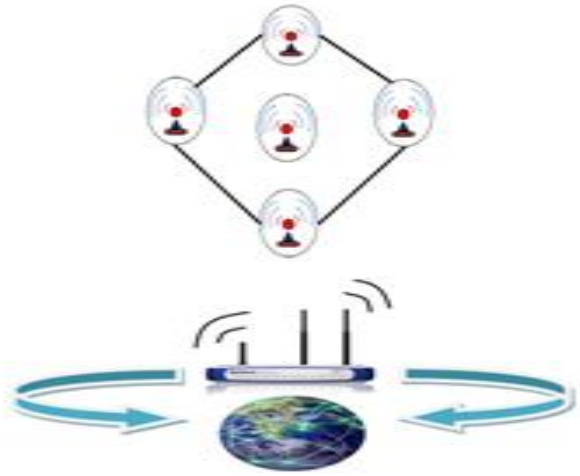

Figure 1.1 Basic Architecture view of wireless sensor network

Wireless sensor network is growing at its high extend in the field of high tech technology. Nowadays, it can be used in many companies in mobile device the technology of wireless sensor network is growing day by day. Wireless sensor network make our life easier by fascinating us in a matter of data manipulation, processing, tracking.

1.7 Jamming It is like to stop making the device to communicate with the other device .In simple words, jamming is a technique by which it disables the communication between two parties by interfering inside their communication by creating noise into their communication[1].

Jammer has been found to operate on the frequency matching that of cell phones so as to maintain a higher range of frequency overhead to block the signals of devices under consideration. Jammer are usually very tough to detect because the device which are being jammed experience minimal effect such as poor signal reception. Jamming device can be used in any location but they are used typically in the place like where the disturbance due to cell phone is not tolerated like in the confidential places of military in library, classroom and many other places where the information leak can cause much harm to the society [6].

1.8 History

During World War 2, ground radio operator used to send the false instruction in their own language to the pilots. Records dating back to 1960s show the use of jamming techniques. Blocking the radio station of American government but also the station of the Miami and many more American made SCR-399 transmitter was used by soviets to jam US and western broadcast.

1.9 Radio jamming

Radio jamming is used to transmit the radio signal to descript communication by decreasing the original signal to the noise ratio that is created by some intruder. Jamming mechanism is achieved by sending high frequency signals. The main aim is to disrupt the original ones. This is because it finds its main use in military whether it is important .Other uses include battle findings. Examples of this type of jamming are delineated as follows: warbler, tone rotary pulse, spark recorded sound, random noise. It is divided into two groups obvious and subtle jamming [14].

Obvious jamming this type of jamming can be detected because it can be listen or detected by receiver equipment. The function of this jamming is to block the transmitting signal of receiver and sending the noisy packet to the receiver.

Subtle jamming this type of jamming don't create any noise and thus not easily detected by receivers end. It is very hard to detect. It is very difficult to differentiate between the original signal, and any sort of interference .These are the type of attack which is being used for jamming in modern equipment.

1.10 Jamming techniques

The ratio between signals to noise is the primary parameter to find whether the jamming technique is successful or it has failed. For this, the ratio is calculated as:

POW (signal) / pow (noise) = $R_{sn.,}$ where R_{sn} is signal to noise ratio. Jamming is beneficial and effective only when

The existing jamming techniques are-

a) Spot jamming being one of the strongest methods of jamming the most powerful jamming method in which the intruder uses a single frequency for transmission of its entire power. The main disadvantage is cracking of the technique due to usage of a particular frequency again and again.

b) Sweep jamming the hopping of the power inherent in the jammer is done one after another. This technique help in jamming the multiple frequency in a very fast sequence. The packet loss is quite visible and therefore the energy consumption is very high.

c) Barrage jamming in this technique, a number of frequency signals are jammed at the same time at the same instant. It can jam multiple frequency at once with more power. The output power is decreased to minimum due to increase in frequency signal.

d) Deceptive jamming the basic working is achieved either by employing one frequency or an extended group of frequencies and it is manly used when there should be no evidence while jamming. It works like a flooding of fake data on a WIRELESS SENSOR NETWORK. It can deceive the network's defensive mechanisms. It don't leave any trace behind. It cannot be easily detected and thus this function make it more powerful jamming than other.

1.11 Types of jammer

From a simple transmitter to an entire jamming station equipped with various special equipment's comes inside the category of jammer. There are many jammer that are against the wireless sensor network [1].

Constant jammer The jammer used to emit the radio signal either by using the wave form generator or can easily be used by using any wireless device that continuously emit a random bit of radio signal without seeing any MAC layer. MAC protocol used to emit signal only when the channel onto which it is working is to be idle. Constant jammer is useful for genuine traffic source from getting stop on a particular channel and sending packets continuously.

Deceptive jammer the jammer used to send the randomly generated bits. It continuously send the packet without leaving any gap in between the previous node transmission. Even if the node want to send the packet to the network it cannot send because of the continuously packet transmission is there by the jammer so it cannot switch to the sending state and thus remain in receiving state.

Random jammer not sending out continuous packet, it sends the packet in a random form like it works as deceptive and a constant jammer but for a particular time interval then it goes in a sleep mode. It works again after coming back from "sleeping" state. This type of jammers are used in the areas where the less power is required and to the hardware equipment which doesn't have unlimited power supply [1].

Reactive jammer the above discussed three jammer are called active jammer these type of jammer work without seeing the condition they just emit the packet. Active jammer usually used to create the channel busy all the time. Reactive jammer remain in silent mode until the node doesn't perform any activity in the environment but when it finds the activity of the node in its coverage area it starts its transmission. This type of jammer is very difficult to detect.

CHAPTER-2
REVIEW OF LITERATURE

A glimpse of the existing research in wireless sensors network and jamming is presented in the following chapter. In the field of wireless sensor network there are works which defines the working of wireless sensor network there coordination among various nodes the data transmission and many more. In the field of jamming there is a large amount of work done in which mainly there are various types of jammer and these techniques include the Attack and Defense strategies of jamming sensor network.

Hafsa toqeer (2013) [4] suggested various wireless sensor that are being used in our daily life as well as the wireless sensors are those that are used for various disaster detection notification, emergencies detection in the indoor environment, structure monitoring and many other areas where wireless sensors are used. In this paper we concentrate on various factor like on structure monitoring, emergency response notification for indoor situation and also the use of wireless sensors network in different areas (fields).

Wireless sensor is the growing latest technology that make the whole mechanism to control the things wirelessly. WSNs are being used as a tool for engineers to build the new technology and for monitoring various application .WSNs is the fast growing technology in the market nowadays .The main advantage for it is that they are used wirelessly in the network, and also build up system which make life easier in data manipulation, processing, tracking etc.

The paper focus on the wireless sensors network there working, uses. From the papers that are reviewed earlier. The papers that are reviewed contain very nice explanation with the work done is excellent. The work done in this paper provides a revolutionary step in the area of wireless sensors.

Network is that which is used for communication between person to person that is used for sharing data our ideas our opinion etc. Network are everywhere in environment from telephone line, communication cable, radio waves or different types of file(data) transferring instrument, mobile is the perfect example that we use in our daily life. From the past few years everyone thinks of that network is like a lots of wires with different port connection. It makes the normal person very difficult to understand also provoke the person and disturb the person due to cluster of wires for simple network for this the best way to get rid of these wire is that to use wireless device that is wireless sensor network. It provides you liberty form the congested wires, cable. Wireless sensor network is the combination effort and activeness of micro (small) sensors nodes. Sensors are of very small size with low cost, low power, low maintenance but it is capable of sensing and communicating. It helps in communicating from a very long distance. It is like for event detection at the sink side relies on the collective information of sensor source nodes. It sense the detection and send that information to the database where it is linked to within few seconds. Sensors is a device that convert the signal in one form of energy to another form of energy for example: heat, motion, light, pressure. It combines with various components that are being used like transceiver, Microcontroller, power source, external memory for storage, and sensors.

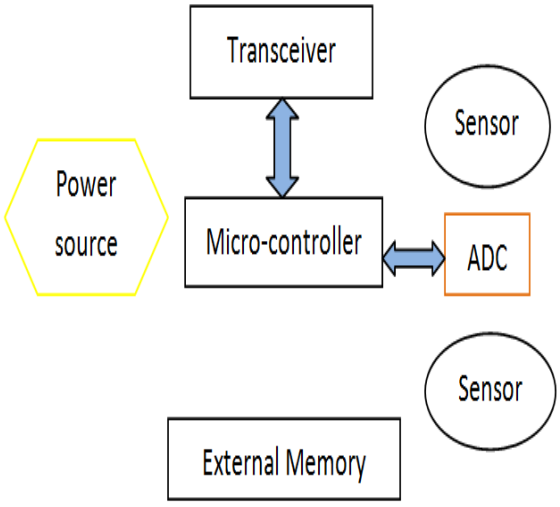

Figure2.1 Sensor content

Every component is necessary in performing different task in wireless sensors.

Working It's collection of motes. Motes used to communicate with each other in a way that every child motes collects the sensed data (event detection) and send it to the parent mote that can be anywhere where data is to be stored.

WSN Architecture

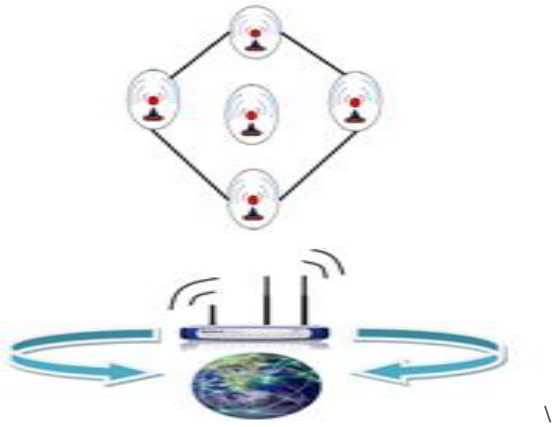

Figure 2.2 Architecture view of WSN

Syed Waqar Shah, M. Inayatullah Babar, M. N. Arbab, K. M. Yahya, GuIzar Ahmad, Tariq Adnan, Ammara Masood (2006) [12]come up with the research that gives the light on the two techniques of jamming the cell phone their design and implementation are also discussed. For jamming the cell phone Noise attack and spectrum distortion technique are also used. The technique discussed here is stronger and cost-effective. This Paper has done comparison between old technique performance with the new technique that is being proposed in it with various parameters taken into consideration that are cost of implementation, power usage, consumption design, complexity of technique, robustness of the technique, coverage area into which it is to be implemented, components needed for the implementation (hardware) and performance of the technique. Cell phone jammer is a device which interfere into the transmission of mobile and wireless devices. Cell phone jammer used to block the transmitting and receiving packet which cell phone gets from base station. Cell phone jammer are being used to avoid the disturbance of cell phone in places where disturbance is not tolerated like in religious places and confidential places.

In the previous technique, the commercial jammer used to work on noise transmission (noise attack) it contains an electronic devices which transmit the electromagnetic signals with particular frequency with high power just like GSM/DCS use .Voltage controlled oscillation (VCO) is used for generating of jamming frequency.

The technique which is previously done is quite complex, so the technique which author proposed gives the jamming through spectrum distortion. It is simpler and cost effective in comparison to other techniques.

Jamming through spectrum distortion techniquehere the distortion means to represent in different-different manner. Here the author uses amplifier for amplifying all mobile signals present in its state of being near and add a pleasant to hear noise to it. Then it will make frequency of mobile phone clash with each other [6].
Newly designedJammer is used today use high power due to which it burns the electronic equipment used due to heat and may cause damage to the human health.
GSM/DCS receives the frequencies from the antennae and these frequencies are used as input to the transistor base. After amplifying the signals it add pleasant noise to it. It makes the signal distorted. The collector output is joined to the input of antennae for next level and that is being boosted further to the jamming signals so jamming get hard with the combination of every amplifying stage. [15]

Comparison between two jamming techniques
The new jamming technique is more superior to the old one when it is being implemented there is no possibility that a discrete frequency of mobile is not available on every neighboring jammer at every instant. It does not effect if power of mobile signal that are being transmitted bybase station because it didn't work on noisy signal which have large power than mobile signal power

ConclusionIt is quite effective and perform well in comparison to the old technique in comparison to cost, health because author have used the transistor, capacitor and resistor and also use the low power circuit. No setting by user is too done can be handled easily.

Jian Xu*, Ting Lin, Zeming Gan and Zhiyin Gan (2013) [7] researched on versatile signal generator which equipped with the phase lock loop (PLL) chip and a direct digital synthesizer (DDS) chip to produce microwave signal for 3G communication jamming [7]. It is used to produce single frequency, amplitude modulation (AM); frequency shift keying (FSK) or binary phase shift keying (BPSK) signals. It can also be used for other application spectrum and in field test demonstrated the jamming signals.

Due to development of high tech communication, 3G communication plays an important role in field of exchanging data from one device to other at a very fast rate. The communication here can be seen as the signal spread system which is based on the specified frequency band only with the proper (SNR) signal to noise ratio; the device could communicate normally lower, the SNR device will face more failure to the communication. The carrier in the 3G communication system would lower the SNR and make the jamming. Based on this, the jamming the 3G communication with producing a signal whose frequency could cover the frequency used for the downlink PLL (phase lock loop) and DDS (direct digital synthesizer) is used [12].

System design

- **Hardware design** PLL is programmed to make the output frequency scan in a range. It could not be modulated digitally. Then the DDS AD9854 is used. It is a digital chip used to produce an adjustable signal with AM, FM, FSK or BPSK, with the DDS output as the reference to PLL. The output frequency and status could be controlled by DDS. Frequency stabilization of the PLL output was decided by the reference of the DDS. If the reference could be stable, the PLL output could be stable. [7]

  The DDS is responsible for providing a radio frequency signal adapted according to requirements by applying there technique of synthesizing keeping the frequency in a controlled mode hence the signal for PLL as it a reference in order to make the PLL output signal could be adjustable with the AD9854, the frequency could be small as 1muHz and its maximum output frequency could be 150 MHz The PLL is the main chip which could be controlled by the MCU [MICRO CONTROLLER UNIT] to output different frequency. In PLL the microwave output frequency range could be

from 1700 MHz to 3600 MHz which cover the frequency band of 3G and 2.4G wireless communication.

- **Software design** In order to make the hardware easily to drive, a self-development software was used. The system clock was set to 180 MHz to make less false and node was set to ramped FSK to realize the frequency scanning amplitude and the frequency are set in a proper value to make PLL output frequency cover the frequency range of the 2.5G and 3G communication.[7]

- **System Test** The self-developed software was based on the computer with the window XP SP2 as operating system. To demonstrate the frequency coverage of the generator a spectrum analyzer Agilent N1996A was put into practice.

ConclusionOn the basis of significant development of the digital chips, a perfect computer controllable signal generate for jamming 2.4G and 3G communication was proposed and realized.

P.Naresh1, P. Raveendra Babu 2, K.Satyaswathi(2013) [10] have done research on, jamming device that broadcast the radio frequency signal in the frequency range which is being fixed for the cell phone.it interface with the cell phone and when cellphone comes into the coverage area of the jammer it display “no network” and all phones get silenced until they leave the coverage area. The time of jamming the cell phone is being scheduled by programming in microcontroller. Real time clock chip DS1307 is used for scheduling. [10]Mobile phone are not to be used in the area where disturbance of the phone ringing don’t look good. Jamming is illegal in many countries. Take a jammer and plotting it in an area where to jam signal.

Mobile jammer

It is used to jam the communication between cell phone and tower. The signal comes from the base station is being jammed when it reaches to the mobile phone. Cell phone jammer block the cell phones by sending the frequency similar to the mobile device that is to be jammed.

Radius of cell phone jammer is about few meters may be kilometer or more. The range of cell phone jammer depends upon the power and the condition like differentdifferrent obstacle

in between the cell phone jammer. It takes less energy for jammer to interfere between towers to mobile device in comparison to mobile phone to tower.

Jamming techniques

Three most common techniques are:

a) Spoofing in this technique the jammer inform the mobile device to turn off its device by sending a message of "mobile disable" through mobile disable signal.

b) Shielding attackclosed area like cage in which mobile device cannot transmit and receive signal.

c) Denial of servicein this technique the device transmit the frequency similar to the mobile device so that to reduce the signal to noise ratio of mobile device. This jammer contains components like RF section, power supply and antenna

ARM 7 CLP (2148)it is a 32 bit general purpose microprocessor which take less power and performance is higher. Architecture is based on RISC principle. It is simpler than CISC[8].

Real time clock (RTC)it tell the true time and date. RTC chip present in it gives hour, minute and second with additional feature of data calendar. [10]

Keypad The basic 12 button keypad for user input, jammer ON and OFF time is given by keypad.

Conclusion The hardware implemented here is perfect for jamming mobile devices using mobile jammer and ARM7.The device used here work on duel band .It jam devices which use GSM 900 and GSM 18OO bands.

Wenyuan Xu, Ke Ma, Wade Trappe, and Yanyong Zhang (2013) [13] have suggested wireless sensor network built onto a shared wireless medium so because of that malicious activity can be take place. The attack can be possible either by passing MAC layer protocol or by emitting radio signal. Survey on different jamming attack is done. To fight against these type of attack, two phase strategy is being used to defend against these type of attack. Deleting of jamming signal is done. Two strategy are used to defend against jamming it is either by channel surfing or spatial retreats) and other is by adjusting the power level, and different communication coding to achieve back communication into the network when it is jammed. [13]

Cryptographic security is being used against the packet injection and spoofing attack.
System like the Berkeley MICA 2, the ZigBee [5] and even 802.11 is based on carrier sensing multiple access.so use of it in MAC, this cause jamming. [13]

Jamming attacks

- **Constant jammer** The jammer used to emit the radio signal either by using the wave form generator or can easily be used by using any wireless device that continuously emit a random bit of radio signal without seeing any MAC layer. MAC protocol used to emit signal only when the channel onto which it is working is to be idle. Constant jammer is useful for genuine traffic source from getting stop on a particular channel and sending packets continuously.

- **Deceptive jammer** the jammer used to send the randomly generated bits. It continuously send the packet without leaving any gap in between the previous node transmission. Even if the node want to send the packet to the network it cannot send because of the continuously packet transmission is there by the jammer so it cannot switch to the sending state and thus remain in receiving state.

- **Random jammer** not sending out continuous packet, it sends the packet in a random form like it work as deceptive and a constant jammer but for a particular time. Interval then it goes in a sleep mode. It work again after coming back from "sleeping" state. This type of jammer are used in the areas where the less power is required and to the hardware equipment which do not have unlimited power supply.

- **Reactive jammer** the above discuss three jammer are called active jammer these type of jammer work without seeing the condition they just emit the packet. Active jammer usually used to create the channel busy all the time. Reactive jammer remain in silent mode until the node don't perform any activity in the environment but when it finds the activity of the node in its coverage area it starts its transmission. This type of jammer is very difficult to detect.[6]

Interfere cause by jammer depends upon the factor like distance between the jammer and mobile node.MAC protocol decide whether the channel onto which node is to be send is idle

or not, if the signal strength is lower than its threshold value.Packet send ratio (PSR) and packet delivery ratioare used for stronger jamming. [13]

Detecting jamming attack in sensor networks

- **Signal strength** measuring the signal strength value can be effective for jamming. Taking the threshold value with the noise emission and then operating it on window sample.

- **Carrier sensing time** In this the jammer doesn't allow the original source for sending out the packet because it will appear constantly busy and it will be possible if it uses carrier sensing time to check whether the device is jammed or not.

- **Packet delivery ratio** presence of jamming is detected by PDR, as the jammer with incorrect transmission will have the PDR value to be low and the jammer with the perfect transmission will have the PDR value to be high. If the sender battery is low it will stop its transmission. And thus PDR is 0 percent. [13]

- **Advanced detection strategies** combination of PDR and signal strength strategy works. In this high signal strength means high PDR.

Mapping jammed area it helps in mapping the areas which are jammed by which the network supporter use high power and high layer planning to that mapped area.

Evasion defense strategies channel surfing it is like frequency hopping in which the change of frequency continuously. It is on high demand that operates at link layer.
Spatial retreats here the jamming node try to leave the jammed region.
Two phases are there
Escape plan is likenode inside jammed area need to move to normal environment for getting connected to its own network.
Reconstruction phase mobile node here is to get into the continuous network area for preventing the jammer from partitioning the network. [13]
Competition strategies: power controlling and code modificationnodes which are jammed or near to the jammed area must adjust their power and coding according to area of

communication.At the lower layer.It should be realize that when increasing the power level will also increase the larger radio coverage pattern.

CHAPTER-3
PRESENT WORK

The current section, we haveproposed the problem of my research work, its objectives, and the methodology that I have used for my proposed research.
In the following section I have explained how I formulated my problem and what the approach I am going to use in my work,in 3.2 and 3.3 section the objectives and the methodology of the work done. In the methodology part the work is explained through the diagrams with step by step explanation.

3.1 PROBLEM FORMULATION

Jamming is like to stop making the device to communicate with the other device .In simple words, jamming is a technique by which it disables the communication between two parties by interfering inside their communication by creating noise into their communication.
Jammer has been found to operate on the frequency matching that of cell phones so as to maintain a higher range of frequency overhead to block the signals of devices under consideration. Jammer are usually very tough to detect because the device which are being jammed experience minimal effect such as poor signal reception

In this technique for jamming the mobile device is been presented. In previous work the jamming is very power consuming so there arises a need for a jamming technique which

conserves power. In this paper focus is done on the aspects of jamming and their various performance issues. Technique of packet delivery ratio (PDR) has been used. Two techniques have been used. In the first technique calculation of PDR value is done and sent it to the neighboring nodes for updating by which there will be a coordination between the neighboring nodes and thus which node have to stop it depends upon the condition according to the situation. In Second technique threshold PDR value is calculated for each node within their coverage area by which it select which node to jam and which node to "sleep" sleeping is done for the particular interval of time which helps in power conservation. Optionally according to the PDR value the packet delivery is decided that how the packets have to transfer at what rate it has to jam the signal

3.2 Objective of the study

This work aims at the improvement of jamming techniques and finally simulating it in an environment, and hence correlating it with everyday applications where its requirements is necessary

- To improve the coordination among various nodes by sending and receiving signals and control messages to their neighboring nodes for obeying the rules.
- To provide a continuous communication within a regulated zone by disabling only mobile phone.
- To demonstrate the sleeping mode of jamming.
- To understand the working practically
- To improve the power requirement.
- To compare result with previous technique.

3.3 METHODOLOGY

3.3.1 Packet Delivery Ratiopacket delivery ratio can be defined as the number of packet destination nodereceived to the number of packet sender node send. It is the ratio of the number of packet that is delivered to the destination.

3.3.2 Mathematically we can say that

Packet delivered ratio = Pr / Ps

Where Pr is the no. of packet received (acknowledged packet) and Ps is the no of packet send to the destination. Use of PDR in this work is that each node should calculate the PDR value and when it is being calculated, it updates its PDR to its storage and sends that PDR value to the neighboring nodes. When the neighboring node receive the PDR value from its neighboring, it stores the PDR value to its storage.

Relay network is also formed inside a network basically relay network is a very broad class inside network to form various topology which we can use in wireless network. It's like when some intermediate nodes are placed between the source and the destination. These are being used in the places where the source and the destination cannot communicate to each other because of the greater transmission range between both the end systems. There the use of relay node is necessary inside a network.
A relay network is used to send info and to communicate between the source and destination which are not in transmission range of each other. Relay information is being transferred between the source and destination. Relay node are to be the intermediate node between the source and destination they can be used in many topologies like line shape ,ring shape, tree shape and also they pass the information between the source and destination in fastest and most efficient way as possible.

By using the packet delivery ratio (PDR) in my work, here the sender nodes will calculate the PDR value just by calculating {No of packet received (acknowledge) / total no of packet send} and then it send that PDR value to its neighboring nodes to compare its PDR with the other neighboring node. When the neighboring nodes get the PDR value, they compare the PDR value with their PDR value (figure 3.1). If they found the PDR value greater than their PDR value, they update that to their storage and stop jamming the target node because the jamming node with more PDR value will only jam the target node and make all other neighboring node to stop jamming the target node. Same criteria is being applied to all other jamming nodes.
Relay nodes are also used inside a network. In the following work relay nodes are being establish between the intermediate nodes such as between 1 and 3, 1and 2, 2 and 4, and 4 and 3 such that to make the nodes 1 ,2,3 and 4 to communicate to each other.

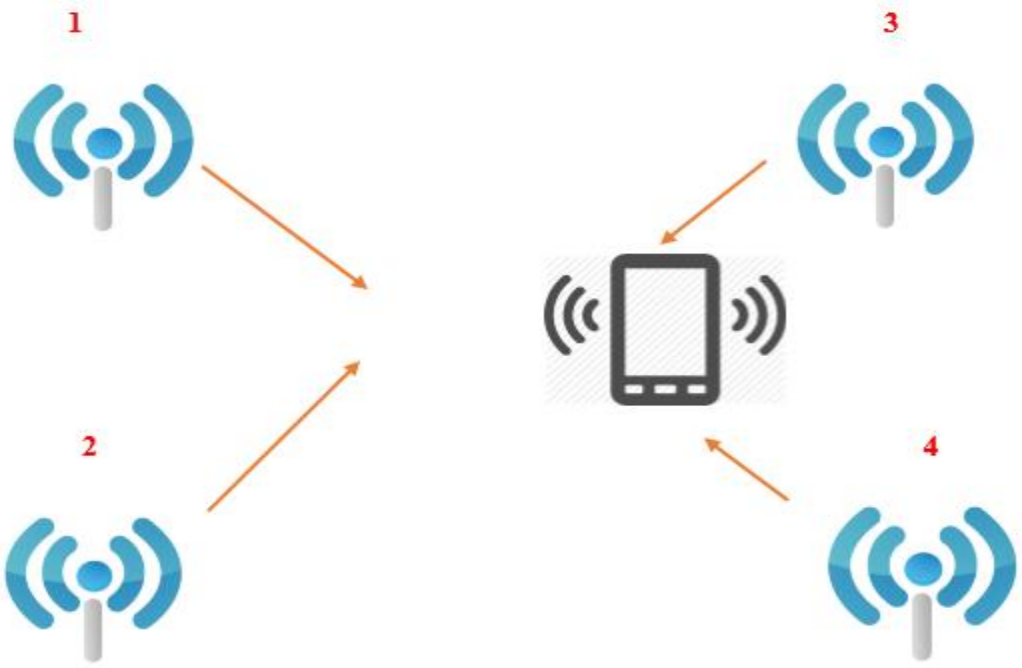

Figure 3.1 Checking of PDR value by each node 1,2,3,4

Node 1 and 2 don't find any mobile node into their range so they stop there radio transmission and check again after a particular interval of time (figure 3.2).

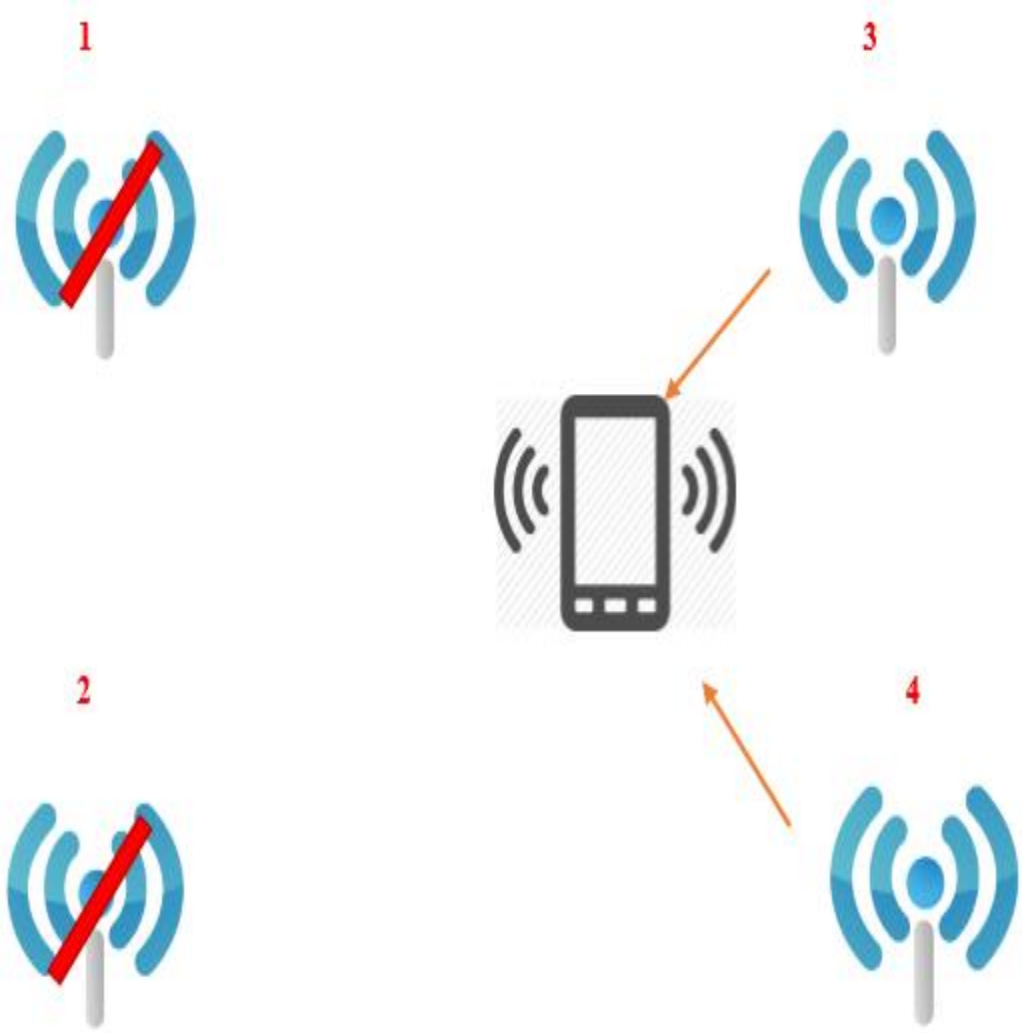

Figure 3.2 Calculation of PDR value by node 3 and 4

The packet delivery ratio is calculated by jamming node 3 and jamming node 4 because the mobile node (target node) is in range of both the nodes, so by calculating the PDR by both the jamming node 3 and 4, we will find the greater PDR value. If the PDR value of node 4 is greater than PDR value of node 3 then node 4 will transmit a broadcast message to all the neighboring nodes to stop transmitting radio signal (jamming signal) to its mobile node and this jamming node 4 will jam that particular mobile node because of greater PDR value (Figure 3.3).

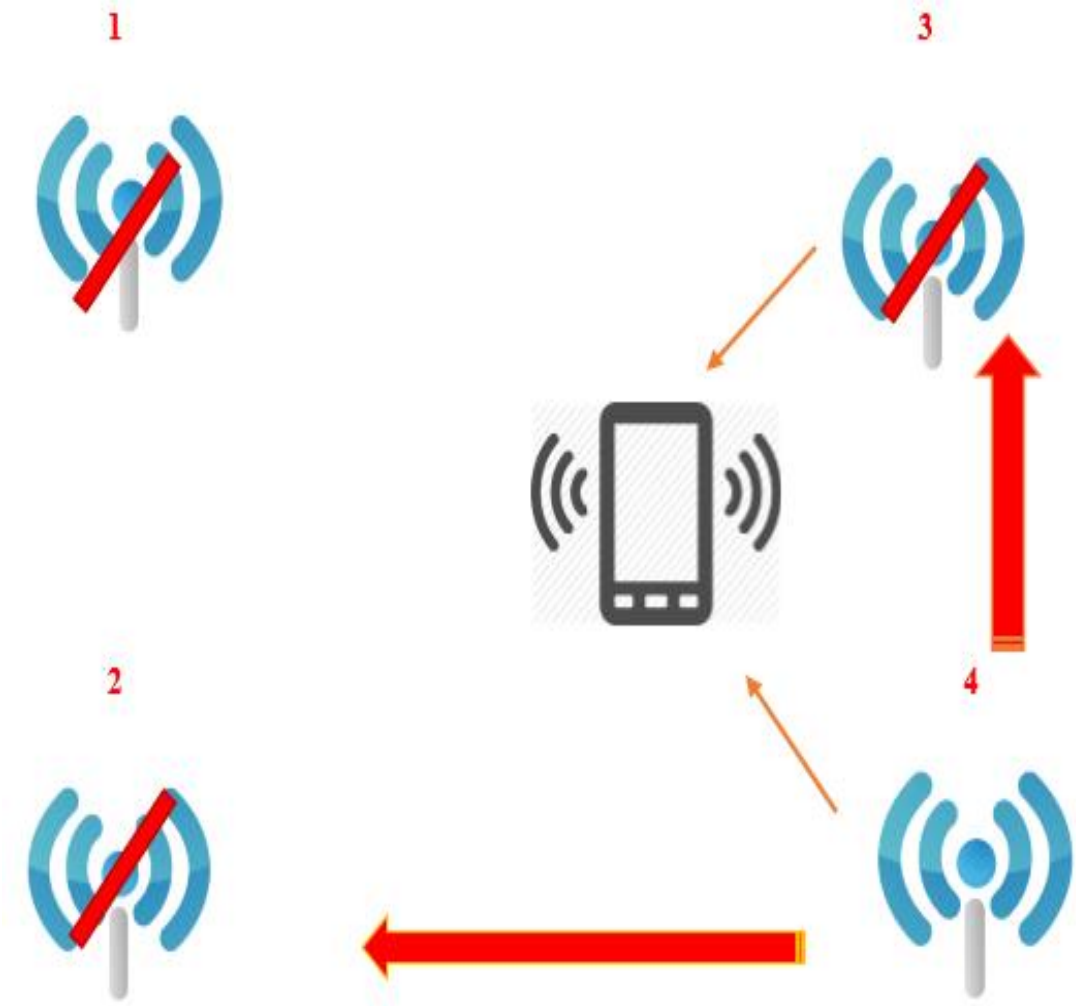

Figure 3.3Broadcast message by node 4 to its neighboring node Telling about its PDR value

The PDR value is being checked by each node after a particular interval of time such that node which is to be jammed is jammed by its nearer jamming node, so the less power is to be conserved such that in the previous work, jamming nodes used to transmit the radio signal continuously even if there is no mobile node into their coverage range (figure 3.4). By using the packet delivery ratio, the particular jamming node with highest PDR calculated is to transmit the radio signal to the target node which is in the proper range of the particular jamming node.

All the jamming nodes are transmitting the radio signal even if there is no mobile node within their range such that the power consumption is more in that scenario because 1,2,3 are

Figure 3.4 previous scenario

Transmitting the radio signal without any use. By using the PDR power consumption in my scenario will be less in comparison to the previous work done.

3.3.3 Packet delivery ratio by using the particular threshold value

When the packet is being transfer from one node to the other mobile node, it checks its PDR value for that particular mobile node like in the figure the PDR value is calculated by each mobile node. After calculating the PDR value for each mobile node they calculate the threshold Value for each node if the PDR value of the jamming node is within the threshold value it will transmit the radio signal to the particular mobile node and jam it (figure 3.5). If the PDR value is out of the threshold value then the particular jamming node will stop its transmission and wait for the mobile node to come into its coverage area till where the threshold value is calculated.

Figure 3.5 Calculated threshold value

When the mobile node comes into the area of particular jamming node it will again start transmitting the radio signal.

- "Threshold value is defined as the value which is being assigned to each and every jamming node according to their coverage area. Till where they can jam the mobile node".

In the following case also relay nodes are being establish between the intermediate nodes such as between 1 and 3, 1and 2, 2 and 4, and 4 and 3 such that to make the nodes 1 ,2,3 and 4 to communicate to each other and form an efficient communication between the network. Here we are calculating the average PDR value of the jamming node which is like a threshold PDR value to each and every jamming node. Now the jamming node will compare its original PDR value with assigned threshold PDR value (that we have calculated earlier) and after comparison it will transmit the radio signal and jam that mobile device. Let us look with the help of example now here, there are 4 jamming nodes in which they are having their coverage area to which they will transmit their radio signal and jam the devices. Here 1,2,3,4, is having their own coverage area till where the threshold value is calculated for PDR. If the

mobile device comes in the coverage area of any node it will be jammed by jamming nodes by calculating the PDR value and comparing it with the threshold PDR value of its own. If mobile node leave the coverage area of particular node then the node will stop its transmission for a particular interval of time and wait for its come back.

3.4 Network Simulator

A network simulator is a tool which is used for representation network in a logical manner. Two types of network simulation is done defining first is that in which the existing network is being simulated and the second is used for constructing new and logical network. Important purposes of these kinds of simulations are to find a problem in the existing network or finding or developing the unexpected interaction which has not been built yet. By solving the existing problem and finding out the reliable solution for it companies can build an improved network with low maintenance cost. Now days the technologies have become so advance that they can simulate the real world scenarios on any systems .The main purpose of simulation in system is same as it can form the real scenarios on systems. To simulate these types of works in the computer system we use network simulator. Main aim of network simulator is to monitor the different behavior of the network. Monitoring the behavior of the network is done through the inbuilt entities inside simulator or by using mathematical integrated formulas or can be monitored by playing back the observed network [19].

Network Simulator have various integrated features, easily adaptable and easy-to-use Graphical user interface-based network designing tools that can simulate any type of network with SNMP, FTP, TCP, Telnet and also many Cisco IOS device. Range serves as an important parameter for the classification of various types of network simulator that are being used today. Which can work in very simple as well as in very complex situation these are basically used to

- Identify nodes in the network
- Identify the link between end nodes
- Identify the traffic occurrence between end nodes
- Specify various types of protocols that are to be used to handle the traffic
- Visualize the working of the network in a graphical environment
- Customize text based application

3.4.1 Network Simulator 2 (NS2)

A discrete event simulator developed as a part of a project in California, university of Berkeley named NS2, an acronym for network simulator version. The basic aim behind its development was to facilitate innovative research in the network community so as to analyze the protocol used in the network domain. The simulator was extended an improved by incorporating mobility models, which help in visualizing the real life scenarios. Types of language used for the simulation is C++ and OTcl is used for transferring message via objects. It is free of cost on internet and thus no cost for downloading [19].

3.4.2 Features of NS2

- Various Protocol design, traffic studies in a network
- Comparison of various protocols
- New architecture design are also supported
- It is freely distributed and open source
- Increase confidence in result
- Modular, documented core
- C++ and OTcl programming language used
- Adjusted with real system
- Software integration
- Virtualization and tested integration
- Updated models for network

3.4.3 Properties of NS2

A simulator used to maintain a scheduler which is used for timing of events. Types of languages used are:-

- **System language**: C++ which is a medium level language is used as an implementation for compilation purposes, it is fast and easy language, widelyused for implementation, and compilation purpose, used to manage complexity, with efficiency.

- **Scripting language**: OTcl is a high level language used for faster processing since used to interpretation rather than compilation hence it is less efficient.

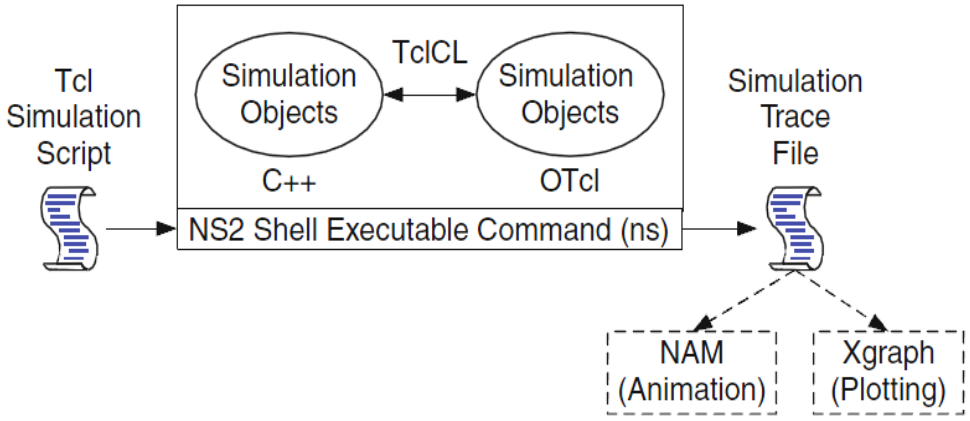

Figure 3.6 Basic architecture of NS.

3.4.4 NS2 Visualization Tool (Nam)

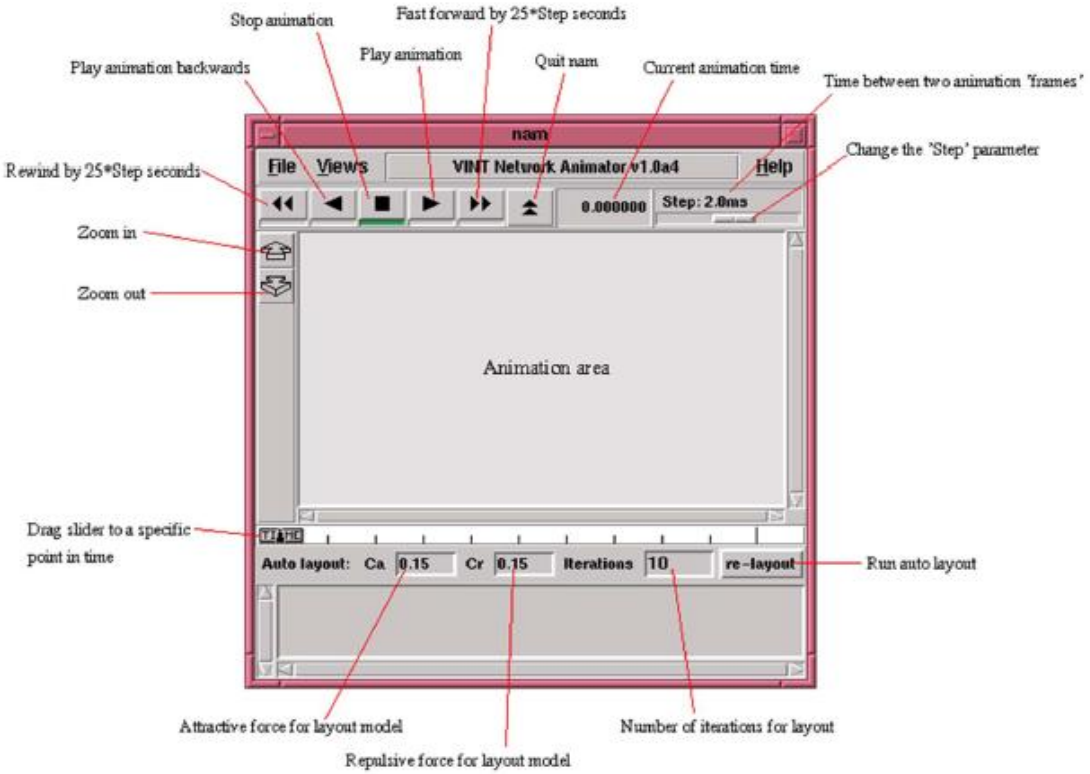

Figure 3.7 NS2 Visualization Tool

3.4.5 NS2 Analysis Tool (Xgraph)

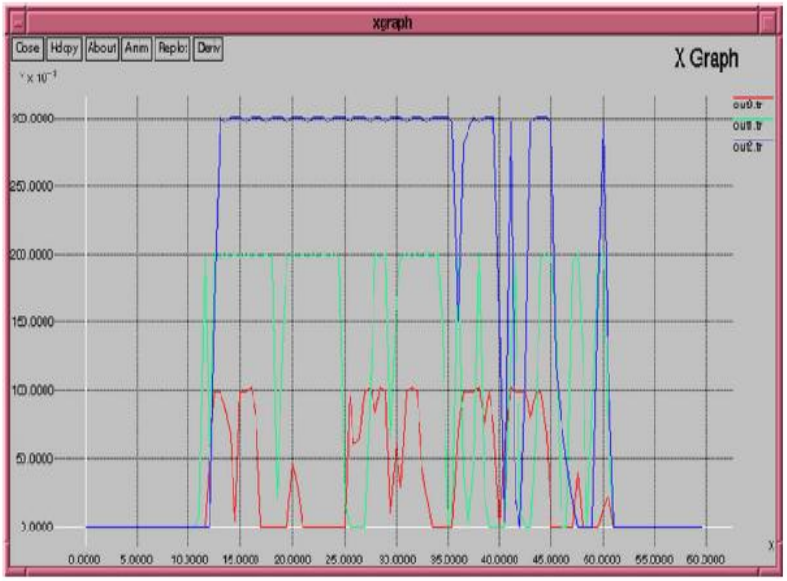

Figure 3.8 NS2 Analysis Tool (Xgraph)

CHAPTER-4
RESULTS AND DISCUSSIONS

In this section various results have been outlined by using snapshots and various types of graph at each and every point of time with our proposed approach and compared with the existing work done and various other scenario. We have performed various experiments on the purposed method. The work on which the experiments are being performed are in scenario, scenario1, scenario2. Various graph are of all three scenario with the comparison are being shown.

4.1 Result of 1st scenario

In the 1st scenario there are 4 mobile nodes 0,3,4,7 are being establish inside a network and also 8 relay node relay nodes are used because Relay network is a very broad class inside network to form various topology which we can use in wireless network. It's like when some intermediate nodes are placed between the source and the destination. These are being used in the places where the source and the destination cannot communicate to each other because of the greater transmission range between both the end systems then there is a need for relay node inside a network.

A relay network is used to send info and to communicate between the source and destination which are not in transmission range of each other. Relay information is being transferred between the source and destination. Relay node are to be the intermediate node between the source and destination they can be used in many topologies like line shape ,ring shape, tree shape and also they pass the information between the source and destination in fastest and most efficient way as possible.

In the following scenario relay nodes are also being establish between the intermediate nodes such as between 0 and 3, 0 and 4, 4 and 7, and 7 and 3 such that to make the nodes 1 ,2,3 and 4 to communicate to each other. Relay nodes are used because the distance between the nodes 3,4,0,7 is greater for transmission of information

Starting with the 1st scenario here is the snapshot of the initial point at which the mobile nodes (M.node) is starting at its initial point and all the sensor nodes are active at this point

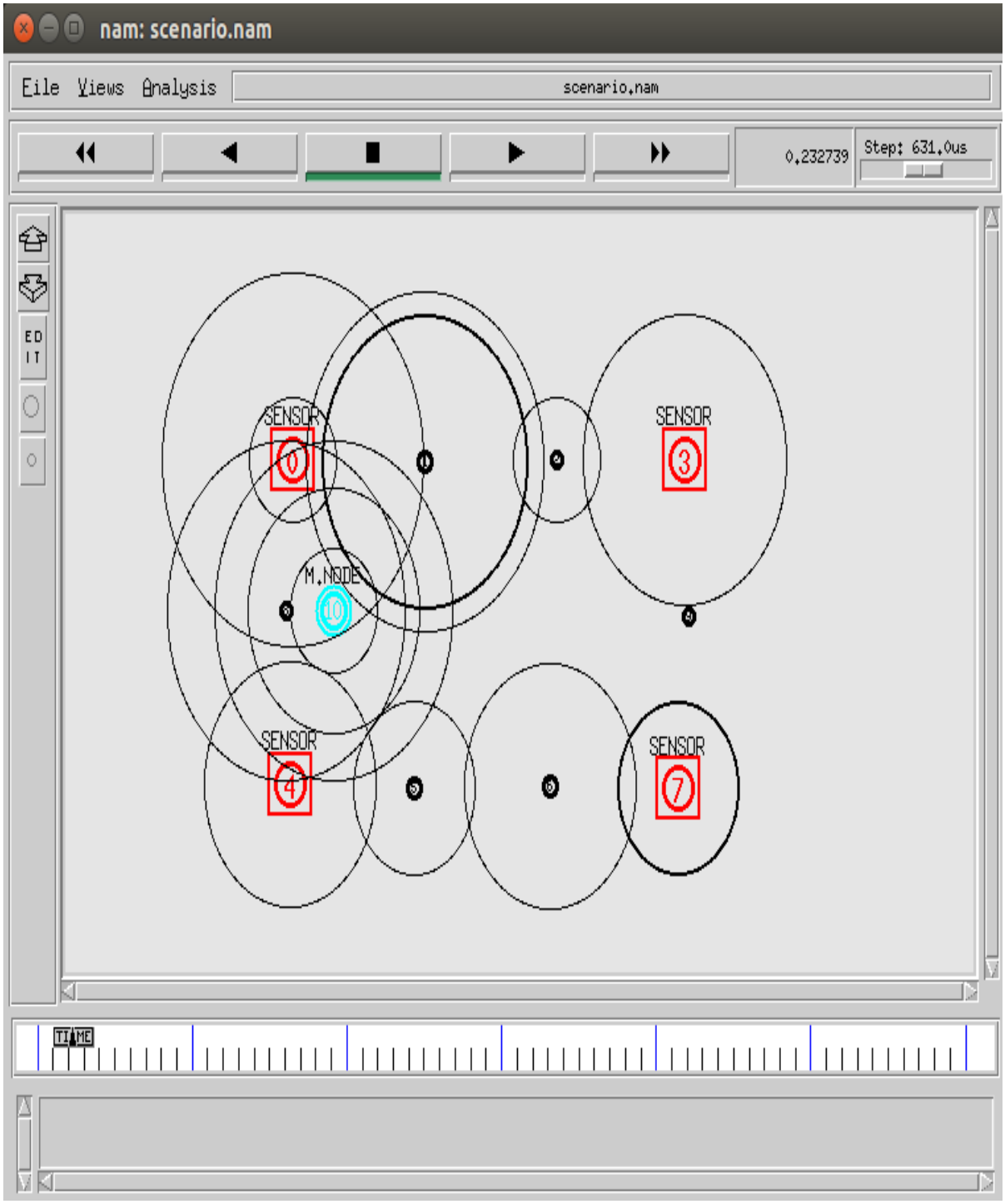

Figure 4.1 Initial point of the 1st scenario

of time. All the sensor nodes 0,3,4,7 are active at this point of time.

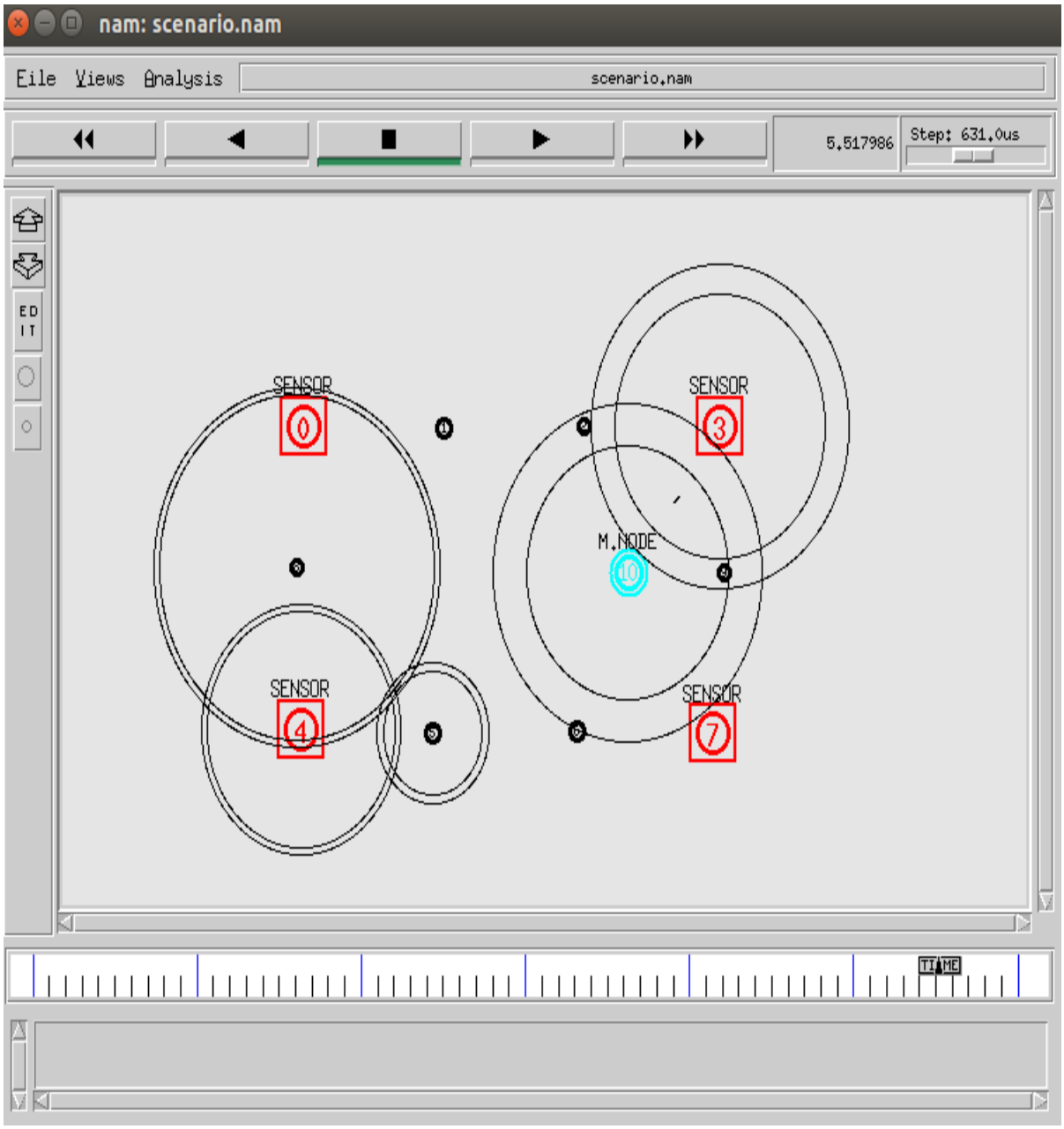

Figure 4.2 Final point of mobile node of the 1st scenario

Here in figure4.2 activation and loss of energy of sensor nodes are there all time whether there is mobile node in there range or not like sensor node 0 and 4 are wasting their power and the nodes like 7 and 3 are jamming the mobile node.

Here there is relay nodes are being attach to make the connection between the sensor nodes.

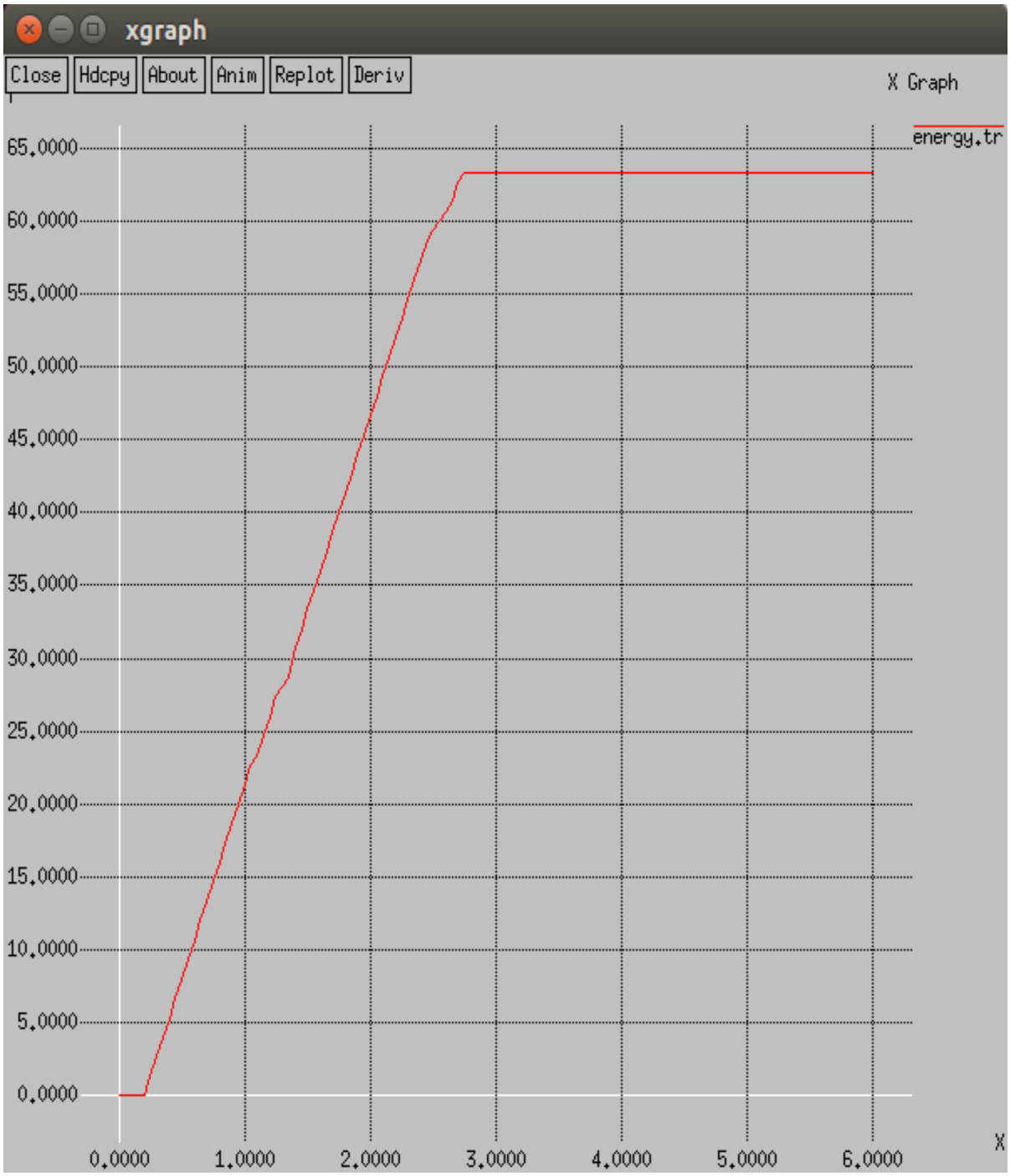

Figure 4.3 Energy graph for the 1st scenario

In this (figure 4.3) graph the energy raises at different interval of time and then at a particular time interval it become constant.In this scenario the energy loss is maximum because all the nodes sending signal all the time to the particular mobile node

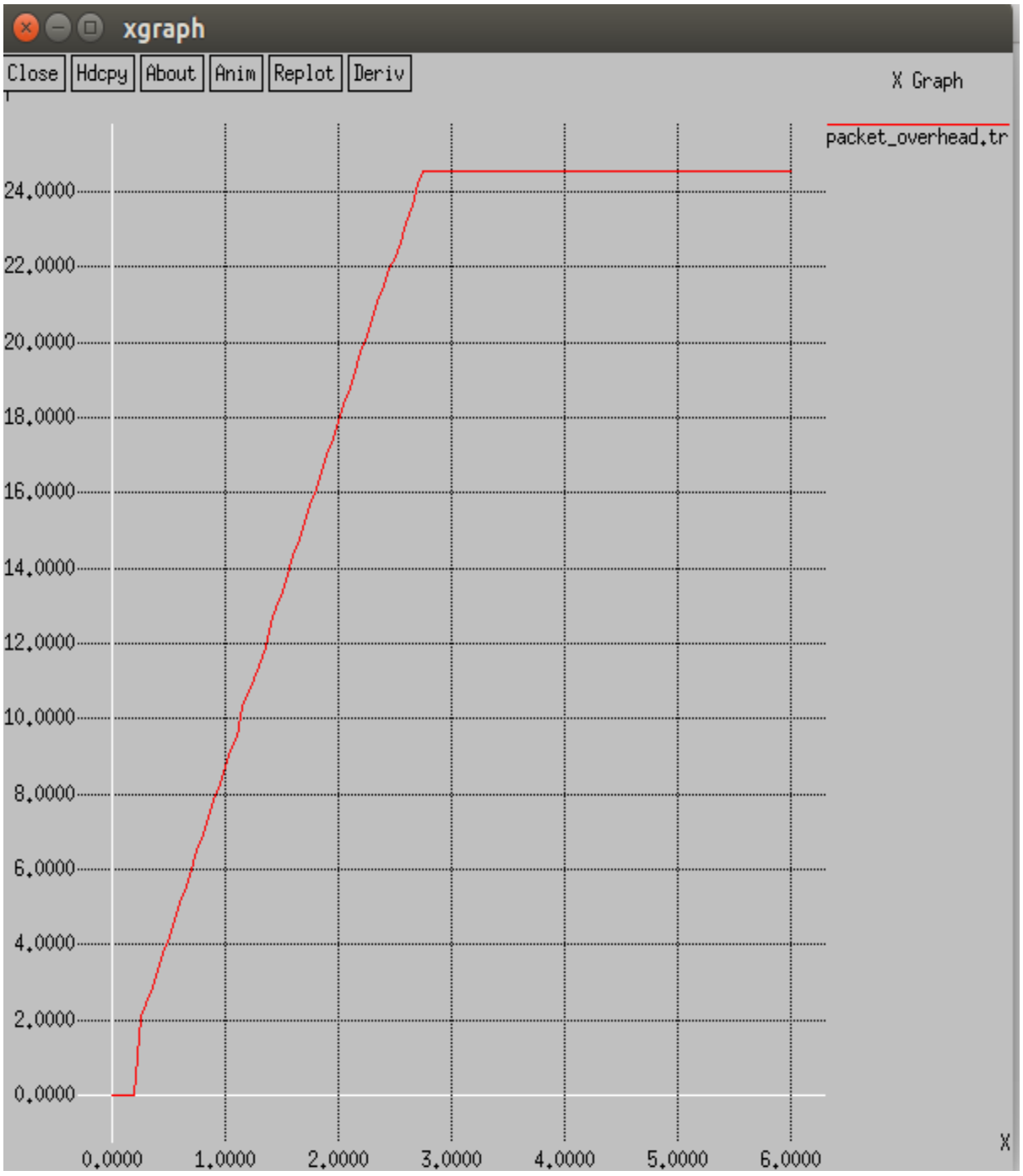

Figure 4.4 Packet overhead graph for the 1st scenario

Here in (figure 4.4) graph of packet overhead is calculated for the 1st scenario.

Packet overhead is calculated at all time period and it raises higher and then at a certain point it become constant.

4.2 Result of 2nd scenario

In the 2nd scenario there are 4 mobile nodes 0,3,4,7 are being establish inside a network with one mobile node and also 8 relay node relay nodes are used because Relay network is a very broad class inside network to form various topology which we can use in wireless network.It's like when some intermediate nodes are placed between the source and the destination. These are being used in the places where the source and the destination cannot communicate to each other because of the greater transmission range between both the end systems then there is a need for relay node inside a network.

A relay network is used to send info and to communicate between the source and destination which are not in transmission range of each other. Relay information is being transferred between the source and destination. Relay node are to be the intermediate node between the source and destination they can be used in many topologies like line shape ,ring shape, tree shape and also they pass the information between the source and destination in fastest and most efficient way as possible.

In the following scenario relay nodes are also being establish between the intermediate nodes such as between 0 and 3, 0 and 4, 4 and 7, and 7 and 3 such that to make the nodes 1 ,2,3 and 4 to communicate to each other. Relay nodes are used because the distance between the nodes 3,4,0,7 is greater for transmission of information

Now starting with the 2ndscenario let's begin with various screen shots that are being taken at the time for experiment.In figure 4.5 there are 4 sensor node 0,4,3,7 and one mobile node that is defined by M.node.is being used all the 4 sensor are being plotted at a fixed point inside a network and the mobile node M.NODE is used to move all along the network and the nodes 0,3,4,7 used to calculate the PDR value and by the calculation of the PDR value the nodes 0,3,4,7 goes into a sleep mode to consume less power. Figure 4.5 is the initial view of the scenario 2nd where the mobile node (M.NODE) is going to start from the initial location inside a network to and pass along all the sensor node and then it reach to its final location after going through all the sensor node between the process all the sensor node will calculate the energy, packet overhead, and the PDR (packet delivery ratio) value which is defines in further snapshot.

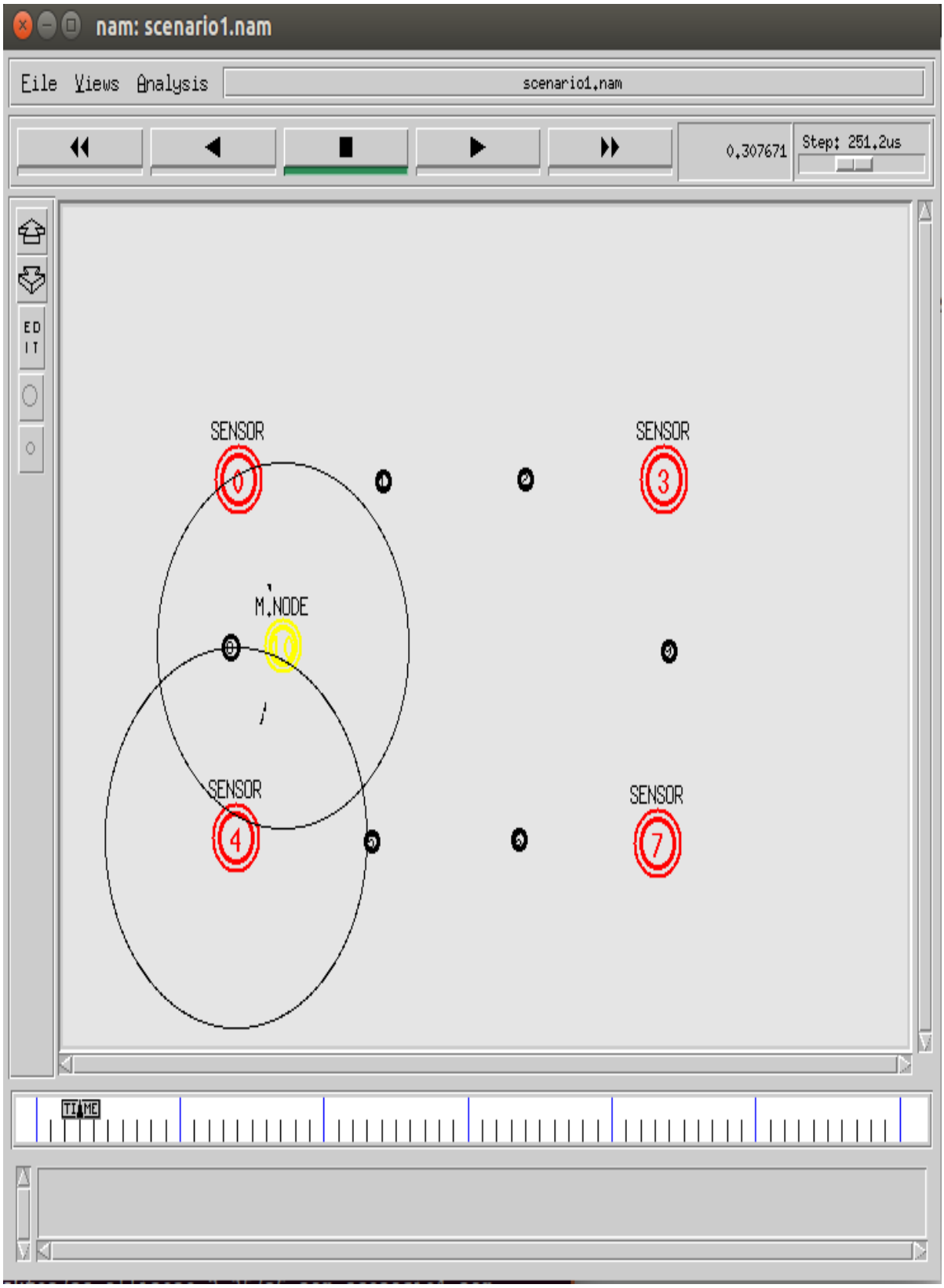

Figure4.5 Initial point of 2nd scenario

By using the packet delivery ratio (PDR) in my work, here the sensor nodes will calculate the PDR value just by calculating {No of packet received (acknowledge) / total no of packet send} and then it send that PDR value to its neighboring nodes to compare its PDR with the other neighboring node.

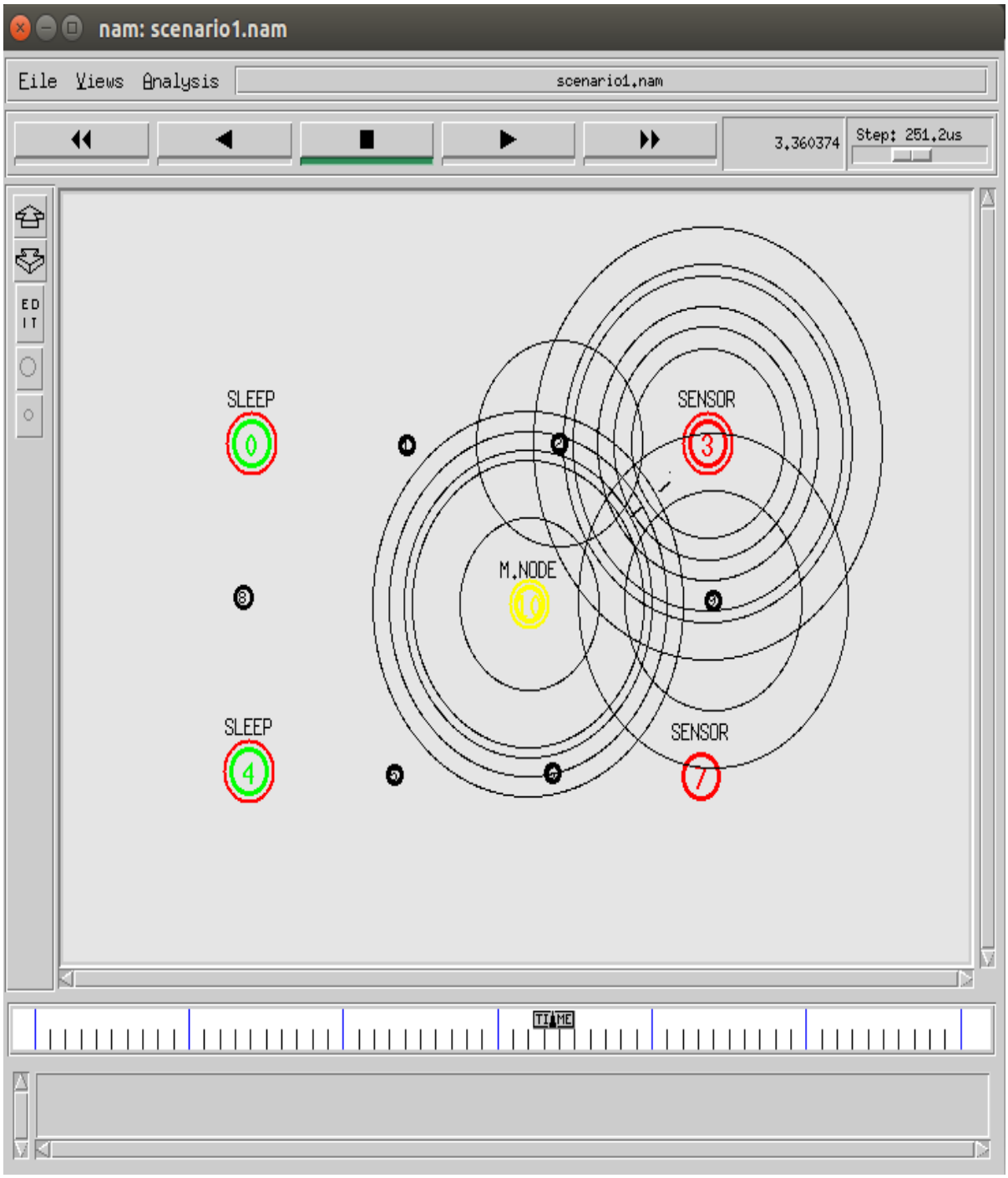

Figure 4.6 Sensor node 0 and 4 goes in sleep mode

When the neighboring nodes get the PDR value, they compare the PDR value with their PDR value. If they found the PDR value greater than their PDR value, they update that to their storage and stop jamming the target node and goes in sleep mode because the jamming node with more PDR value will only jam the target node and make all other neighboring node to stop jamming the target node.

The packet delivery ratio is calculated by sensor node 0 and 4 because the mobile node (M. node) is not in range of both the nodes, so by calculating the PDR by both the sensor node 0 and 4, we will find the PDR value. And the PDR value of both the nodes is lesser then both the nodes goes into the sleep mode.

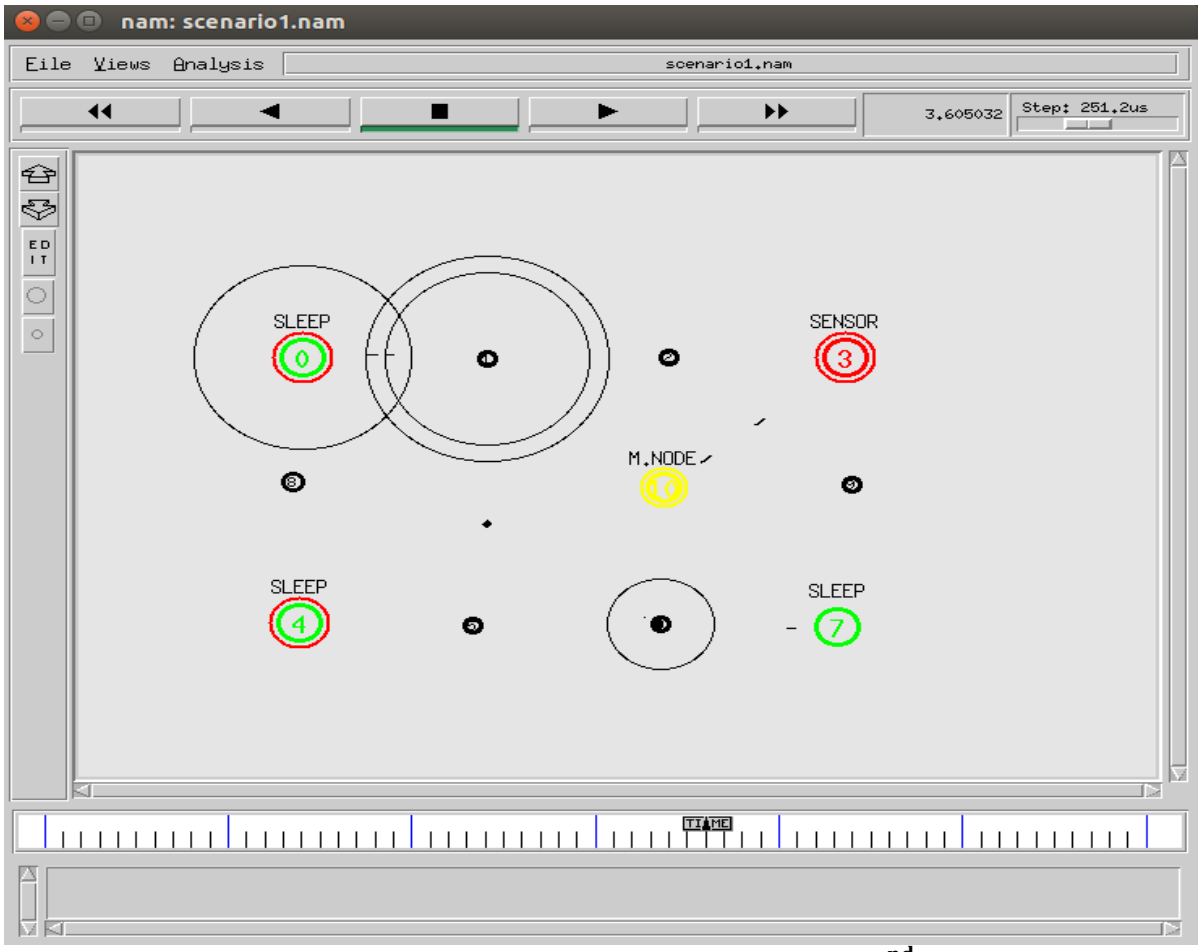

Figure 4.7 Sensor node 0, 4, 7 goes in sleep mode in 2nd scenario

In figure 4.7 the PDR value of node 7 and 3 is calculated then we found the PDR value of node 3 is greater than of the sensor node 7 then it will transmit a broadcast message to all the

neighboring nodes to stop transmitting radio signal to the mobile node and this jamming node 3 will jam that particular mobile node because of greater PDR value.

The PDR value is being checked by each sensor node after a particular interval of time such that node which is to be jammed is jammed by its nearer jamming node, so the less power is to be conserved such that in the 1st scenario, sensor nodes used to transmit the radio signal continuously even if there is no mobile node into their coverage range.
By using the packet delivery ratio, the particular jamming node with highest PDR calculated is to transmit the radio signal to the target node which is in the proper range of the particular jamming node

All the jamming nodes are transmitting the radio signal even if there is no mobile node within their range such that the power consumption is more in that 1st scenario because all sensor nodes are transmitting the radio signal without any use. By using the PDR power consumption in my scenario will be less in comparison to the previous work done.

NODE ID	**PDR CALCULATION**
Node 0	24200
Node 1	24222
Node 2	24244
Node 3	24266

Table 4.1 Table for PDR calculation for the 2nd scenario

Table 4.1 shows the PDR value of each and every node in the scenario by which the nodes are going into the sleeping mode

In this (figure 4.8) graph the energy raises at different interval of time and then at a particular time interval it become constant. In this scenario the energy loss is less as compare to the

1st scenario because 0, 4, 7 nodes gone into a sleeping state for a particular interval of time so energy is consumed less.

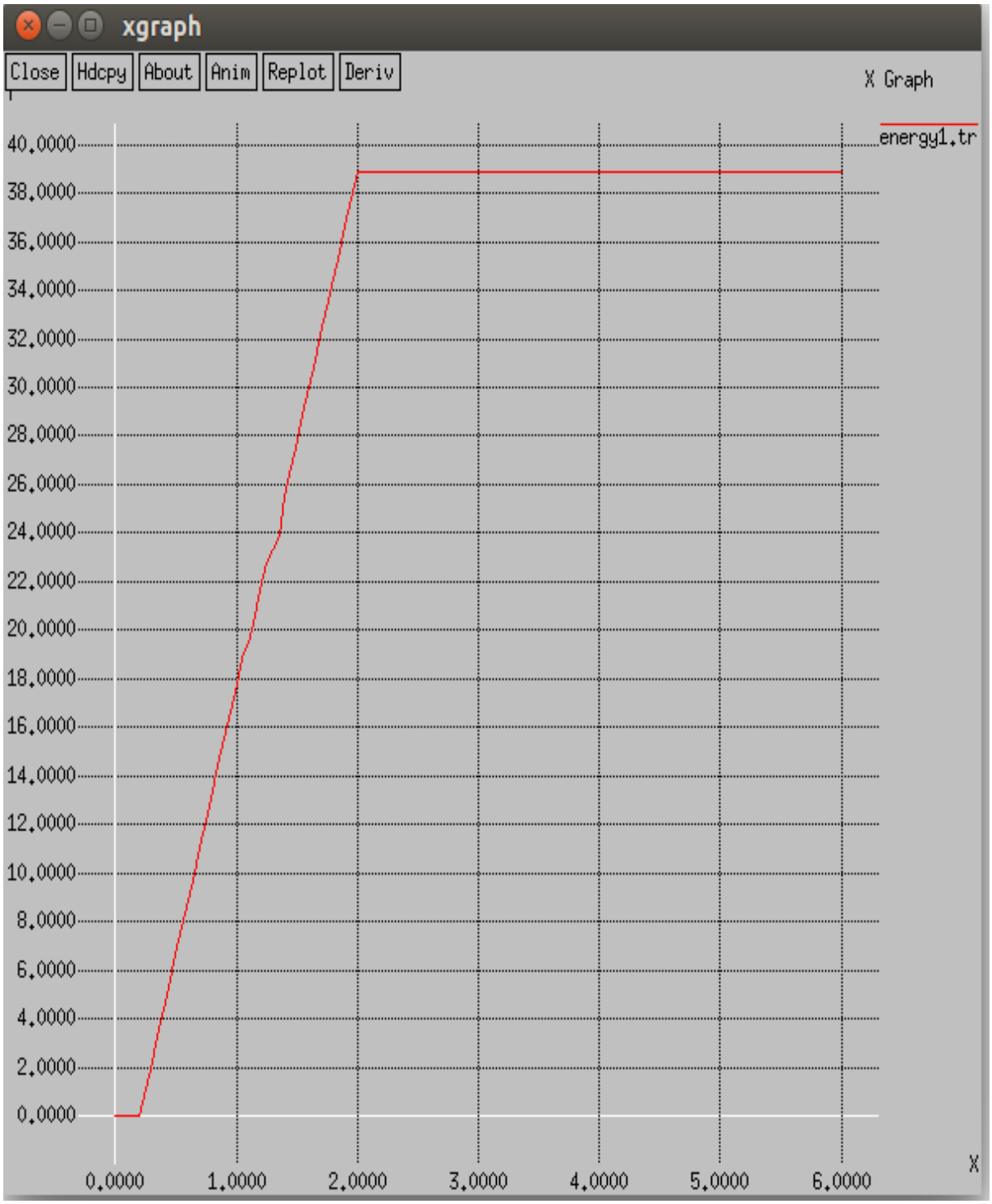

Figure 4.8 Energy graph for the 2nd scenario

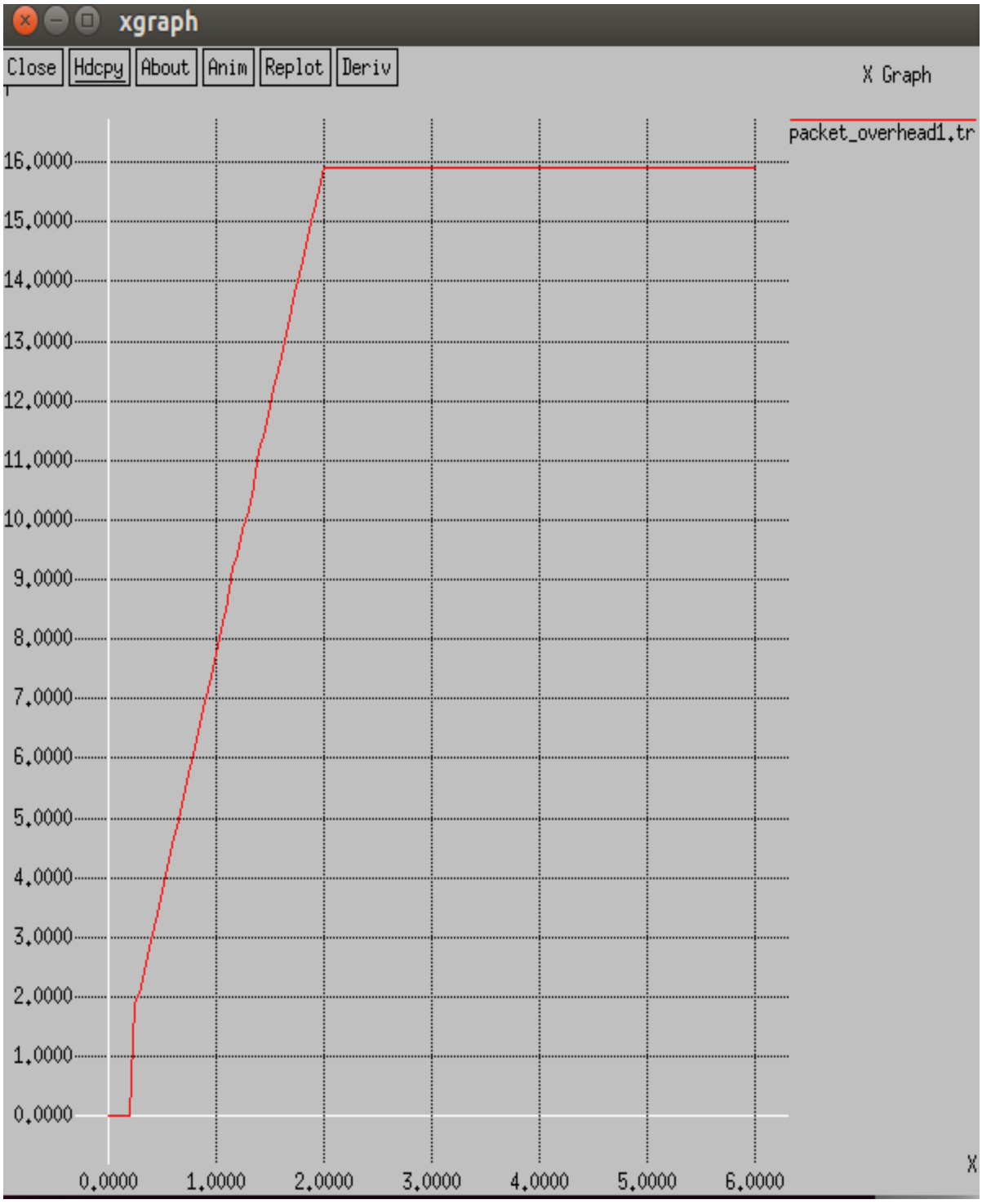

Figure 4.9 Packet overhead graph for the 2nd scenario

Here in (figure 4.9) graph of packet overhead is calculated for the 2nd scenario. Packet overhead is calculated at all time period and it raises higher and then at a certain point it become constant.

4.3 Result of 3rd scenario

In the 3rd scenario there are 4 mobile nodes 0,3,4,7 are being establish inside a network with one mobile node and also 8 relay node relay nodes are used because Relay network is a very broad class inside network to form various topology which we can use in wireless network. It's like when some intermediate nodes are placed between the source and the destination. These are being used in the places where the source and the destination cannot communicate to each other because of the greater transmission range between both the end systems then there is a need for relay node inside a network.

A relay network is used to send info and to communicate between the source and destination which are not in transmission range of each other. Relay information is being transferred between the source and destination. Relay nodes are to be the intermediate nodes between the source and destination they can be used in many topologies like line shape,ring shape, tree shape and also they pass the information between the source and destination in fastest and most efficient way as possible.

In the following scenario relay nodes are also being establish between the intermediate nodes such as between 0 and 3, 0 and 4, 4 and 7, and 7 and 3 such that to make the nodes 1 ,2,3 and 4 to communicate to each other. Relay nodes are used because the distance between the nodes 3,4,0,7 is greater for transmission of information

Now starting with the 3rd scenario let's begin with various screen shots that are being taken at the time for experiment.In figure 4.11 there are 4 sensor node 0,4,3,7 and one mobile node that is defined by M.node.is being used all the 4 sensor are being plotted at a fixed point inside a network and the mobile node M.NODE is used to move all along the network and the nodes 0,3,4,7 used to calculate the PDR value and by the calculation of the PDR value the nodes 0,3,4,7 goes into a sleep mode to consume less power. Figure 4.10 is the initial view of the scenario 3rd where the mobile node (M.NODE) is going to start from the initial location inside a network to and pass along all the sensor node and then it reach to its final location

after going through all the sensor node between the process all the sensor node will calculate the energy, packet overhead, and the PDR (packet delivery ratio) value which is defines in further snapshot.

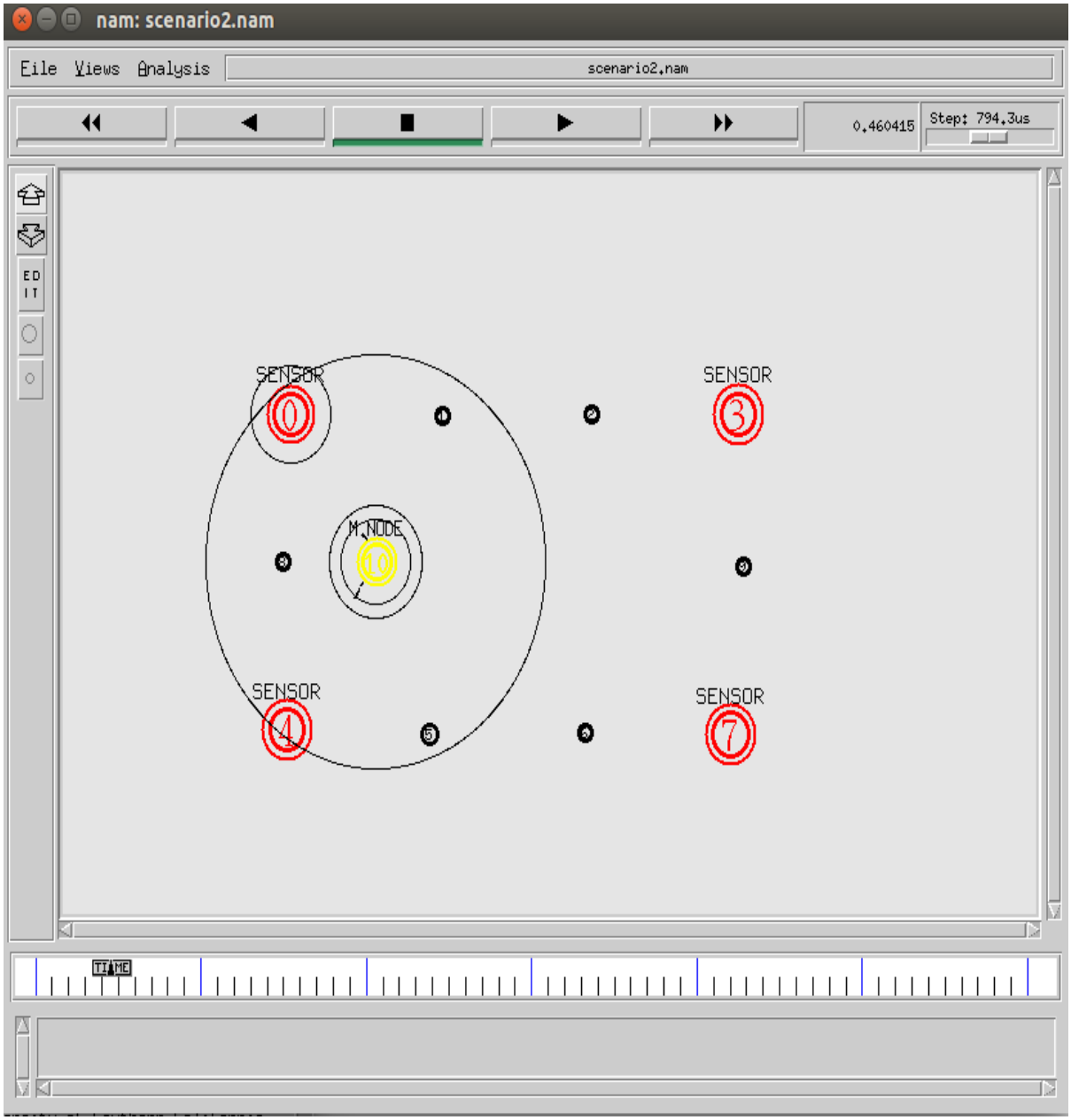

Figure 4.10 Initial point for the 3rd scenario

Packet delivery ratio by using the particular threshold value. When the packet is being transfer from one node to the other mobile node, it checks its PDR value for that particular mobile node the PDR value is calculated by each mobile node. After calculating the PDR

value for each mobile node they calculate the threshold Value for each node if the PDR value of the jamming node is within the threshold value it will transmit the radio signal to the particular mobile node and jam it

If the PDR value is out of the threshold value then the particular jamming node will stop its transmission and wait for the mobile node to come into its coverage area till where the threshold value is calculated. When the mobile node comes into the area of particular jamming node it will again start transmitting the radio signal.

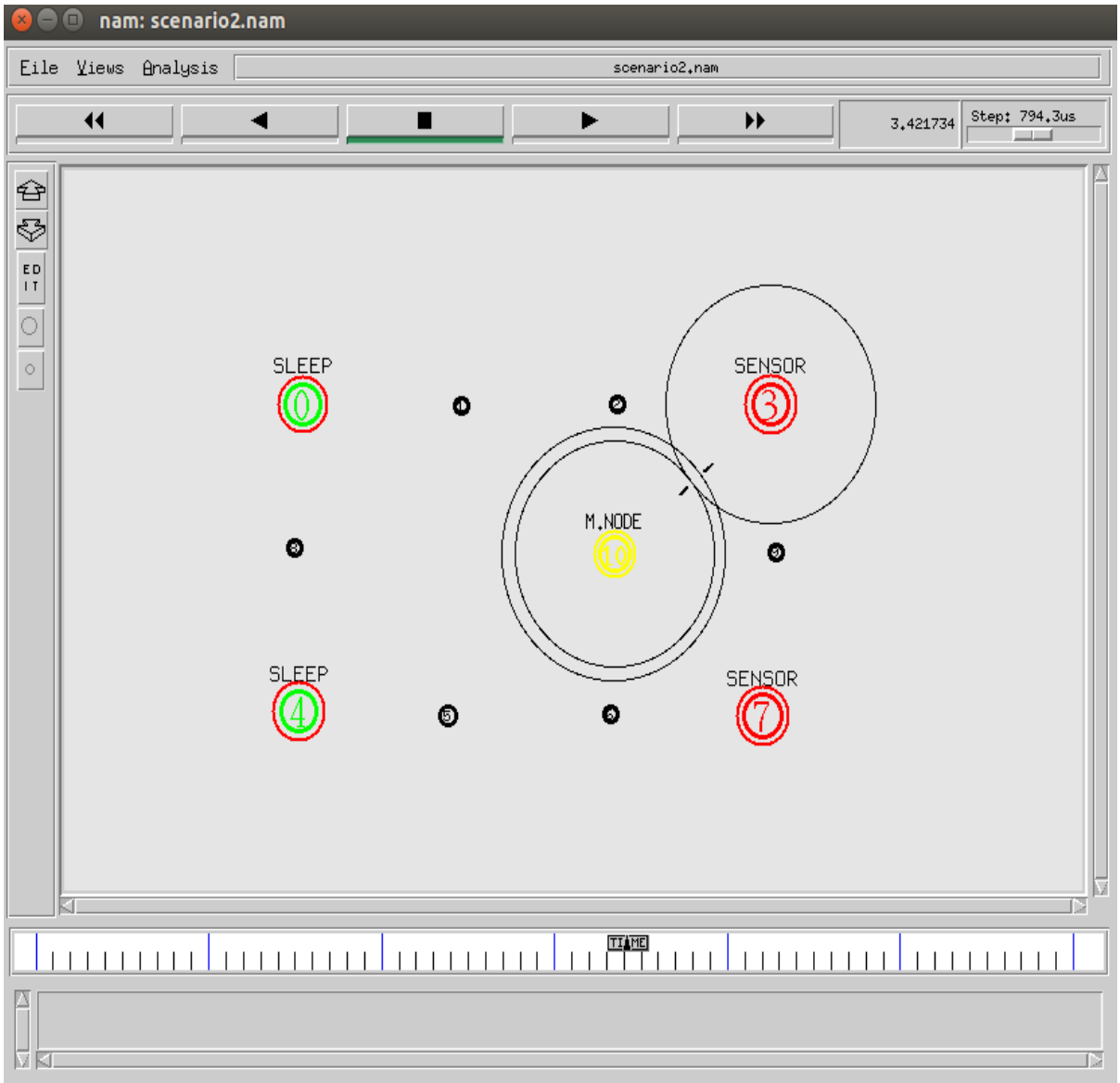

Figure 4.11 Sensor node 0 and 4 goes in sleep mode

Threshold value is defined as the value which is being assigned to each and every jamming node according to their coverage area. Till where they can jam the mobile node.

Here in the (figure 4.11) node 0 and 4 goes in sleep mode after comparing the threshold value with their PDR value.

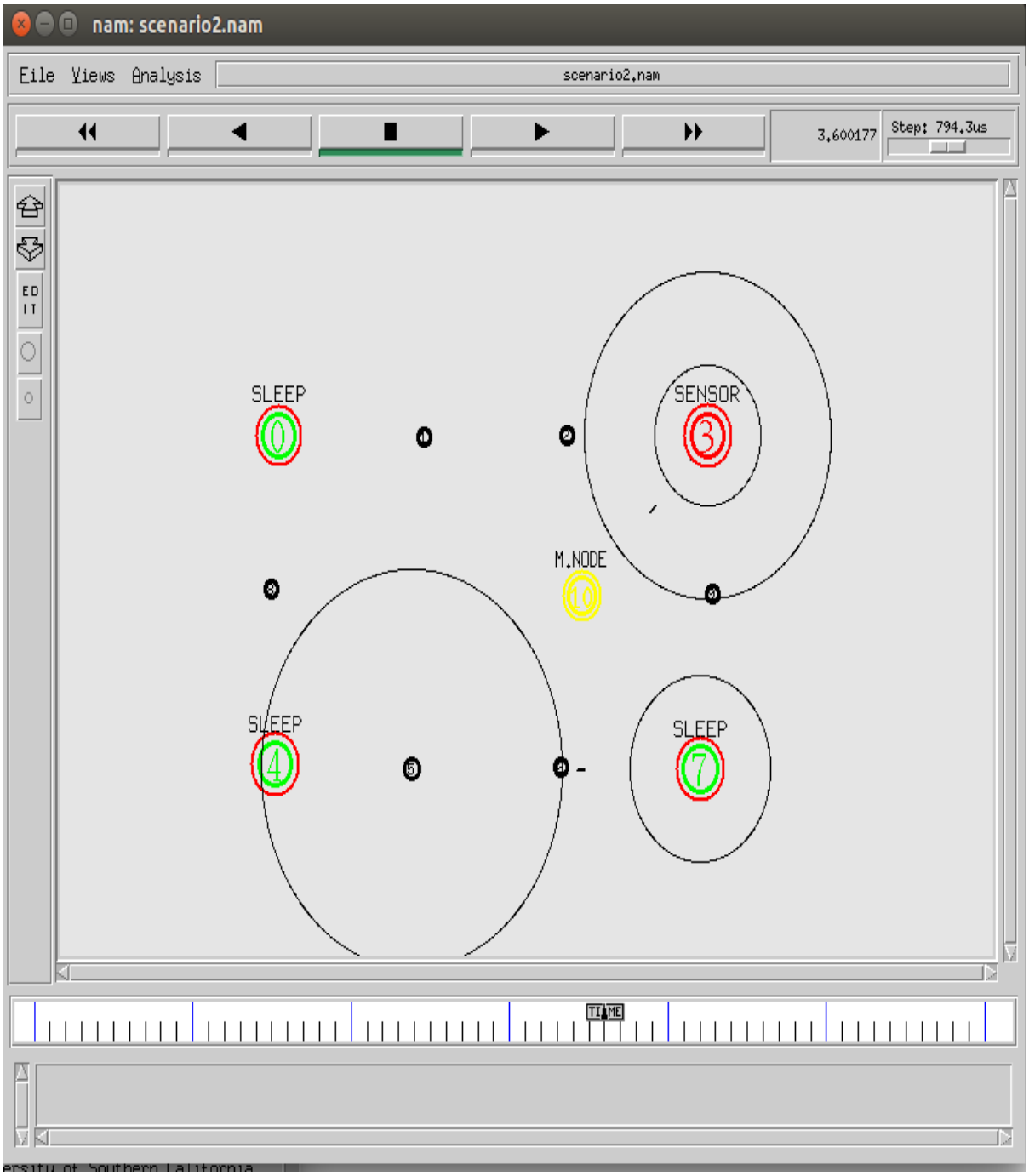

Figure 4.12 Sensor node 0.4,7 goes in sleep mode

Here we are calculating the average PDR value of the jamming node which is like a threshold PDR value to each and every jamming node. Now the jamming node will compare its original PDR value with assigned threshold PDR value (that we have calculated earlier) and after comparison it will transmit the radio signal and jam that mobile device.

Now here, there are 4 sensor nodes in which they are having their coverage area to which they will transmit their radio signal and jam the devices. Here 0,4,3,7 is having their own coverage area till where the threshold value is calculated for PDR.

If the mobile device comes in the coverage area of any node it will be jammed by jamming nodes by calculating the PDR value and comparing it with the threshold PDR value of its own. If mobile node leave the coverage area of particular node then the node will sleep.

In this the PDR value of node 0 and 4 is calculated then we found the PDR value of node 0 and 4 is less than of the threshold value that is assigned tothem then it will transmit a broadcast message to all the neighboring nodes to stop transmitting radio signal to the mobile node for a particular interval of time and thus goes into the sleeping mode for a particular time being and this jamming node 7 and 3 will jam that particular mobile node because of greater PDR value.
But after a particular interval of time the node 7 PDR goes less to its threshold value so node 7 will go into a sleeping mode for a particular interval of time.

NODE ID	**PDR CALCULATION**
Node 0	48000
Node 1	48048
Node 2	48096
Node 3	48144

Table4.2 Table for PDR calculation for the 3rd scenario

The PDR value is being checked by each sensor node after a particular interval of time such that node which is to be jammed is jammed by its nearer jamming node, so the less power isto be conserved such that in the 1st scenario, sensor nodes used to transmit the radio signal continuously even if there is no mobile node into their coverage range.By using the packet delivery ratio, the particular jamming node with highest PDR calculated is to transmit the radio signal to the target node which is in the proper range of the particular jamming node.

All the jamming nodes are transmitting the radio signal even if there is no mobile node within their range such that the power consumption is more in that 1st scenario because all sensor nodes are transmitting the radio signal without any use. By using the PDR power consumption in my scenario will be less in comparison to the previous work done.

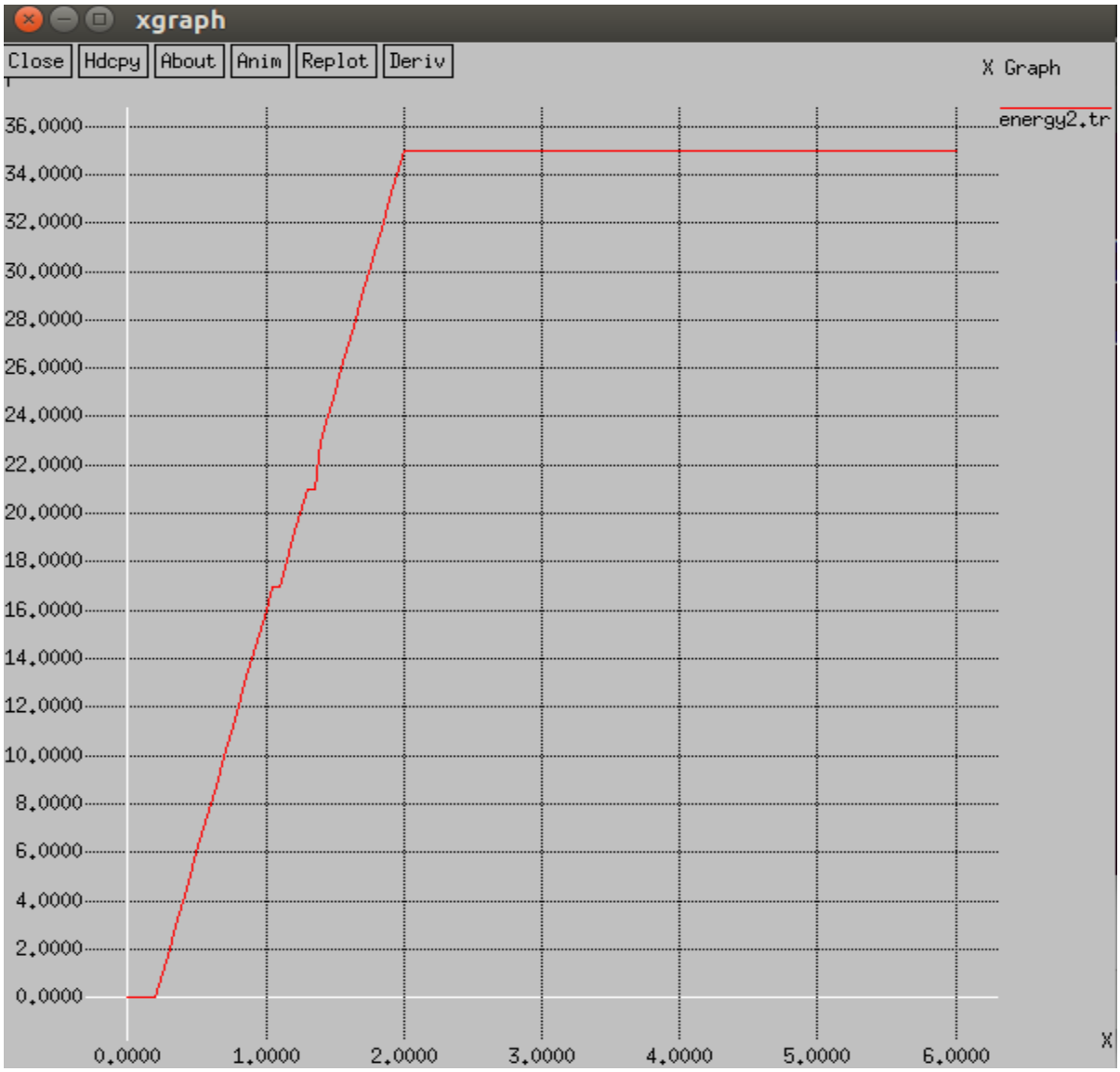

Figure 4.13 Energy graph for 3rd scenario

In this (figure 4.13) graph the energy raises at different interval of time and then at a particular time interval it become constant. In this scenario the energy loss is less as compare to the 1st and 2nd scenario because 0,4,7 nodes gone into a sleeping state after looking at their own threshold value for a particular interval of time so energy is consumed less in 3rd scenario.

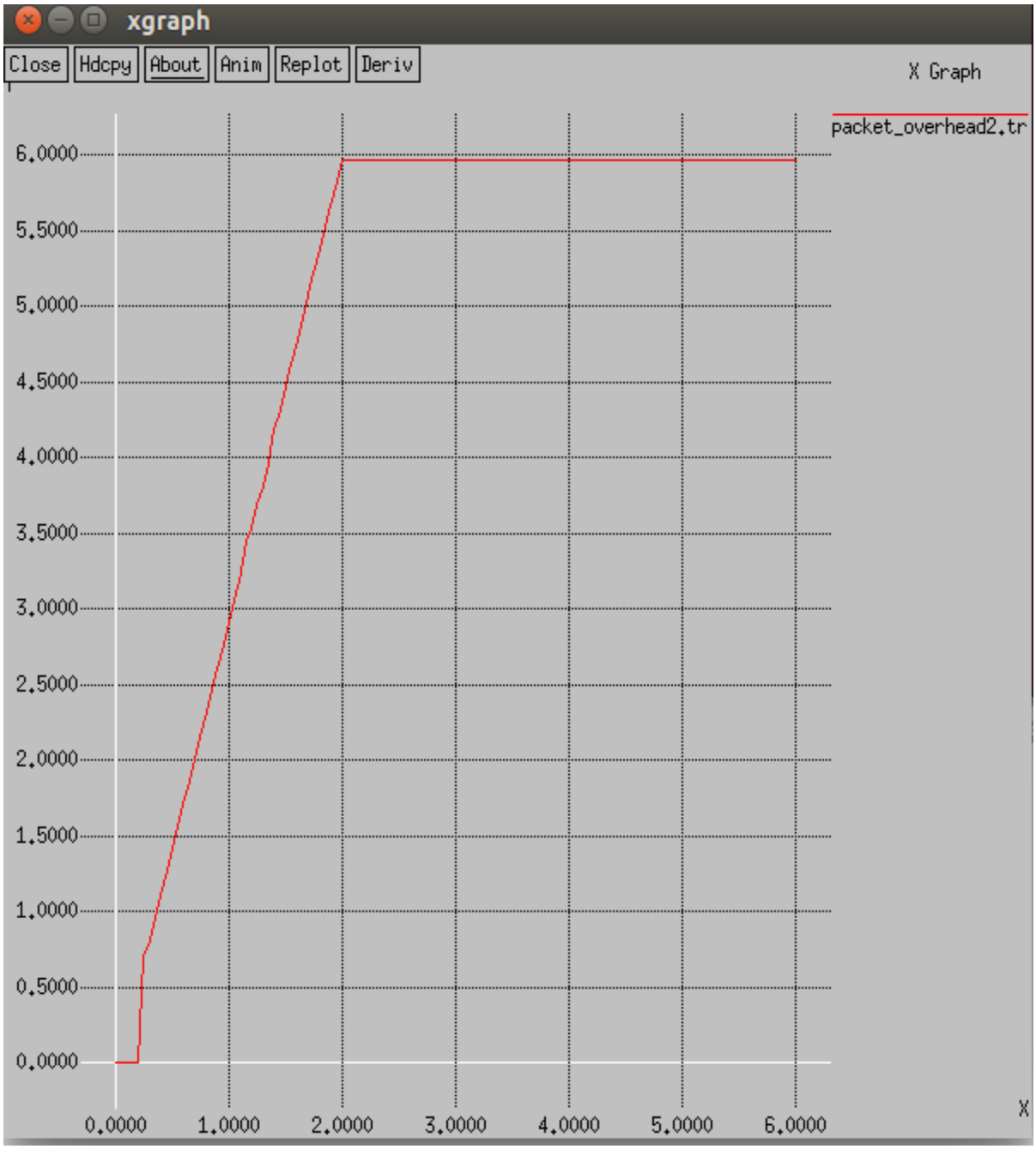

Figure 4.14 Packet overhead graph for 3rd scenario

Here in (figure 4.14) graph of packet overhead is calculated for the 3rd scenario.

Packet overhead is calculated at all time period and it raises higher than at a certain point it become constant.

4.4Comparison between all the scenarios by using energy graph

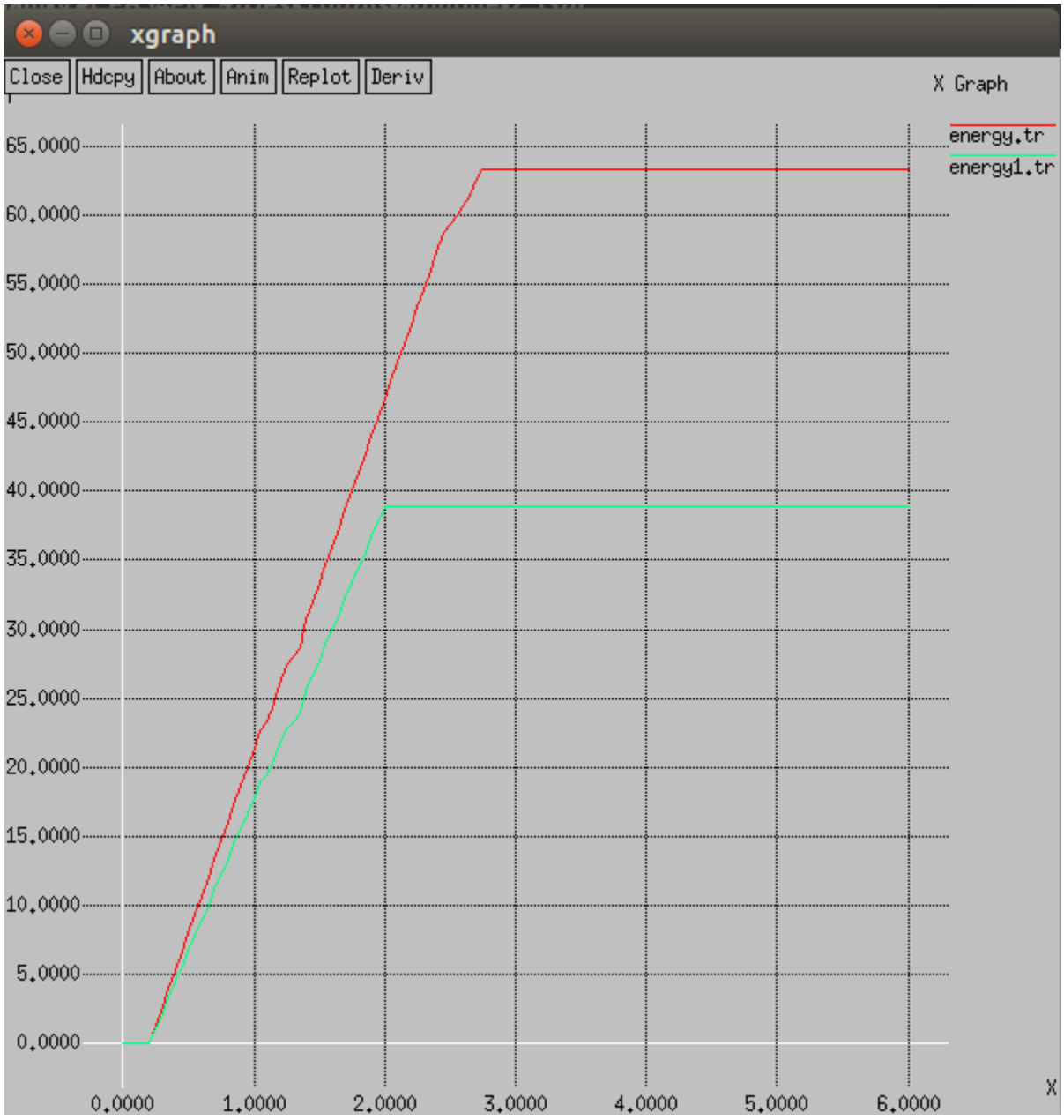

Figure 4.15 Energy of 1st scenario and 2nd scenario

Here in figure 4.15 there is a comparison between the 1st scenario and the 2nd scenario is being shown so that there is large amount of energy gap is in between both the scenario.

In 1st scenario due to large amount of wastage of energy is there such that it shows the higher energy graph and in 2nd scenario due to the comparison of PDR value with each of the sensor node and then activation of sleep mode by the sensor nodes it shows the less energy is being consumed.

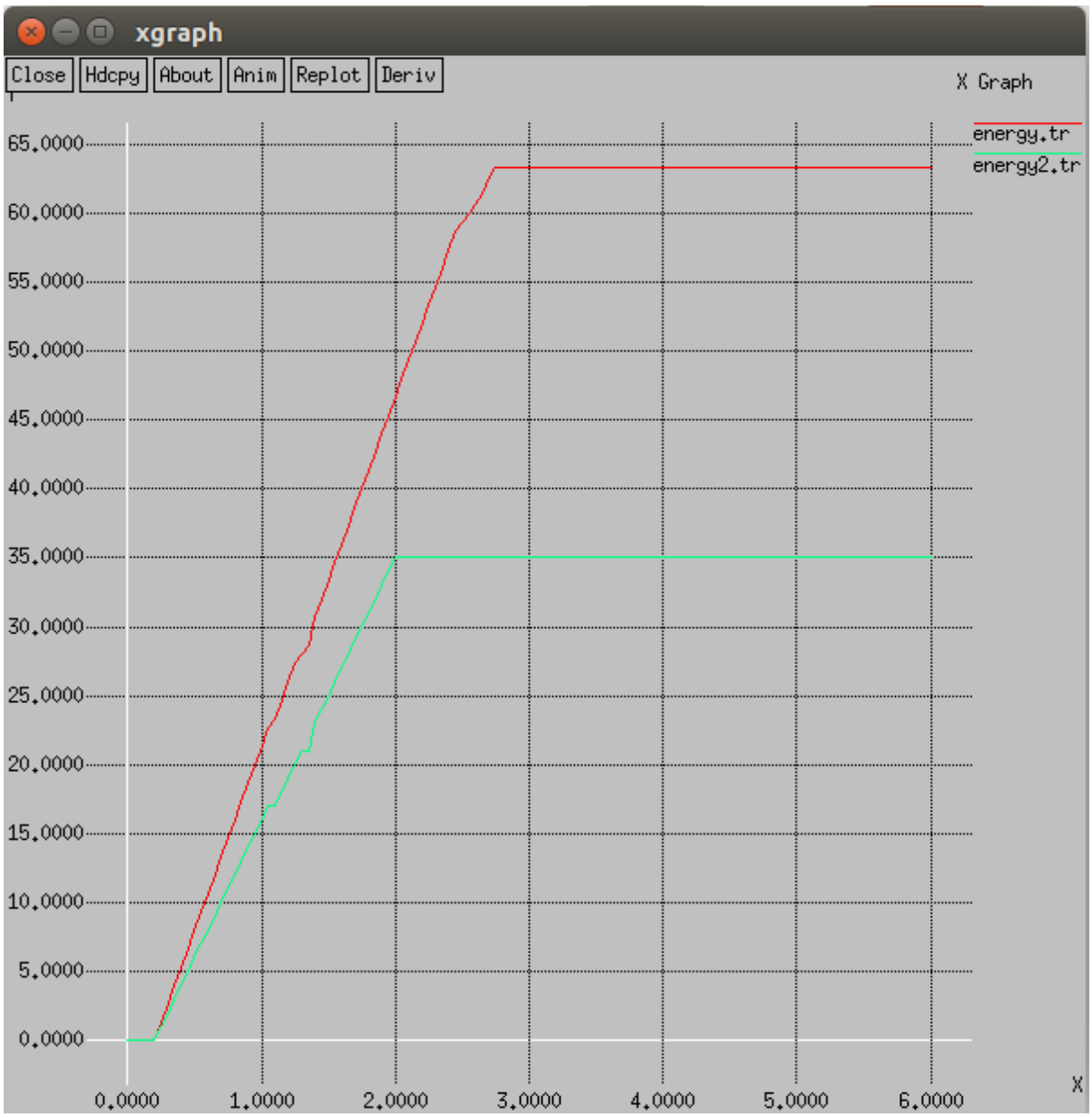

Figure4.16 Energy of 1st scenario and the 3rd scenario

Here in figure 4.16 there is a comparison between the 1st scenario and the 3rd scenario is being shown so that there is large amount of energy gap is in between both the scenario.

In 1st scenario due to large amount of wastage of energy is there such that it shows the higher energy graph and in 3rd scenario due to the comparison of PDR value with their own threshold value the activation of sleep mode by the sensor nodes is done so it shows the less energy is being consumed.

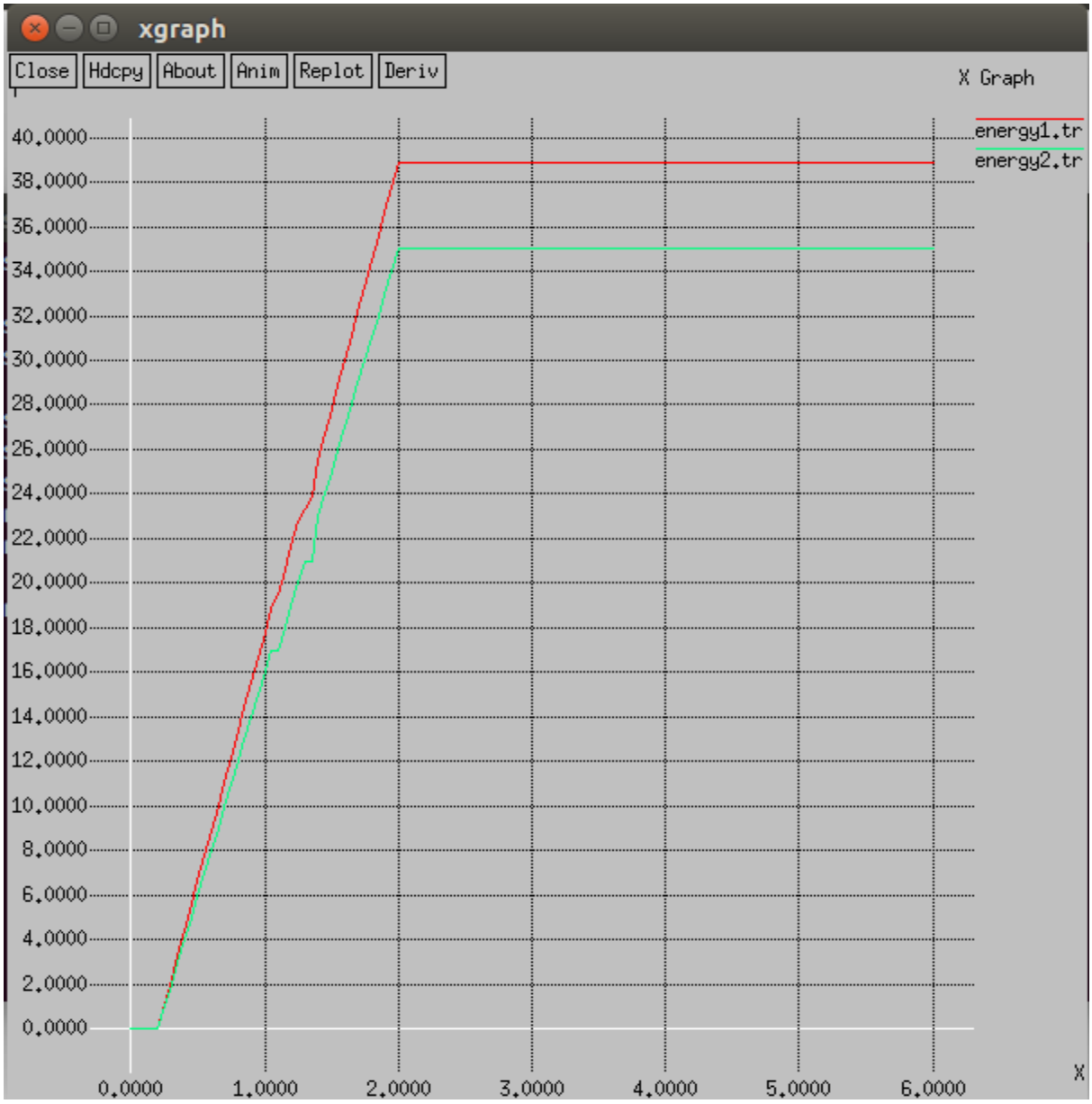

Figure 4.17 Energy of 2nd scenario and 3rd scenario

Here in figure 4.17 there is a comparison between the 2nd scenario and the 3rd scenario is being shown so that there is less amount of energy gap is in between both the scenario.

In 2nd scenario there is due to comparison between the neighboring node for the PDR value and then gone into sleep mode it shows the less energy and in 3rd scenario due to the comparison of PDR value with their own threshold value the activation of sleep mode by the sensor nodes is done so it shows the less energy is being consumed.

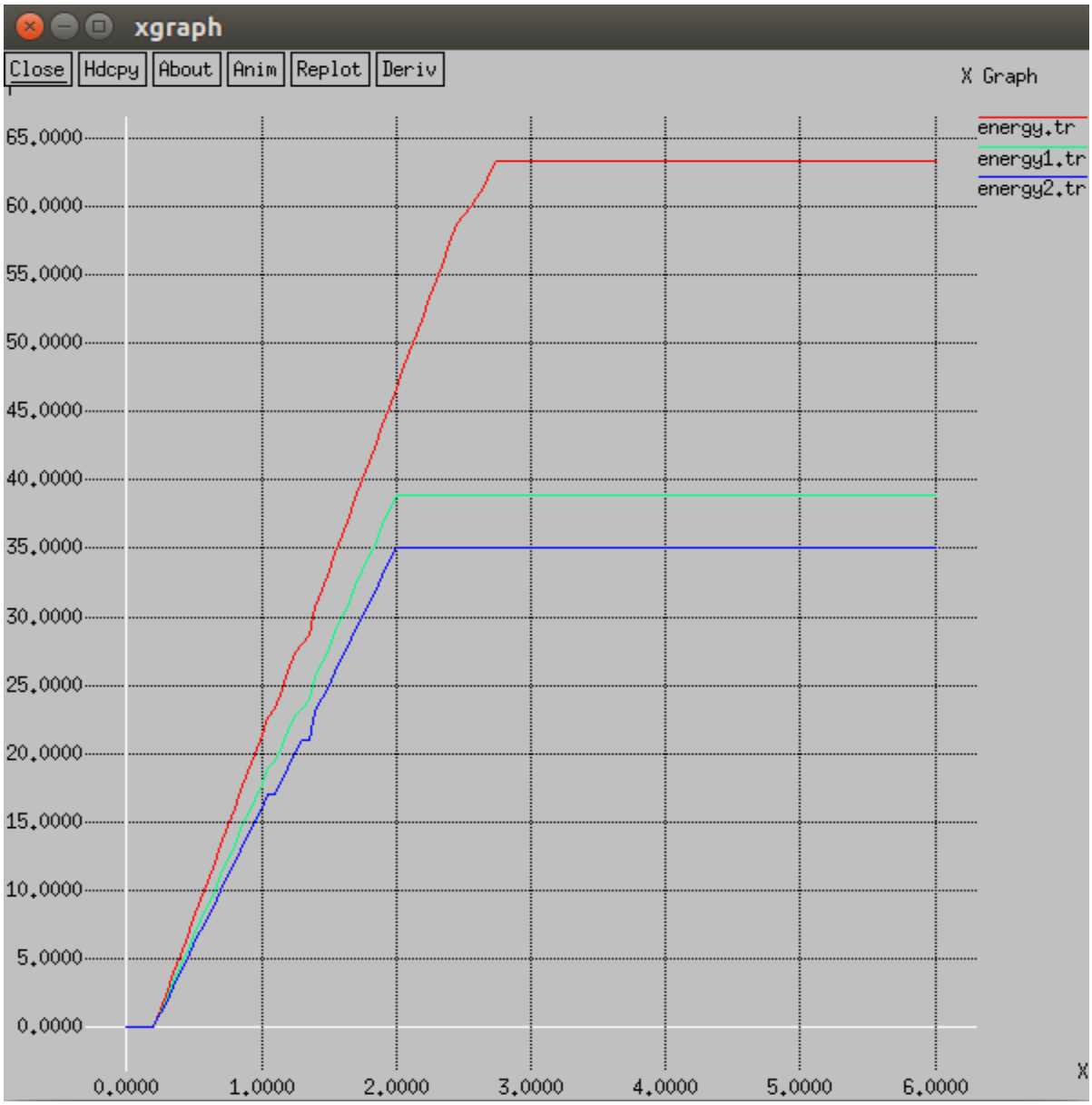

Figure 4.18 Energy comparison of all scenario

In the following figure 4.18 shows the comparison of all 1st,2nd and 3rd scenario.

4.5Comparison between all the scenarios by using packet overhead

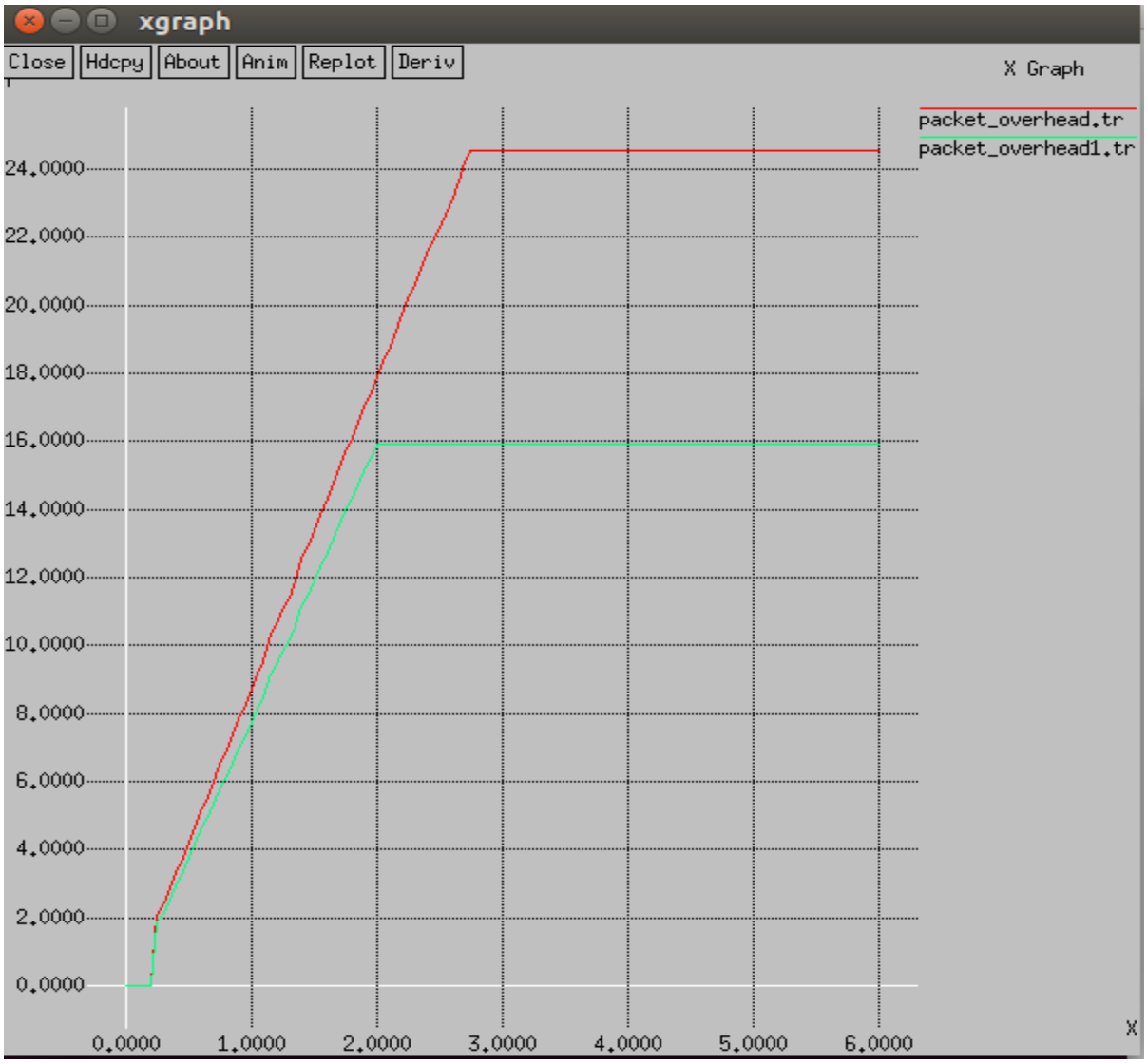

Figure4.19 Packet overhead of 1st scenario and 2nd scenario

Here in figure 4.19 there is a comparison between the 1st scenario and the 2nd scenario is being shown so that there is large amount of packet overhead is in between both the scenario. In 1st scenario due to large amount of wastage of energy is there such that it shows the higher packet overhead graph and in 2nd scenario due to the comparison of PDR value with each of the sensor node and then activation of sleep mode by the sensor nodes it shows the less packet overhead.

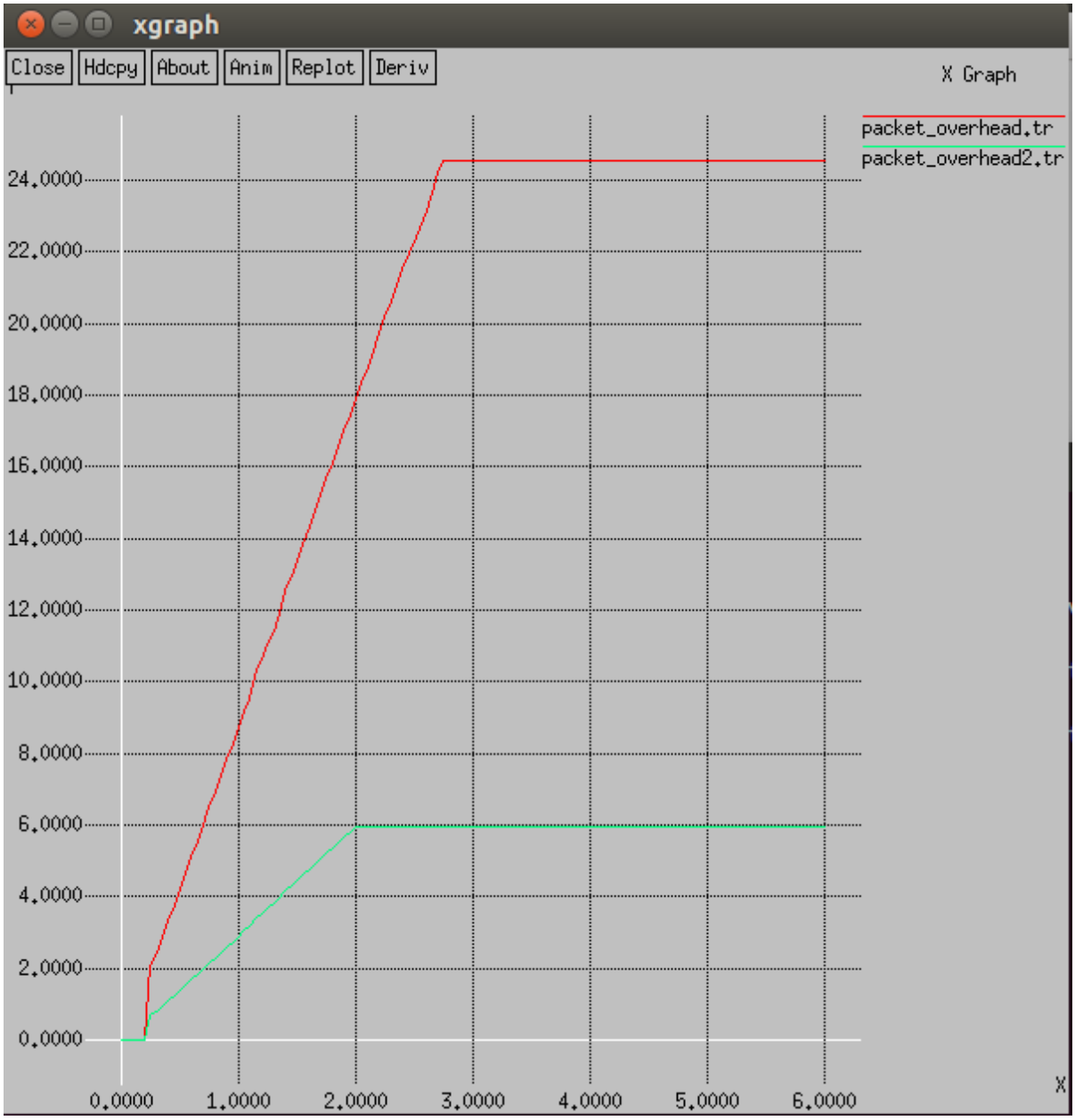

Figure4.20 Packet overhead of1st scenario and 3rd scenario

Here in figure 4.20 there is a comparison between the 1st scenario and the 3rd scenario is being shown so that there is large amount of gap is in between both the scenario for the packet overhead.

In 1st scenario due to more time it takes to transfer data is there such that it shows the higher packet overhead in graph and in 3rd scenario due to the comparison of PDR value with their own threshold value the activation of sleep mode by the sensor nodes is done so it shows the less packet overhead because it takes less time for the data transfer.

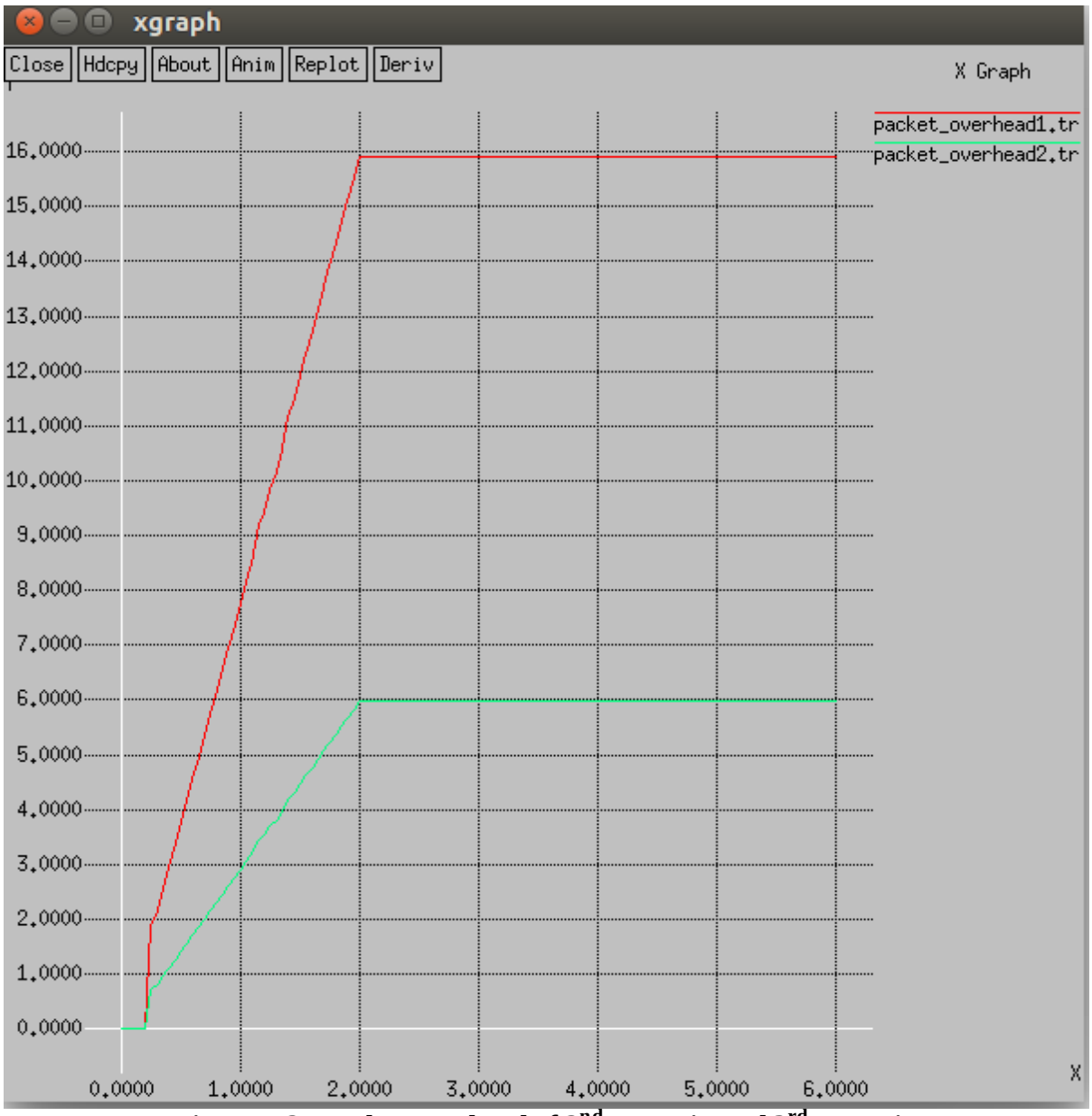

Figure 4.21 Packet overhead of 2nd scenario and 3rd scenario

Here in figure 4.21 there is a comparison between the 2nd scenario and the 3rd scenario is being shown so that there is large amount of packet overhead is in between both the scenario. In 2nd scenario there is due to comparison between the neighboring node for the PDR value and then gone into sleep mode it shows the less packet overhead and in 3rd scenario due to the comparison of PDR value with their own threshold value the activation of sleep mode by the sensor nodes is done so it shows the less packet overhead is being shown in graph.

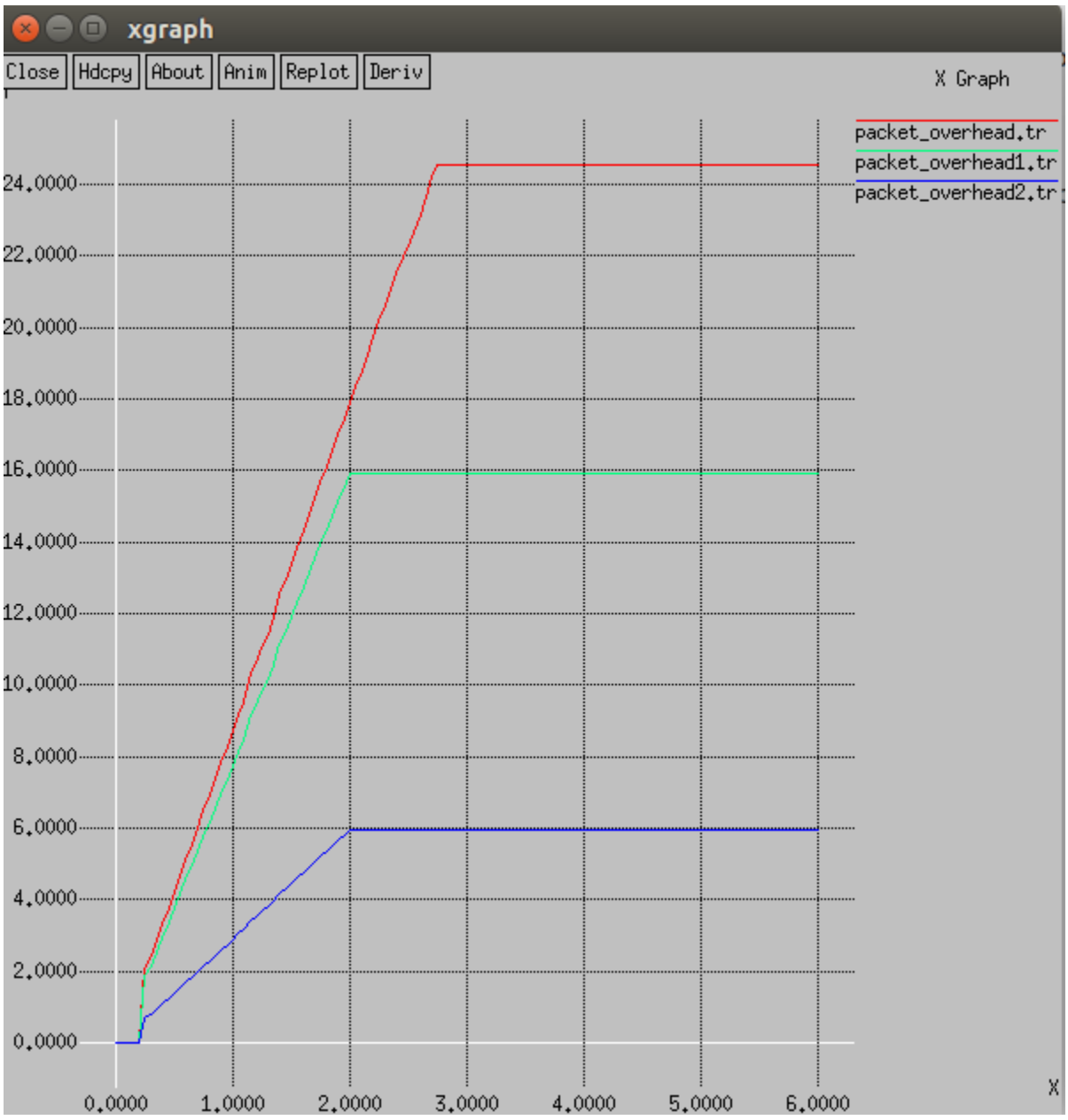

Figure 4.22 Packet overhead comparison of all scenario

In the following figure 4.22 shows the comparison of all 1st, 2nd and 3rd scenario.

CHAPTER-5
CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

Jamming It is like to stop making the device to communicate with the other devices .In simple words, jamming is a technique by which it disables the communication between two parties by interfering inside their communication by creating noise into their communication.In previous work the jamming is very power consuming so there arises a need for a jamming technique which conserves power.In this the main focused is on the aspects of jamming and their various performance issues like power conservation. So the new technique is being shown of packet delivery ratio (PDR). Two techniques are here to conserve power in jamming. In the first technique calculation of the PDR value and sent it to the neighboring nodes for updation by which there will be a coordination between the neighboring nodes and thus which node have to sleep is according to the following PDR calculation which helps in power conservations. In Second technique threshold PDR value is calculated for each node within their coverage area by which it select which node to jam and which node to "sleep" this helps in power conservation. The following results are presented in the paper. Comparing the results of purposed approach with existing approach which shows that our results are better than existing approach using PDR.

5.2 FUTURE WORK

In the above scenarios there are some issue related to the jamming. We tried to improve it by using the two cases through PDR as mentioned above. For future work there are some point in the scenario where the mobile node is not jammed like at the center of the scenario where no sensor node is jamming the mobile device because it is not in the range of any of the sensor node so this issue can also be improved. For future work jamming can also be done through by using Received Signal Strength indicator (RSSI) or can be done through advance jamming strategies by using a hybrid approach of PDR and RSSI. The above work can also be simulated on simulator like OMNET++.

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APPENDIX

LIST OF ABBREVIATIONS

3G	Third generation
ADC	Analog to digital converter
ARM7	Advanced RISC Machines
AM	Amplitude modulation
BPSK	Binary phase shift keying
CISC	Complex instruction set computer
CDMA	Code division multiple access
DDS	Direct digital synthesizer
DCS	Doppler current sensor
FTP	File transfer protocol
FSK	Frequency shift keying
GSM	Global system for mobile
IOS	Internetwork operating system
MCU	Micro controller unit
MAC	Medium access control
NAM	Network animator
NS2	Network simulator 2
OTcl	Object oriented tool command language
OMNET++	Optical micro network
PSR	Packet send ratio
PDA	Packet delivery ratio
POW	Power optimized waveforms
PLL	Phase lock loop
PDR	Packet delivery ratio
RISC	Reduced instruction set computer
RTC	Real time clock
RSSI	Received signal strength indicator
SCR	Silicon- controlled rectifier

SNR	Signal to noise ratio
SNMP	Simple network management protocol
TCP	Transmission control protocol
VCO	Voltage controlled oscillation
WSN	Wireless sensor network