IOT BASED SECURITY ALTER SYSTEM WITH CONTACTLESS DELIVERY DROP BOX FOR HOMES

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"IOT BASED SECURITY ALTER SYSTEM WITH CONTACTLESS DELIVERY DROP BOX FOR HOMES "** is the bonafide work of **" GOKULAPPADURAI K(420719104010), MOHAMED AFRITH N (420719104024), RANJITH KUMAR K (420720104041), ROOPAN V (420720104304)"** who carried out the project work under my supervision.

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DECLARATION

We hereby declare that the work entitled **"IOT BASED SECURITY ALTER SYSTEM WITH CONTACTLESS DELIVERY DROP BOX FOR HOMES"** is submitted in partial fulfillment of the requirement for the award of the degree in B.E, Anna University Chennai, is a record of our own work carried out by us during the academic year 2022-2023. Under the supervision and guidance of Mrs. C. Sudha, Assistant Professor, Department of Computer Science and Engineering, CK College of Engineering & Technology the extent and source of information are derived from the existing literature and have been indicated through the dissertation at the appropriate places. The matter embodied in this work is original and has not been submitted for the award of any other degree or diploma, either in this or any other University.

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ABSTRACT

People suffering from color-blindness suffer from the problem of viewing some colors or differentiate between several color shades. The person with colorblindness faces many difficulties such as traffic signal cannot be well understood, they face difficulty to interpret colorful graphs and charts, they also cannot enjoy videos and sports matches. It limits people for viewing true colours with their naked eye. A suffering person faces various challenges in everyday life from identifying the different colour, choosing clothes or using colour dyes for concoction. 1 in 200 women and 1 in 12 men are suffering with tis deficiency. It is a genetic disorder and also it may appear after some years of grown-up. A colour-blind person faces problem in distinguishing the right colour in such case. Similarly, colour-blind struggles to find a software application suited to overcome their colour impairment. So, we propose a vision aid with improved user experience to use voice command. By our system, user can get the colour of an object by requesting the inbuilt assistance. The system processes the video and finds the object and notifies the colour to the user through voice. Our system improves the vision of the colour vision deficiency people to look the world better. Even if it is not curable, at least it extends the hand for the people to enjoy the sights.

KEYWORDS: Color-blindness, Color Vision Deficiency, Genetic disorder, Software application, Voice assistance.

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LIST OF ABBREVIATIONS

ACRONYMS	ABBREVIATIONS
APSOA	Adaptive Particle Swarm Optimization Algorithm
CNF	Consistency Based Future Selection
DoS	Denial of Service
ERAOA	Efficient Resource Allocation Optimized Algorithm
GSDM	Glow Worm swarm Algorithm
ICMP	Internet Control Message Protocol
IoT	Internet of Things
LEACH	Low Energy Adaptive Clustering Hierarchy
M- RAS-HO	Modified Resource Allocation Scheme-Hybrid Optimization
MAC	Medium Access Control
MAMO	Modified Animal Migration Optimization
M-APSA	Modified Adoptive Particle Swarm Algorithm
MEMS	Micro Electro-Mechanical System
MLEACH	Modified Low Energy Adaptive Clustering Hierarchy
OSI	Open System Interconnection
PSNR	Peak Signal to Noise Ratio
RAS-HO	Resource Allocation Scheme-Hybrid Optimization
SVMA	Support Vector Machine Algorithm
TBDMA	Trust Based Decision Making Algorithm
TCP	Transfer Control Protocol
UDP	User Datagram Protocol
WMSN	Wireless Multimedia Sensor Networks
WSN	Wireless Sensor Networks
WVSN	Wireless Video Sensor Networks

CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

Colorblindness, formally known as color vision deficiency, is referred to as those who have difficulties in discriminating certain color combinations and color differences. There are about 8% of men and 0.8% of women suffering from different types of colorblindness. Existing studies reveal that colors are perceived by humans with their cones absorbing photons and sending electrical signal to the brains. The cones are categorized into Long (L), Middle (M) and Short (S), which absorb long wavelengths, medium wavelengths and short wavelengths, respectively.

Protanopia and deuteranopia have difficulty in discriminating red from green, whereas tritanopia have difficulty in discriminating blue from yellow. Due to the loss of color information, many visual objects (such as images and videos) that have high qualities in the eyes of normal viewers may not be well perceived by colorblind viewers. Several research works have been dedicated to helping colorblind users in better perceiving visual objects.

The most straightforward approach is to re-color the objects, i.e., adopt a mapping function to change the colors of the original images, such that the colors that are mixed up by the colorblind users can be discriminated after re-coloring. Mobile-phones have become invaluable devices frequently used to meet the user’s needs according to their requirements. Currently, Android (Google) and iPhone (Apple) operating systems embed Color Vision Deficiency (CVD) functions for supporting color-blind people.

However, usability problems of complexity and flexibility still exist in the User Interfaces (UIs) of many apps. Even though, many systems are currently evolving, but they are not affordable in low cost. To reduce this inconvenience, our system will act as an extra hand assistance for the people with colour vision deficiency.

1.2 DEEP LEARNING

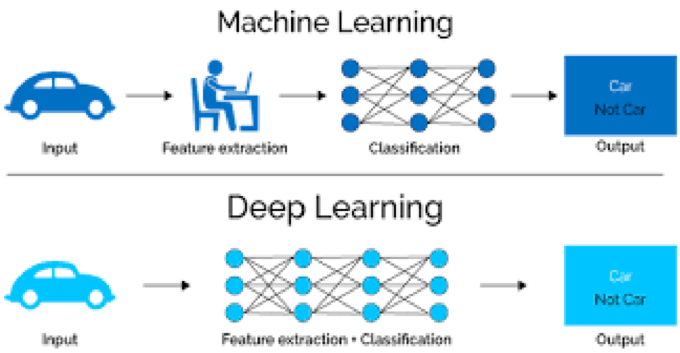


Figure 1.1: Picture of process of deep learning

Deep Learning is a part of Machine Learning that uses artificial neural networks to learn from lots of data without needing explicit programming. These networks are inspired by the human brain and can be used for things like recognizing images, understanding speech, and processing language. There are different types of deep learning networks, like feedforward neural networks, convolutional neural networks, and recurrent neural networks. Deep Learning needs lots of labeled data and powerful computers to work well, but it can achieve very good results in many applications. Deep-learning architectures such as deep neural networks, deep belief networks, deep reinforcement learning, recurrent neural networks, convolutional neural networks and transformers have been applied to fields including computer vision, speech recognition, natural language processing, machine translation, bioinformatics, drug design, medical image analysis, climate science, material inspection and board game programs, where they have produced results comparable to and in some cases surpassing human expert performance. In this project, we are using the processes of speech recognition, pixel colour extraction, object detection and colour recognition using the deep learning.

1.3 ADVANTAGES OF DEEP LEARNING

- Automatic feature learning
- Handling large and complex data
- Improved performance
- Handling non-linear relationships
- Handling structured and unstructured data
- Predictive modelling

1.4 SCOPE OF THE PROJECT

- To detect the object colour from the camera input respect to the desire of user.
- To provide a solution for colour-blindness that is affordable, simple and easily accessible to the people.

1.6 ORGANIZATION OF THE PROJECT

The organization of this thesis is as follows:

Chapter 2 - Gives an overview of Literature survey in which basic techniques are discussed.

Chapter 3 - Describes the detailed design of existing system and proposed system.

Chapter 4 - Describes the system specification.

Chapter 5 - Describes the system modules.

Chapter 6 - Describes the system testing.

Chapter 7 - Describes the conclusion and future work.

CHAPTER 2
SYSTEM STUDY

2.1 LITERATURE SURVEY

[1] Title: Colored Object Detection for Blind People Using CNN

Authors: Aishwarya S, Dr. Rajashree S, Nidhi Shivakumar, K S Shwetha Achar, Akshatha.

The system contains color detection and object detection module, image classification algorithm (CNN) on each cell. Based on the probability of the object belonging to a certain class, the class is determined. The most probable class name is retrieved as the object name along with confidence value. On the other hand, for color detection the RGB values are extracted and each of their distance are calculated from the coordinates the distance which is least is taken into consideration and that corresponding color name is retrieved along with the RGB values the obtained output is in textual format with undergoes Natural Language Processing and Digital Signal Processing to synthesis speech. For, object detection, this system uses COCO dataset in large scale object detection and fragmentation and capturing dataset. Input is a captured image and pixel whose color needs to be determined is selected. The pixel's co-ordinates are compared with RGB coordinates in the dataset. The color for which distance is found to be the least is chosen. It is displayed with corresponding RGB values. The obtained color name and RGB value is read out loud using MP3 module. It has 80 object categories with 330K images. Google Text to Speech API i.e. gTTS API is used for this.

[2] Title: Color Sensing device for Color Blind and Blind people

Authors: Deepak Sharma, Kenil Vora, Sachin Singh, Vidyadhari Singh.

The color to be sensed is decided by the two logic select pins S2 & S3 of the Color sensor. When a red color is sensed both the logic select pins S2 & S3 are kept low. The Color sensor detects the intensity of the color and sends the value to the color sensor module. The light intensity measured by the color Array is sent to the Current to Frequency converter, whose frequency is in relation to current sent by Array. The Arduino UNO here sends data to the Color sensor and the data received is shown on the LCD connected to the Arduino. The UNO detects three color intensities separately and shows them on LCD. The Arduino UNO selects the signal (square) pulse duration because of that, one can get the frequency of square wave sent by module. With the frequency at hand we can match it with color on sensor. The Arduino Uno reads the pulse duration on 10th pin of UNO and stores its value in frequency integer. We are going to do this for red, green and blue colors recognition. All three-color intensities are shown by frequencies on 16x2 LCD. When the system identifies a color, it needs to have a way to let the user know of the result. Since the product is directed towards blind people, a screen to display would be useless. The product should be able to communicate the results to the user using some form of audible signal. The simplest way to achieve that would be using a buzzer. So, whenever a color is recognized the gadget will display as well as speak the name of color with help of speech output system.

[3] Title: Object Recognition Using Deep Learning

Authors: Rohini Goell, Avinash Sharma, and Rajiv Kapoor.

In contemporary object recognition approaches, the deep neural network-based object recognition techniques have remarkable performance due to its powerful learning capability. In this paper, the recent developments of deep neural network-based object recognition framework have been received in detailed. Firstly, the two-step framework has been received which familiarize the architectures used for object recognition. Then, one step frameworks such as: YOLO, SSD etc. are also reviewed. The various benchmark datasets and different application areas of object recognition are also discussed. Finally, we conclude with promising future scope to get an intensive perspective of the object recognition. This paper provides worthwhile wisdom and guidance for future progress in the field of deep learning-based object recognition. Based on literature review, there is scope for future improvement. The object-based CNN for high-resolution imagery classification method has no contextual information on a global level. The main focus will be on the contextual information to further improve the performance because the information about the relationship between image object affect the classification efficiency. In Segnet, the estimation model can be design to calculate uncertainty for prediction from deep segmentation network. The training dataset can be increase in future for the age estimation approach DEX. More robust landmark detectors can lead to better face alignment.

[4] Title: Comparative analysis of deep learning image detection algorithms

Authors: Shrey Srivastava, Amit Vishvas Divekar, Chandu Anilkumar, Ishika Naik, Ved Kulkarni and V. Pattabiraman.

This review article compared the latest and most advanced CNN-based object detection algorithms. Without object detection, it would be impossible to analyze the hundreds of thousands of images that are uploaded to the internet every day [42]. Technologies like self-driving vehicles that depend on real-time analysis are also impossible to realize without object detection. All the networks were trained with the open-source COCO dataset by Microsoft, to ensure a homogeneous baseline. It was found that Yolo-v3 is the fastest with SSD following closely and Faster RCNN coming in the last place. However, it can be said that the use case influences which algorithm is picked; if you are dealing with a relatively small dataset and don't need real-time results, it is best to go with Faster RCNN. Yolo-v3 is the one to pick if you need to analyze a live video feed. Meanwhile, SSD provides a good balance between speed and accuracy. Additionally, Yolo-v3 is the most recently released of the three and is actively being contributed to by the vast open-source community. Hence, in conclusion, out of the three Object Detection Convolutional Neural Networks analyzed, Yolo-v3 shows the best overall performance. Tis result is similar to what some of the previous reports have obtained. A great deal of work can still be done in the future in this field. Every year, either new algorithms or updates to existing ones are published. Also, each field—aviation, autonomous vehicles (aerial and terrestrial), industrial machinery, etc. are suited to different algorithms.

[5] Title: Object Detection with Deep Learning: A Review

Authors: Zhong-Qiu Zhao, Peng Zheng, Shou-tao Xu, Xindong Wu.

Due to its powerful learning ability and advantages in dealing with occlusion, scale transformation and background switches, deep learning-based object detection has been a research hotspot in recent years. This paper provides a detailed review on deep learning-based object detection frameworks which handle different sub-problems, such as occlusion, clutter and low resolution, with different degrees of modifications on R-CNN. The review starts on generic object detection pipelines which provide base architectures for other related tasks. Then, three other common tasks, namely salient object detection, face detection and pedestrian detection, are also briefly reviewed. Finally, we propose several promising future directions to gain a thorough understanding of the object detection landscape. This review is also meaningful for the developments in neural networks and related learning systems, which provides valuable insights and guidelines for future progress.

2.2 SYSTEM ANALYSIS

In System analysis, the method proposed consists of major steps:

- **i.** Camera accessing,
- **ii.** Processing the image of object,
- **iii.** Detecting the colour of an object and
- iv. Notify the colour to user.

2.2.1 Existing system

The existing system is designed for multiple moving tracking in real time. We use the bounding rectangular box for labeling the objects. The initial stage of the system starts with the collection of images and generation of the train and test dataset. The CNN model comprises of the convolutional layer and pooling layer with regional propositional network or region generation. The feature maps are generated from the input image and fed into RoI layer with the regions generated. The system consists of camera, a portable computer. The system has the features of obstacles detection, traffic light recognition and color detection.

Color Object detection system we proposed is based on self-adaptive threshold image segmentation. The input image is preprocessed. The image is intersected with region of interest (ROI) firstly. ROI is set before detection. The output of the system provides labeling of the objects in the test image with the representation of the rectangular anchor boxes.

2.2.1.1 Disadvantages

- Using the patterns could not completely resolve the problem.
- Comparatively, CNN is slower than yolo.
- Packet Loss and Loss of Efficiency.
- .

2.2.2 Proposed system

Firstly, the application accesses the camera and the user shows or requests the object to know its colour. The system gets the image of an object through the mobile camera and sends it to the next process. Secondly, the received image has to be processed to know what is the object in the frame. It uses the Yolo (You Only Look Once) algorithm to detect the object. For this process, a dataset from the Kaggle.com is used to train the system for efficiently detecting the object. And the detected object is checked with the requested object. If they are same, then the colour of the object is detected using the RGB values in the pixels of the object image. The resultant RGB value is compared with the colour dataset (.csv file) which contains the combination of 3000 colour variants with their respective hue values. Finally, the detected colour of the object is notified to the user through the microphone. To achieve this, the user has to grant permission to access the microphone and the camera.

the Existing protocol. The compete black diagram of the proposed system is displayed through Figure 2.1 shown below.

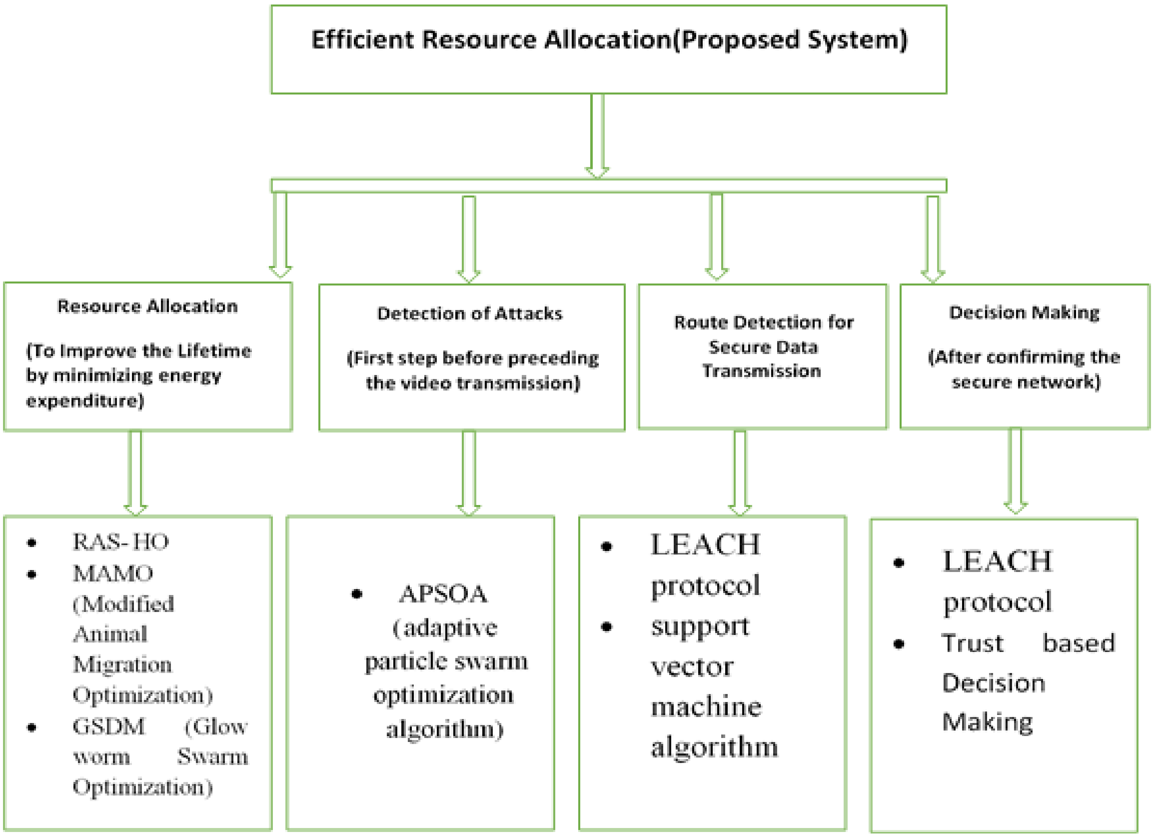


Figure 2.1 : Block diagram of the proposed system

The proposed work implement in five stages starting from energy optimization through M-RAS-HO algorithm, then Modified Adoptive Particle Swarm Algorithm (M-APSA) in second stage used to detect obstacle in the transmission line, the transmission line surety features carried out by Modified LEACH protocol and finally trust based decision making protocol is to be implement for secure data transmission. The proposed system is going to be implement using NS-2 tool and comparative analysis will be justify with the existing methodologies for efficiency analysis.

2.2.2.1 Advantages

- Effective Energy is Low.
- Low Propagation Delay.
- Low Packet Loss and Efficiency is High.
- Low Packet Intensity drop.

- High Packet Delivery Ratio.

2.3 SYSTEM DESIGN

In this system design, This project focuses on providing solution for detection of Denial of service attacks in wireless multimedia sensor networks. Denial of Service attack (DoS) target the bandwidth of the server leading to volumetric attacks supposed to be injected in the network layer of the OSI model. The attacks are made on ICMP, UDP, TCP and food based attacks. Protocol based attacks takes place on the resources involved with target server. Ping food and SYN food are the best examples of this attack. Certain DoS attacks are at application level crashing the target server. But there are no methodologies suggested for wireless multimedia sensor networks regarding denial of service. The methodologies are approached by statistical analysis, soft computing and machine learning methods. Quantitative analysis is applied on traffic, signature methods and by analyzing the quality of the traffic.

2.3.1 Selection of features for enhancing the performance

Neural network based feature selection enhances the performance of the network. It focusses on selecting required features from original dataset. The learning algorithm performance is improved because of the selection of optimal features. It removes complicated and redundant features from the dataset used for improving the algorithm and developing the phenomena under analysis. Features are skipped out and opted without a proper justification. The approaches involved can be classified into three major categories one is wrapper approach where a machine learning algorithm which is predetermined selects the feature subset. The evaluation criterion is based on the performance of the classification. The next approach is embedded method where feature selection is based on training in specific to machine algorithm used. Third approach is filter approach where feature selection is based on general characteristics. Ranking of features is done by statistical criteria and highest ranking features are opted.

The method used for filtering is Consistency based feature selection (CNF) and Correlation based feature selection (CFS). CNF enhances the accuracy of learning algorithm. But consuming computational resources and selection process becomes complicated. CFS does not consume more resource thereby improving the performance of the classifier. This approach is suitable for DoS attack detection. Flow of network during transmission of multimedia data. The flow of network is based on collection of media sequences transmitted between source and destination hosts. The parameters to identify the flow of networks are IP of source and destination, port address of source and destination, protocol. Malicious attack on IP cannot be detected observing a single packet, the packets has to be clustered and inspected to provide optimal solution. Correlation based feature selection in neural network consists of two essential steps:

i. For every pair of features in dataset Pearson coefficient is calculated to detect redundant features subset.

$$P(i,j) = \frac{cne(X,Y)}{\sqrt{sd^2(X)sd^2(Y)}} \tag{2.1}$$

ii. The second step involves correlation of many features, the relevant features are selected for new dataset. Based on the result final list of high relevant features are constructed.

2.3.2 Dos detection using traffic analyzer architecture

In this module, various metrics have been pioneered in integration with the malicious traffic. The metrics such as

- Traffic flow
- Throughput
- Bandwidth
- Deviation
- Generalized entropy
- Generalized information divergence
- Projected entropy are taken into account.

The received packets usually compare the threshold value with minor size than the threshold entropy instead of taking from the illegal user. Semi-centralized architecture has used in the traffic analyzer system (Figure 2.2) for maintaining the installation of local IPDS in a group at the local routers. Near the gateway router, global IPDS is installed. This paper sheds light on amalgamate detection on spoof-based attacks on collaborative flooding DDoS. The four main components incorporated in the traffic analyzer for involving in alleviating attacks from the collaborative footing DDoS.

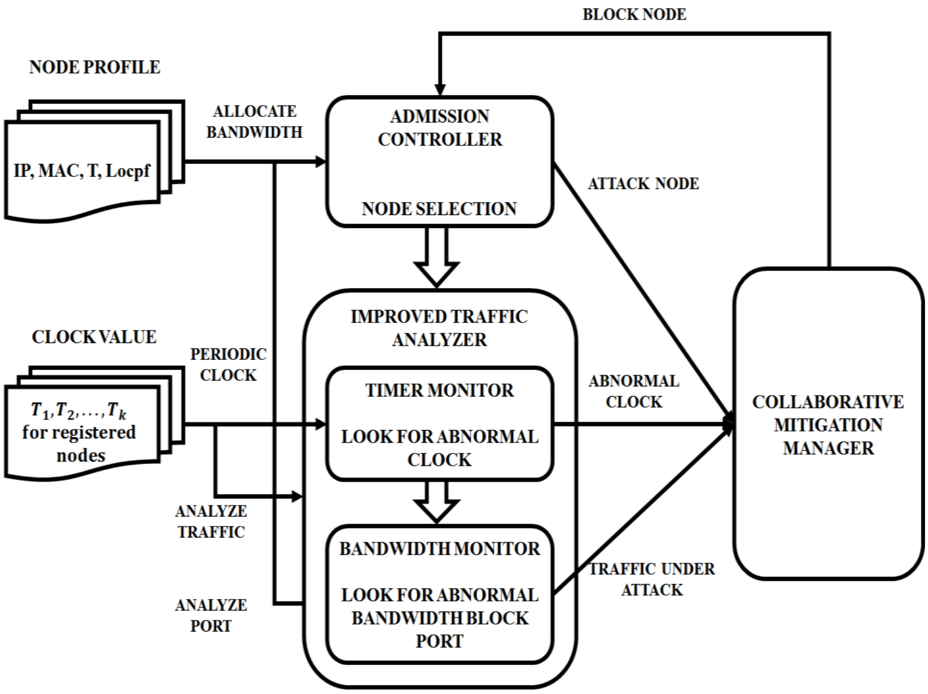


Figure 2.2: Traffic analyzer architecture.

Figure 2.2 pivot on the structural range of the traffic analyzer system. The elements of the traffic analyzer have recounted as follows: For the initial bandwidth allocation admission controller used the bandwidth allocation algorithm in each node. At the start, the confidential information has sent to the network for registering the nodes. Bandwidth validity time and bandwidth bn for each node have indicated as TTL in the final registration process by the admission controller. Each node has monitored by the timer and maintains the clock value systematically- meanwhile, the threshold value juxtaposed with these clock values. Ultimately, the collaborative mitigation manager has monitored the abnormalities of each node by the timer, bandwidth monitor and the admission controller. The final decision of accepting and rejecting the node and its traffic is to be made by the collaborative mitigation. The whole traffic is efficiently monitored by the multiple IPDS components that have been promoted to detect and filter the attack instead of a single global IPDS component (Figure 2.3).

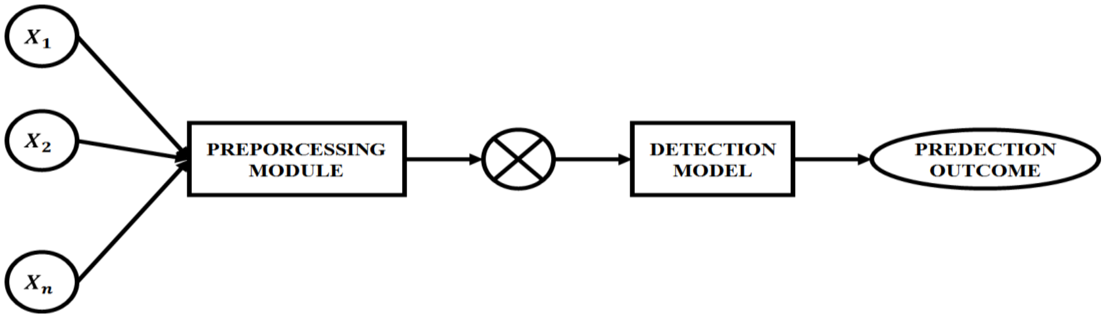


Figure 2.3 : Identifying the normal and DoS affected traffic through Neural Network.

The global IPDS sustains a node profile by the corresponding information. By maintaining the client node IP address and MAC address, timer value, node location proof details, allotted bandwidth and value. It also keeps records on the local profile with an IP address of the local IPDS, the average of clients nodes linked with the neighbouring local IPDS. The entropy metrics that are considered in this work are, "traffic flow metric, throughput metric, bandwidth allocation metrics, bandwidth deviation metric, Generalized Entropy (GE), Generalized Information Divergence (GID) metrics, Projected Entropy". Traffic flow metric: Traffic analyzer system assists in determining the overall communications take place in the network through this matric. The total traffic flow at the global IPDS is given by,

$$f(G_m) = \sum_{m=1}^{i} f_{out}(L_m) \quad (2.1)$$

The confined IPDS outgoing traffic flow has measured from the sum of f_{out} (L_m). Local IPDS have utilized to send and receive messages through all mesh client nodes. Hence, the total incoming and outgoing traffic flow at each mesh client mode has gained through local IPDS. The total circulation of traffic at the local IPDS has given as,

$$f(L_m) = \sum_{n \in N} f_{in}(n) + \sum_{n \in N} f_{out}(n) \quad (2.2)$$

The incoming and outgoing traffic of the client node has indicated as $f_{in}(n)$ and $f_{out}(n)$, respectively. The mesh client's total traffic flow has marked as

$$f(n) = \sum_{c=1}^{i} f_c(n) + \sum_{d=1}^{i} f_d(n) \quad (2.3)$$

In this equation $f_c(n)$ denotes the measure of the traffic flow control of the client, $f_d(n)$ is the individual client node and its flow at the mesh of the client node. The traffic control measure of the mesh client node is expressed below

$$f_c(n) = f_{cin}(n) + f_{cout}(n) \quad (2.4)$$

Here $f_{cin}(n)$ specifies the control flow of the incoming client nodes, $f_{cout}(n)$ is the control flow of the outgoing nodes and the velocity of the data flow in the field of mesh client node is given by

$$f_d(n) = f_{din}(n) + f_{dout}(n) \quad (2.5)$$

In the above equation, $f_{din}(n)$ formulates the incoming data flow and $f_{dout}(n)$ is the outgoing data flow traffic at the client node. The total number of control messages exchanged between the mesh clients, the local IPDS and the global IPDS are required to calculate the communication overhead.

Throughput metric: The proposed system guarantees a minimum throughput of λ and all client nodes should adhere within this throughput. i.e.

$$\sum_{n \in N} b_n \leq \lambda \quad (2.6)$$

The throughput is affected by the fraction of bandwidth allocated to each client node. The client nodes for which the bandwidth is allocated through the bandwidth allocation protocol are considered for achieving wireless mesh network throughput.

Bandwidth allocation metrics: b_n is the fraction of bandwidth allotted to each client node $n \in N$ and Br=B−Bmb where B is the total bandwidth allotted to the network, Bmb is the bandwidth allotted for the local and global IPDS and Br is the bandwidth allotted to each mesh client nodes who joins the network. The bandwidth constraint is given by,

$$b_n \leq B_r/N \quad (2.7)$$

Bandwidth deviation metric: The bandwidth deviation metric is given

$$dev(b_n, b_n) \leq \omega \tag{2.8}$$

Each client node is allotted a bandwidth b_n within the network and they are permitted to utilize only their allotted bandwidth. Nodes failing to use b_n might have been deviated tob_n. The deviation of b_n andb_n' must not exceed ϖ whose value is 0.1. If the deviation exceeds ϖ then it leads to rejection of that client node.

Generalized entropy (GE): Entropy was introduced to measure the uncertainty of an event associated with a given probability distribution X. The formal definition of entropy in terms of a discrete variable X, with possible outcomes $x_1, x_2, \ldots, x_n$ can be defined as:

$$H(x) = \sum_{i=1}^{n} P(x_i) \log_2 \frac{1}{P(x_i)} = -\sum_{i=1}^{n} P(x_i) \log_2 P(x_i)$$

(2.9)

Where $P(x_i) = Prob(X = x_i)$ is the probability of the i^{th} outcome of X. A generalized entropy (GE) can be defned as:

$$H_a(X) = \frac{1}{1-\alpha} \log_2\left(\sum_{i=1}^{N} P_i(\alpha)\right) \tag{2.10}$$

By varying the α order, different types of entropy values can be obtained. When α=0, it indicates the maximum value of the generated information. But, when α=1, it can be expressed as:

$$H_1(x) = -\sum_{i=1}^{n} P(x_i) \log_2 P(x_i) \tag{2.11}$$

Which is termed as Shannon Entropy (E_{sh}). The value of α increase the deviation between different probability distribution as compared to (E_{sh}) when α>1. In high probability events the GE can produce better and accurate result than (E_{sh}).

Generalized information divergence (GID) metrics: Let's two different probability distribution are $P = (p_1, p_2, \ldots, p_n)$ and $Q = (q_1, q_2, \ldots, q_n)$ .A generalized information divergence (GID) can be derived as:

$$D_\alpha(P||Q) = \frac{1}{1-\alpha} \log_2\left(\sum_{i=1}^{N} p_i^\alpha q_i^{1-\alpha}\right), \text{where } \alpha \geq 0 \tag{2.12}$$

Projected entropy: According to for a stochastic processes the entropy rate H (x) of two random processes are same

$$H(X) = \lim_{n\to\infty} \frac{1}{n} H(x_1, x_2, \dots, x_n)$$

(2.13)

If $H(X) \leq th2, th2$ is the threshold value2, Mark the flow as attacked, raise a final alert, discard the attack flow.

The threshold value of packets has assigned by the administrator at intrusion detection on the system. The time slot has collected to control the traffic flow. The packages entropy H(x) has determined by the IP address, the input flow size of ports in finding normalized entropy. The threshold packets comparison has done by considering the size of threshold entropy is more substantial than normalized entropy to avoid illegal users. Creating value of the threshold is not an easy task. The legal users packages have confined to higher costs. Setting the false-positive rate is not an easy task to maintain the threshold value.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS

- System : Intel Pentium 4, 3.0 GHz
- Hard Disk : 80GB
- Ram : 512MB

3.2 SOFTWARE SPECIFICATIONS

- Operating System : Windows 7 & Linux
- Coding Language : NS-2 Allinone -2.28

3.3 HARDWARE DESCRIPTION

To check your PC hardware specs, click on the Windows Start button, then click on Settings (the gear icon). In the Settings menu, click on System. Scroll down and click on About. On this screen, you should see specs for your processor, Memory (RAM), and other system info, including Windows version.

- Processor speed, model and manufacturer.
- Random Access Memory(RAM), This is typically indicated in gigabytes (GB).
- Hard disk (sometimes called ROM) space.
- Other specifications might include network (ethernet or wi-fi) adapters or audio and video capabilities.

3.4 SOFTWARE ENVIRONMENT

Network simulator 2.28 is used as the simulation tool in this project. NS was chosen as the simulator partly because of the range of features it provides and partly because it has an open source code that can be modified and extended. There are different versions of NS and the latest version is ns-2.1b9a while ns-2.1b10 is under development.

3.4.1 Network simulator(NS)

Network simulator (NS) is an object–oriented, discrete event simulator for networking research. NS provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks. The simulator is a result of an ongoing effort of research and developed. Even though there is a considerable confidence in NS, it is not a polished product yet and bugs are being discovered and corrected continuously.

NS is written in C++, with an OTcl1 interpreter as a command and configuration interface. The C++ part, which is fast to run but slower to change, is used for detailed protocol implementation. The OTcl part, on the other hand, which runs much slower but can be changed very fast quickly, is used for simulation configuration. One of the advantages of this split-language program approach is that it allows for fast generation of large scenarios. To simply use the simulator, it is sufficient to know OTcl. On the other hand, one disadvantage is that modifying and extending the simulator requires programming and debugging in both languages.

NS can simulate the following:

1. **Topology:** Wired, wireless
2. **Scheduling Algorithms:** RED, Drop Tail,
3. **Transport Protocols:** TCP, UDP
4. **Routing:** Static and dynamic routing
5. **Application:** FTP, HTTP, Telnet, Traffic generators.

3.4.2 User's view of NS-2

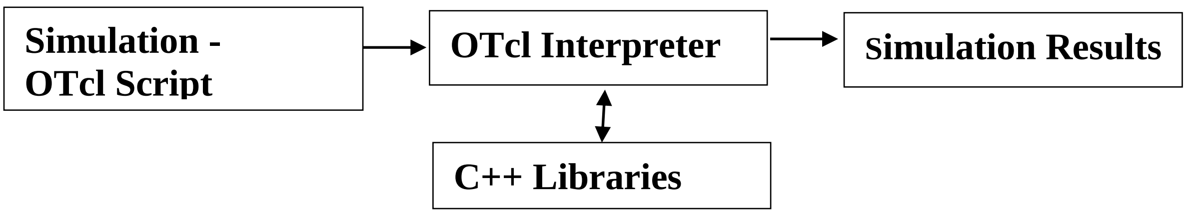


Figure 3.1: Block diagram of Architecture of NS-2

3.4.3 Network components

This section talks about the NS components, mostly compound network components. Figure 1.1 shows a partial OTcl class hierarchy of NS, which will help understanding the basic network components.

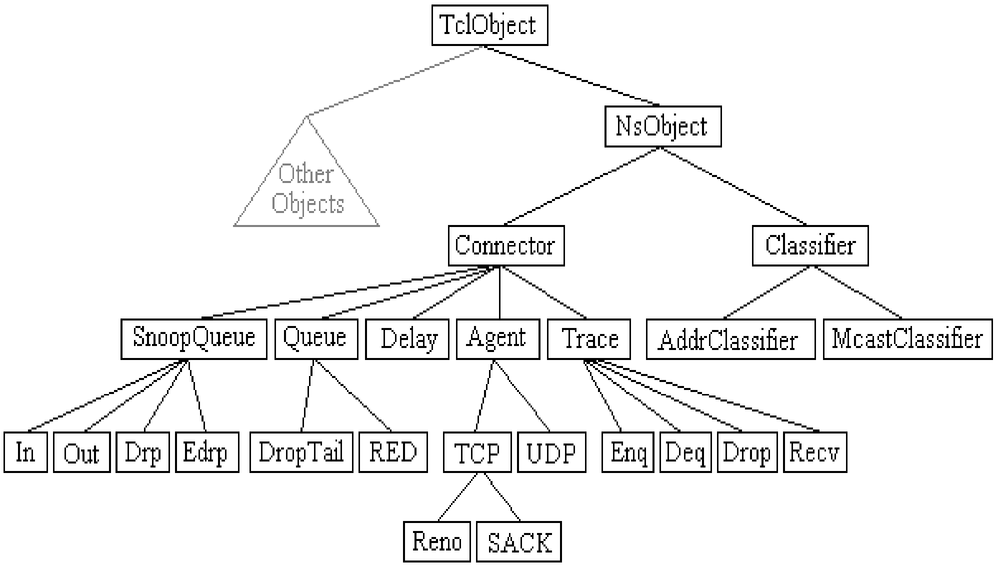


Figure 4.2: OTcl Class Hierarchy

The root of the hierarchy is the TclObject class that is the super class of all OTcl library objects (scheduler, network components, timers and the other objects including NAM related ones). As an ancestor class of TclObject, NsObject class is the super class of all basic network component objects that handle packets, which may compose compound network objects such as nodes and links. The basic network components are further divided into two subclasses, Connector and Classifier, based on the number of the possible output DATA paths. The basic network and objects that have only one output DATA path are under the Connector class, and switching objects that have possible multiple output DATA paths are under the Classifier class.

CHAPTER 4

SYSTEM MODULE

4.1 LIST OF MODULES

4.1.1 System model for resource allocation

The main focus for this section is attaining maximum power savings to improve the life time of the wireless video sensor network. This section of the protocol effectively handled by modifying the Animal Migration Optimization ride over modified Glow warm Swarm Optimization. This discussion better understood by the Algorithm 1 illustrated below. The proposed resource allocation scheme for WVSN using hybrid optimization (RAS-HO) algorithm. It consists of two phases that are the clustering formation, and best next node identification. The energy efficient cluster formation performed by the modified animal migration optimization (MAMO) algorithm and inspired from the conventional animal migration optimization (AMO) algorithm. Then, we propose a Glowworm swarm optimization based decision making (GSDM) algorithm to compute the best next node among multiple nodes. The decision making algorithm computes the best solution among multiples.Generally, swarm intelligence algorithms computes the optimal thresholds by maximizing an objective function, the GSDM algorithm solve multiple request problems.

Algorithm 1: RAS-HO (Resource Allocation Scheme-Hybrid Optimization)

1 Initialize the number of nodes, network size, energy consumption ($Energy_t = \sum_{k=0}^{T} \frac{E_{avg}(t) + E_{st}(t)}{E_{\eta_{DC-DC}}}$), received signal strength ($\left[\frac{P_R(r_o)}{\overline{\overline{P_R}}(r)}\right] = \left[\frac{r}{r_0}\right]^{\gamma} + \delta$) of each node

2 Optimize the time varying constraints using modified animal migration optimization (MAMO) algorithm

3 Initialize the position and constraints of each node

4 Compute fitness using ($f(i,j) = \sum_{i=1}^{n}\left[p_i^2 - 10\cos(2\pi \,\mathrm{p_i}) + 10\right]$)

5 Update the values using ($p_{i,j} = t_{l_j} + r_{i,j}[0,1] \cdot (t_{u_j} - t_{l_j})$)

6 Check the value New>old If Yes Owner of updated value added

to the cluster Else Maintained in the old cluster

7 Check new added node is best

If Yes Act as CH node

Else Act as cluster member

8 Initialize the delay, throughput, delivery, loss ratio, and link failure of each CH node

9 Compute search space using ($f(i,j)=\sum_{i=1}^{n}\left[p_i^2-10\cos(2\pi\,\mathrm{p_i})+10\right]$)

10 Update the constraints using

($r_d^i(t+1)=\min\{\delta,\max(0,\ r_d^i(t)+\alpha\ (T-|y:d_{x,y}(t)<r_d^i(t)|))\}$)

11 Compute the probability of next possible CH node using

($\mathrm{P}_{xy}(t)=\frac{(L_y(t)-L_x(t))}{\sum_{k\in y:d_{x,y}(t)<r_d^i(t)}(L_z(t)-L_x(t))}$)

12 Compute the distance between the next CHto sink node using

($d_{x,y}(t+1)=d_{x,y}(t)+\delta\left(\frac{l_y(t)-l_x(t)}{\|l_y(t)-l_x(t)\|}\right)$)

13 Update the values using

($r_d^i(t+1)=\min\{\delta,\max(0,\ r_d^i(t)+\alpha\ (T-|y:d_{x,y}(t)<r_d^i(t)|))\}$)

14 Check the CH as best If Yes Forward the data from new selected CH node Else Forward the data from old CH node

15 Power Optimization is Achieved

16 End

4.1.2 System model for fault detection

The second stage of the proposed work is identifying the faulty nodes and detecting various attacks on the implemented network. Refusal of administration assault in remote mixed media systems has been testing and existing recognizing frameworks center around improving the presentation of the framework. This paper is given DoS recognition technique for remote sight and sound sensor systems through neural system. Neural system uses negligible assets for distinguishing DoS assault. The technique proposed comprises of three significant advances:

- Intensity of system traffic in media remote system.
- Relevant boundary assortment for identifying DoS by unaided neural system.
- Classifying the approaching system traffic and event of regular traffic.

The presentation of the framework utilizes two datasets and got results end up being persuading contrasted with different DoS discovery strategies. The casualty is overflowed with colossal number of system bundles or sending adulterated media information much of the time are significant methods in DoS. DoS is named Direct and Reflection based. In direct assault, the casualty is stacked with different media demands utilizing a host. In reflection based technique the host powers over a lot of host named as reflectors.It communicates gigantic measure of sight and sound information and shrouds the IP address. The PCs get tainted by both the assaults influencing the conduct of the system. In light of the differentiation found in dataset we can undoubtedly arrange the ordinary assault and DoS assault which is recorded through Algorithm 2

Algorithm 2: for Fault Detection

Input: Flow of network in training data

Output: Auto encoder and normalization model

1 Creation of normalization model
2 The values for normalization is selected from the dataset
3 Dataset for training and testing is created
4 Auto encoder model is created from the training set

5 Input data set is converted using the model
6 Input: Output obtained from Algorithm 2 is fed as an input (i.e) Encoded input dataset
Output: DoS detection model from neural network Creation of trained data set
7 Neural network is created
8 Denial of service attack is identified
9 Input instance is normalised using the model
10 Input instance is encoded
11 Label for encoded input instance is identified.
12 DoS attack nodes re identified
13 End

4.1.3 System model for secure transmission

Third stage of the proposed work deals with creation or identification or discovery of secure route between nodes to node to achieve the data transmission from source to destination. This part pillared to Privacy is achieved by embracing the encoding of symmetric key encryption estimations. A calculation with negligible multifaceted nature is proposed to give security and uprightness of information that is traded between group heads and entryway hubs. The encoded information from source hub can be adjusted inside the hubs in a group or from another bunch in the middle of the transmission of edge for approved clients. The QoS is improved contrasted with existing models. This segment is better comprehended through calculation 3 examined underneath.

Algorithm 3: Discovery of Secure Routing

1 Formation of cluster
2 The nodes are represented as N.
3 if (time N > back N) thenpodcast :send (CLHD_state , I_idty) to the Neighbours
4 end if1
5 end for1
6 for all i ε Node N
7 for all (j = idty) in receive(CLHd_state, I_idty)
8 Delete CLHD_state
9 Request for join: send (j, I_idty)

```
Update: I_Mem (j , I_idty)
end for2
end for3
if (Time > TCL) then
for each k belongs to CHLD)
podcast : send (CHLD, I_idty)
Update: addc += 2
end for4
end if2
for all (m = id ε N)
if ( receive (CHLD , I_idty > 1) then
Update: I_Mem( id, I_idty , status = NG)
end if3
end for5
end Procedure
End
Cluster_upgrade steps
Initialize r = 0
for every  i belonging to CL
for every  j belonging to  N
if status of j = cluster gateway value then
Increment r by 1
break
end if1
end for1
if r value equals 0 ) then
Formation of cluster(N) method is called
end if2
end for2
end Procedure
```

4.1.4 System model for decision making

The final stage of the proposed system to make decision whether to initiate the communication or not is decided is based on Trust factor is constructed. The detailed analysis of this decision making is understand by the following Algorithm 4

Algorithm 4: Trust based Decision Making

Initial condition: Node advertise with other node in the clustered sensor network. Input: Me-Me (Member to Member Trust Degree), Me-Ma (Member to Master Trust Degree), Ux, Uy Output: Trust value calculation and communication

1 Begin: Successful interaction of the node :S
2 if transmission delay <threshold value Count it as successful interaction else mark it as unsuccessful interaction U
3 Direct trust Degree calculation of the node: Me-Me = (S/(S+U))*(1\√U)if (Me-Me is adequate for communication) Allow communication with the node.else calculate the Me-Ma trust for the node
4 Indirect Trust Degree of the node: Me-Ma =matrix of Me-Me values of all nodes if (Me-Ma is adequate for communication) Then allow communication with the node. else get the Final Trust Value form the Base station
5 if (Me-Me of adjacent CM >5.0) then forward the packets to adjacent CM else choose the alternate path
6 if (Me-Me of adjacent CH >5.0) then forward the packets to adjacent CH else choose the alternate path
7 if sender overhears the Me-Ma trust degree of its neighbour exceeds the threshold limit then establish the path else Deny communication with the node
8 end loop
9 End

CHAPTER 5

SYSTEM TESTING

5.1 SYSTEM TESTING

The parameters used to simulate the algorithm using NS 2 tool is listed through Table 1 shown below. The simulation is done in two scenarios and the simulation parameters disclosed through table 1 is common to both the scenarios. The first scenario the number of video sensors kept changing starting from Hundred and keep changing in multiples of Hundreds while keeping the total number of data transferred is kept constant for example only 100 bits of information is transferred during first analysis. In the second scenario the number of video sensors in each stage kept constant for example only 100 sensing nodes while quantum of data transferred during the study keep changing in multiple of Hundreds starting from 100 data bits per second. And some provisions enabled to change this constant number of sensing nodes to another constant value before execution of any values.

The proposed system is implemented using NS 2 Tool and the system works based on the Algorithm 5. The simulated values of the proposed system are examined for evaluations purpose with the leading existing methodologies.

Algorithm 5: ERAOA (Efficient Resource Allocation Optimized Algorithm)

1 Initialize the parameters Input : Video Sensors Distribution Type :
2 Start Executing Proceed : Call Algorithm 1 Else : Repeat
3 Get the Results Verify the Results Stage 1If ValidProceed : Call Algorithm 2Else : Repeat through Step 1
4 Get the Results of stage 2If ValidProceed : Call Algorithm 3Else : Repeat through Step 1
5 Get the Results Verify the Results Stage 3 If Valid Proceed : Call Algorithm 4 Else : Repeat through Step 1
6 Get the Results If Valid Display the results Else Repeat through stage 1
7 List the Results
8 End All Loops
9 End

Table 5.1: Simulation parameters

Parameters	Values
Network Simulator	NS-2
Number of nodes	100, 200, 300, 400, 500
Data rate	100, 200, 300, 400, 500
Network area	$1000 \times 1000\ m^2$
Source traffic	CBR
Simulation time	100 Sec
Initial energy of sensor nodes	100 joules
Initial power consumption of transmitting circuit	15.9mW
Initial power consumption of receiving circuit	22.2mW

Table 5.2: Scenario – 1 Varying Number of Node Vs Parameters

Scenarios	Number of nodes	Data rate (KHz)	Bandwidth (KHz)
1	100, 200, 300, 400, 500	100	2.5

Table 5.3: Scenario – 2 Varying Data Transfer Rate Vs Parameters

Scenarios	Number of nodes	Data rate (KHz)	Bandwidth (KHz)
1	100	100, 200, 300, 400, 500	2.5

5.1.1 SCENARIO 1: FIXED DATA TRANSFER RATE VERSES NUMBER OF NODES VARIES

The lifetime improvement of any Wireless sensor system starts with the reduction of delay between node to node transmissions as well node to base station or aggregation node. This becomes the first parameters to disclose the effective ness of any WSN system similarly it is applicable to the wireless video sensor system which is the part of wireless multimedia system. The below Figure 2 explains that the proposed ERAOA (Efficient Resource Allocation Optimized Algorithm) is out performed the existing algorithms and produced more than 50 % improvement that the available methodologies.

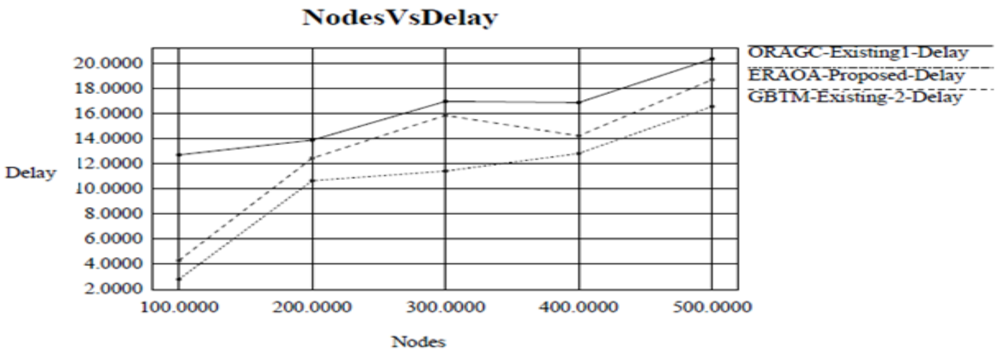


Figure 5.1: Analysis of Delay Performance verses Varying number of nodes by keeping data transfer rate constant

Figure 5.1 elaborated about another important parameters which is essential for wireless video sensor network is successful delivery ratio o the data bits from end to end communication. From this analysis graph it may be concluded that the proposed ERAOA (Efficient Resource Allocation Optimized Algorithm) is produced better delivery performance than the existing protocols around 85% improving in data delivery

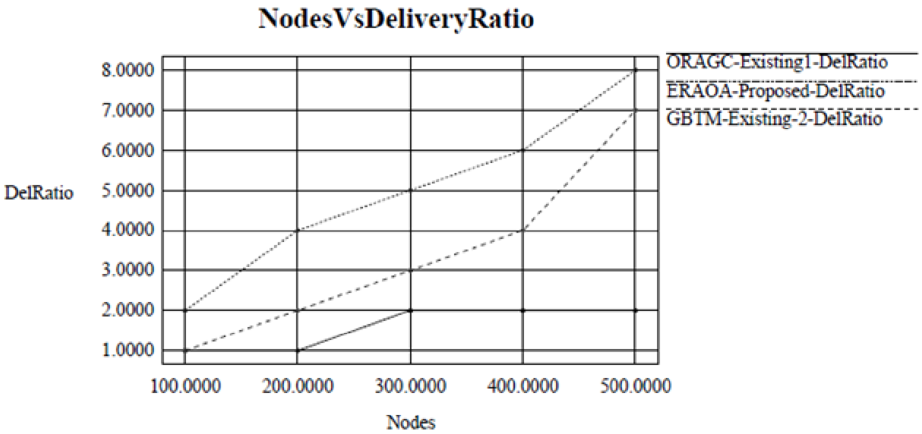


Figure 5.2: Analysis of Delivery ratio verses Varying number of nodes by keeping data transfer rate constant.

The successful parameters helpful to the researcher are ratio of successful data transfer rate from source node to destination node. Another way of identifying the performance in the absences of above said information if Data drop during communication in End to end basis Figure 5.2 discloses the number of drop while keeping the fixed data transfer rate and varying number of node scenarios and the analysis of comparative study suggest that the data drop is reduced more than 85% compared with the existing methodologies.

The cost of any system is purely depends of two parameters the one is material cost and another one is operational cost. While the material cost is very minimal hence the cost should be. The longer the system active or in operation the cost efficiency comes. The longer the operational time defined by the time duration the system is alive that means node utilizes minimal energy expenditure for its each and every task. By keeping this the energy utilization is graphed with the analysis of existing methodologies. The analysis result is plotted in figure 5.3 Rom the figure 5.4 it may evident that the proposed ERAOA (Efficient Resource Allocation Optimized Algorithm) is better than the existing protocol.

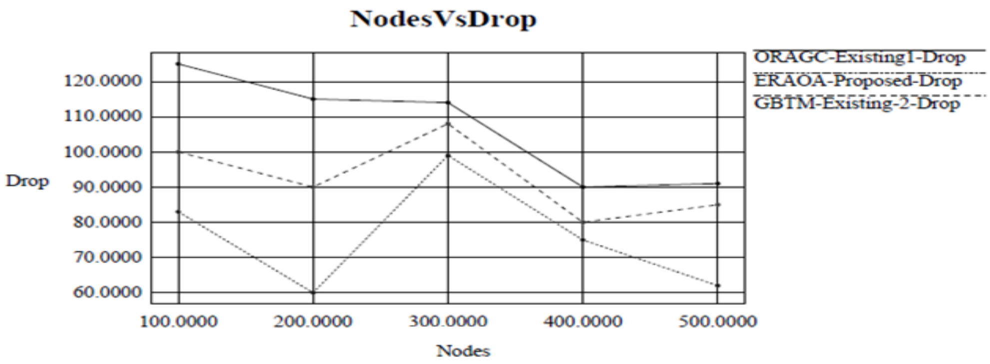


Figure 5.3: Analysis of Drop performance verses Varying number of nodes by keeping data transfer rate constant

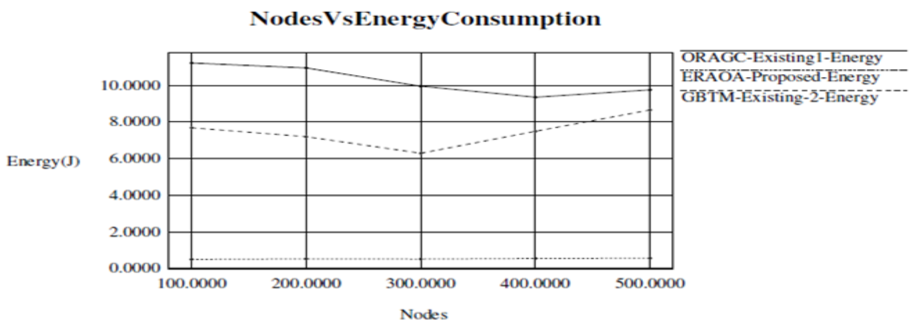


Figure 5.4: Analysis of Energy consumption verses Varying number of nodes by keeping data transfer rate constant

The Energy consumption is averaged at each individual node expenditure patter which gives an over view that how long that the individual node withstand. If all the individual nodes are categorized and estimated the overall network life time is visualized. This visualization is pictured through Figure 5.5 Since the individual life term of the node is improved hence the overall network opera ability (life term of the overall wireless video sensor network) is improved considerable.

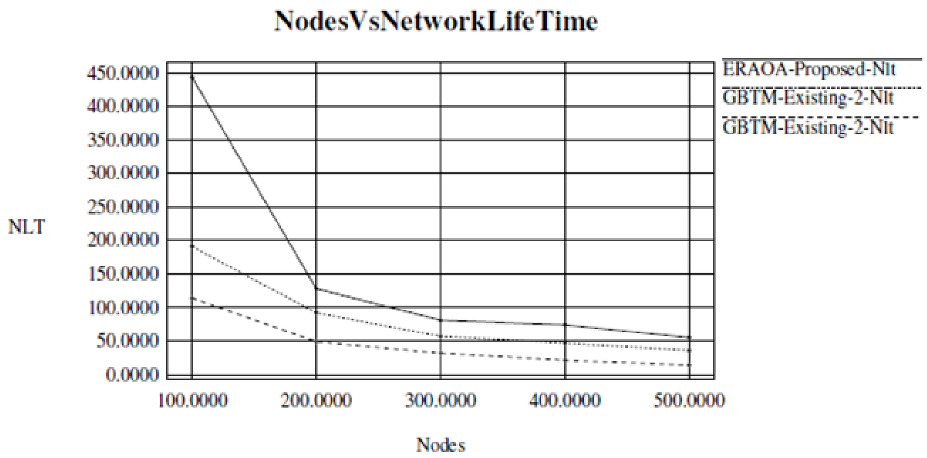


Figure 5.5: Analysis of Network Life Time verses Varying number of nodes by keeping data transfer rate

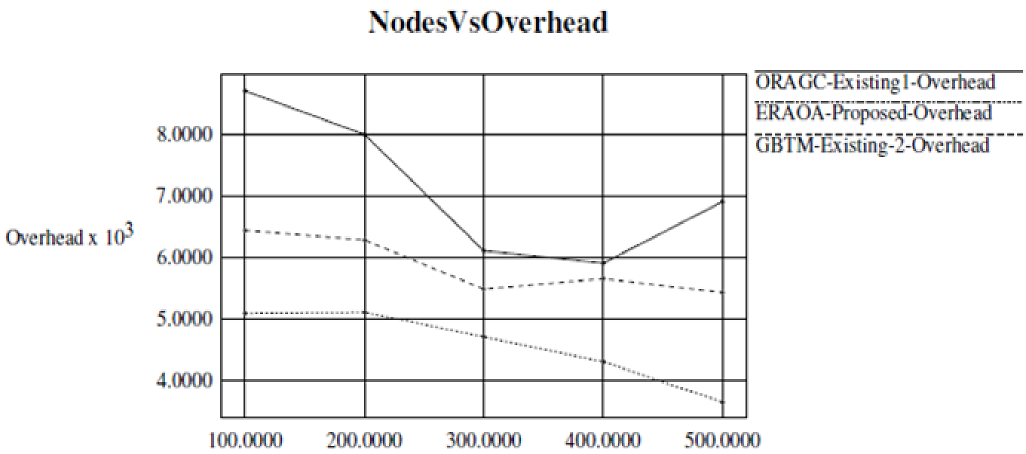


Figure 5.6: Analysis of Over Head verses Varying number of nodes by keeping data transfer rate constant.

5.1.2 Scenario 2: Fixed number of nodes verses number of data transfer varies

In the second scenario the number of nodes kept constant and number of data transfer from node to node is keep varying from each instant. The area of implementation considered is 1000 X 1000 m^2. The similar manner all parameters have been analysed. Figure 5.7 shows Delay comparisons with existing methodologies by keeping the nodes count constant. The study explains that the proposed ERAOA (Efficient Resource Allocation Optimized

Algorithm) is out perform the existing methodologies double fold improvement in comparisons with (16).

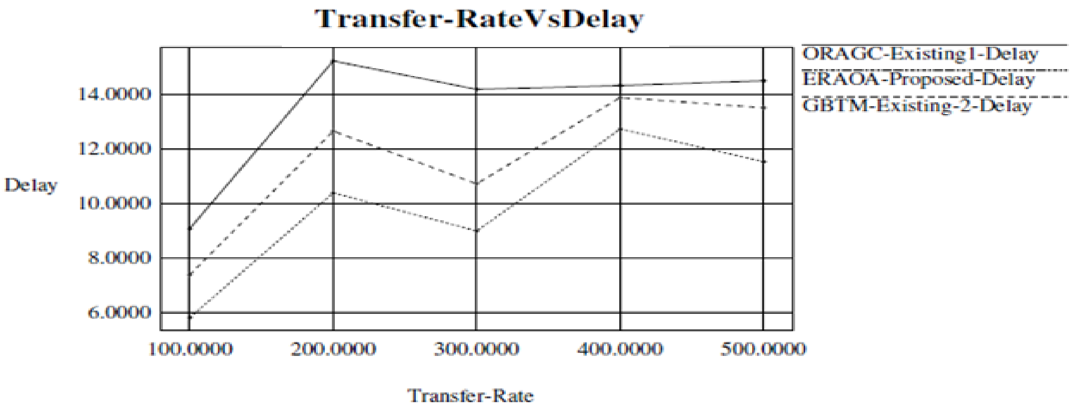


Figure 5.7: Analysis of Delay performance verses varying data transfer rate by keeping constant number of nodes.

The successful delivery of data from end to end communication is improved in comparisons with existing protocols is displayed through Figure 9. Which implies that the data drop is considerable reduced and vice versa of Figure 9 is explained through Figure 6.8. Since the resources effectively handled by the proposed ERAOA (Efficient Resource Allocation Optimized Algorithm) technique the energy wastage is avoided or minimized hence it increases better node battery saving and it can observed through Figure 6.9 in comparisons with the existing techniques.

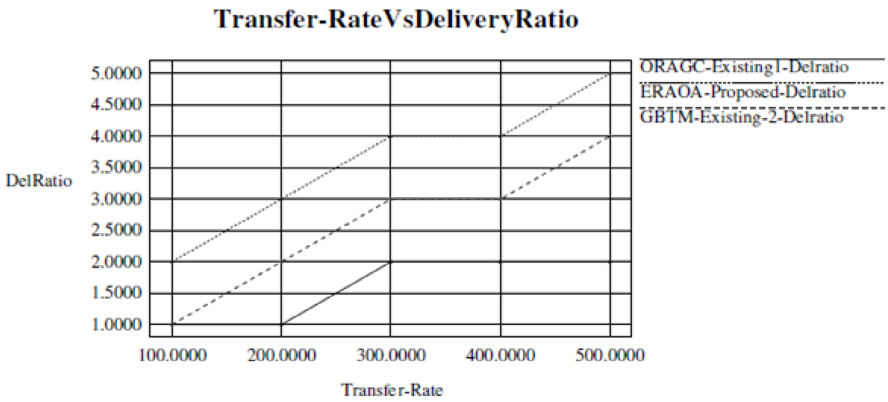


Figure 5.8 : Analysis of Delivery Ratio verses varying data transfer rate by keeping constant number of nodes

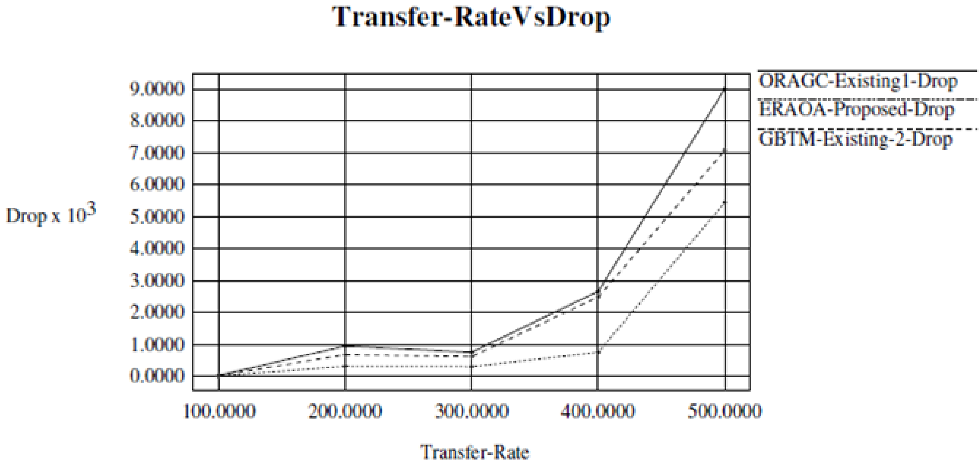


Figure 5.9: Analysis of Drop verses varying data transfer rate by keeping constant number of nodes

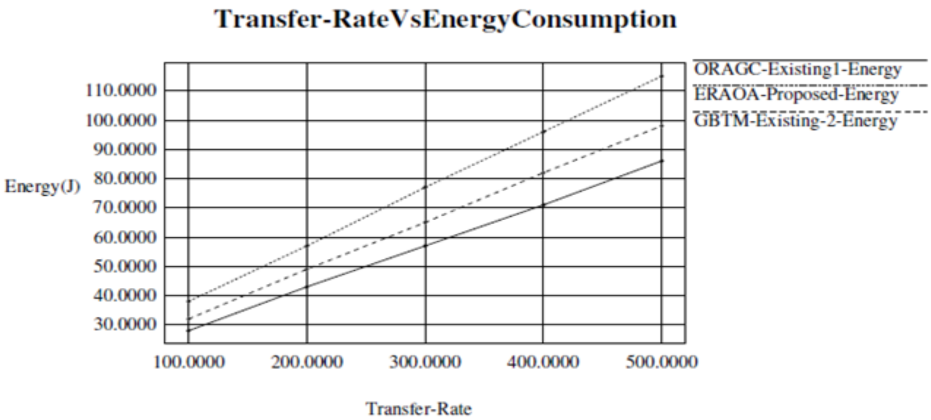


Figure 5.10: Analysis of Energy Consumption verses varying data transfer rate by keeping constant number of nodes

Since, the individual lifetime is saved overall network life span is increased and it is depicted through Figure 5.11. Figure 5.12 compares the throughput analysis of the proposed ERAOA (Efficient Resource Allocation Optimized Algorithm) with existing and the results shows that the proposed method is out-perform the existing methodology.

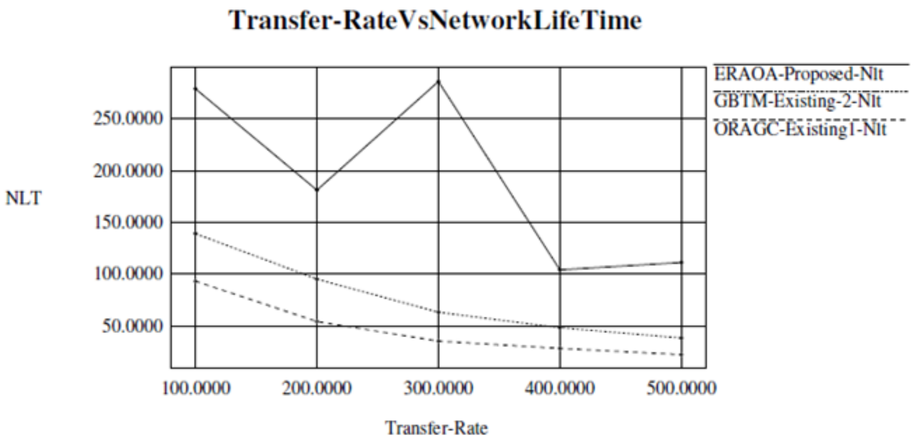


Figure 5.11: Analysis of Network Life Time verses varying data transfer rate by keeping constant number of nodes

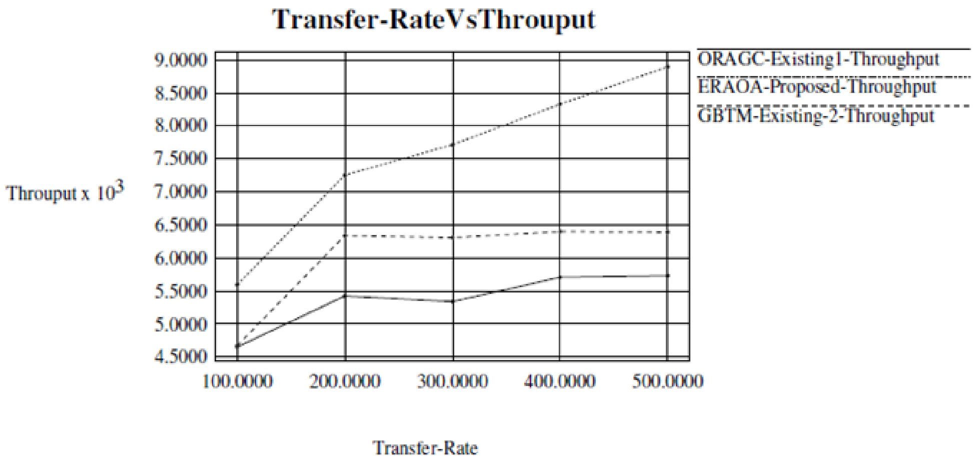


Figure 5.12 : Analysis of Throughput verses varying data transfer rate by keeping constant number of nodes

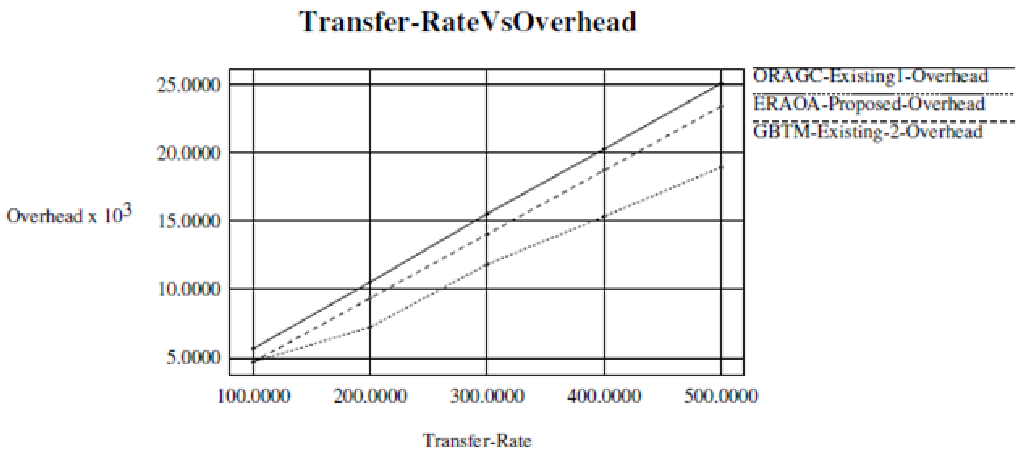


Figure 5.13 : Analysis of Over Head performance verses varying data transfer rate by keeping constant number of nodes

CHAPTER 6

CONCLUSION

In this Project, a resource allocation scheme using hybrid optimization (RAS-HO) algorithm is proposed. The proposed RAS-HO algorithm use modified animal migration optimization (MAMO) algorithm for clustering, which improved the energy consumption. Then, it combined with a glow-worm swarm optimization based decision making (GSDM) algorithm for optimal resource allocation. The ideas, models, and examination system created in this investigation give us significant bits of knowledge on the mind boggling practices of remote video sensors and give a hypothetical premise to asset allotment and execution investigation in WVSNs.

The future developments in sensor nodes must produce very powerful and cost-effective devices, so that they may be used in applications like underwater acoustic sensor systems, sensing based cyber-physical systems, time-critical applications, cognitive sensing and spectrum management, and security and privacy.

The core objective for any wireless sensor network is improving the operational time for that many ways are utilized including delay minimization, throughput improvement, resting energy expenditure, reducing “On” time of the sensing nodes. Some papers are concentrated only in energy optimization but missing on secure transmission, and identifying attack vice versa bottle neck have been presented. This proposed work implemented in four stages which are all elaborated through the sub sections of this chapter of the proposed work.

APPENDIX A (CODINGS)

CODING:

```
#Simulation parameters setup
set val(chan)   Channel/WirelessChannel      ;# channel type
set val(prop)   Propagation/TwoRayGround   ;# radio-propagation model
set val(netif)  Phy/WirelessPhy            ;# network interface type
set val(mac)    Mac/802_11                 ;# MAC type
set val(ifq)    Queue/DropTail/PriQueue     ;# interface queue type
set val(ll)     LL                         ;# link layer type
set val(ant)    Antenna/OmniAntenna        ;# antenna model
set val(ifqlen) 50                         ;# max packet in ifq
set val(nn)     50                         ;# number of mobilenodes
set val(rp)     AODV                       ;# routing protocol
set val(x)      800                        ;# X dimension of topography
set val(y)      800                        ;# Y dimension of topography
set val(stop)   50.0                       ;# time of simulation end

#----------> Initialization

#Create a ns simulator
set ns [new Simulator]

#Setup topography object
set topo       [new Topography]
$topo load_flatgrid $val(x) $val(y)
create-god $val(nn)

#Open the NS trace file
set tracefile [open out.tr w]
$ns trace-all $tracefile

#Open the NAM trace file
set namfile [open out.nam w]
$ns namtrace-all $namfile
$ns namtrace-all-wireless $namfile $val(x) $val(y)
set chan [new $val(chan)];#Create wireless channel

#--------> Mobile node parameter setup
$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) \
        -channel         $chan \
        -topoInstance    $topo \
        -agentTrace      OFF \
        -routerTrace     OFF \
        -macTrace        ON \
        -movementTrace ON

#---------> Nodes Definition

#Create 5 nodes
set n0 [$ns node]
$n0 set X_ 392.323
$n0 set Y_ 270.861
$n0 set Z_ 0.0
#$no set energy 100
$ns initial_node_pos $n0 30
set n1 [$ns node]
$n1 set X_ 364.909
$n1 set Y_ 424.418
$n1 set Z_ 0.0
$ns initial_node_pos $n1 30
set n2 [$ns node]
$n2 set X_ 410.891
$n2 set Y_ 69.2378
$n2 set Z_ 0.0
$ns initial_node_pos $n2 30
set n3 [$ns node]
$n3 set X_ 37.3568
$n3 set Y_ 252.347
$n3 set Z_ 0.0
$ns initial_node_pos $n3 30
set n4 [$ns node]
$n4 set X_ 778.679
$n4 set Y_ 270.352
$n4 set Z_ 0.0
$ns initial_node_pos $n4 30
set n5 [$ns node]
$n5 set X_ 443.484
$n5 set Y_ 370.579
$n5 set Z_ 0.0
$ns initial_node_pos $n5 20
set n6 [$ns node]
$n6 set X_ 10.7389
$n6 set Y_ 147.813
```

```
$n6 set Z_ 0.0
$ns initial_node_pos $n6 30
set n7 [$ns node]
$n7 set X_ 37.3565
$n7 set Y_ 23.8958
$n7 set Z_ 0.0
$ns initial_node_pos $n7 30
set n8 [$ns node]
$n8 set X_ -68.1837
$n8 set Y_ 241.251
$n8 set Z_ 0.0
$ns initial_node_pos $n8 30
set n9 [$ns node]
$n9 set X_ 107.357
$n9 set Y_ 201.788
$n9 set Z_ 0.0
$ns initial_node_pos $n9 30
set n10 [$ns node]
$n10 set X_ -59.1062
$n10 set Y_ 296.232
$n10 set Z_ 0.0
$ns initial_node_pos $n10 30
set n11 [$ns node]
$n11 set X_ 62.0935
$n11 set Y_ 355.658
$n11 set Z_ 0.0
$ns initial_node_pos $n11 30
set n12 [$ns node]
$n12 set X_ 157.356
$n12 set Y_ 22.9855
$n12 set Z_ 0.0
$ns initial_node_pos $n12 30
set n13 [$ns node]
$n13 set X_ -33.7881
$n13 set Y_ 476.801
$n13 set Z_ 0.0
$ns initial_node_pos $n13 30
set n14 [$ns node]
$n14 set X_ -44.5548
$n14 set Y_ 192.92
$n14 set Z_ 0.0
$ns initial_node_pos $n14 30
set n15 [$ns node]
$n15 set X_ 140.669
$n15 set Y_ 295.442
$n15 set Z_ 0.0
```

```
$ns initial_node_pos $n15 30
set n16 [$ns node]
$n16 set X_ 528.595
$n16 set Y_ 350.049
$n16 set Z_ 0.0
$ns initial_node_pos $n16 30
set n17 [$ns node]
$n17 set X_ 78.2545
$n17 set Y_ 149.405
$n17 set Z_ 0.0
$ns initial_node_pos $n17 30
set n18 [$ns node]
$n18 set X_ -0.901975
$n18 set Y_ 339.884
$n18 set Z_ 0.0
$ns initial_node_pos $n18 30
set n19 [$ns node]
$n19 set X_ 113.022
$n19 set Y_ 317.826
$n19 set Z_ 0.0
$ns initial_node_pos $n19 30
set n20 [$ns node]
$n20 set X_ 390.171
$n20 set Y_ 513.352
$n20 set Z_ 0.0
$ns initial_node_pos $n20 30
set n21 [$ns node]
$n21 set X_ 917.843
$n21 set Y_ 81.0134
$n21 set Z_ 0.0
$ns initial_node_pos $n21 30
set n22 [$ns node]
$n22 set X_ 378.878
$n22 set Y_ 334.064
$n22 set Z_ 0.0
$ns initial_node_pos $n22 30
set n23 [$ns node]
$n23 set X_ 260.667
$n23 set Y_ 410.039
$n23 set Z_ 0.0
$ns initial_node_pos $n23 30
set n24 [$ns node]
$n24 set X_ 184.824
$n24 set Y_ 408.552
$n24 set Z_ 0.0
$ns initial_node_pos $n24 30
```

```
set n25 [$ns node]
$n25 set X_ 348.902
$n25 set Y_ 511.724
$n25 set Z_ 0.0
$ns initial_node_pos $n25 30
set n26 [$ns node]
$n26 set X_ 274.11
$n26 set Y_ 472.297
$n26 set Z_ 0.0
$ns initial_node_pos $n26 30
set n27 [$ns node]
$n27 set X_ 296.364
$n27 set Y_ 346.926
$n27 set Z_ 0.0
$ns initial_node_pos $n27 30
set n28 [$ns node]
$n28 set X_ 461.47
$n28 set Y_ 436.231
$n28 set Z_ 0.0
$ns initial_node_pos $n28 30
set n29 [$ns node]
$n29 set X_ 437.664
$n29 set Y_ 484.076
$n29 set Z_ 0.0
$ns initial_node_pos $n29 30
set n30 [$ns node]
$n30 set X_ 482.189
$n30 set Y_ 13.944
$n30 set Z_ 0.0
$ns initial_node_pos $n30 30

#====================================
#       Agents Definition
#====================================
set udp10 [new Agent/UDP]
set udp12 [new Agent/UDP]
set udp13 [new Agent/UDP]
set udp14 [new Agent/UDP]
set udp20 [new Agent/UDP]
set udp21 [new Agent/UDP]
set udp23 [new Agent/UDP]
set udp24 [new Agent/UDP]
set udp30 [new Agent/UDP]

set null01 [new Agent/Null]
set null02 [new Agent/Null]
```

```
set null03 [new Agent/Null]
set null04 [new Agent/Null]
set null12 [new Agent/Null]
set null13 [new Agent/Null]
set null14 [new Agent/Null]
set null21 [new Agent/Null]
set null24 [new Agent/Null]
set null23 [new Agent/Null]

$ns attach-agent $n1 $udp10
$ns attach-agent $n1 $udp12
$ns attach-agent $n1 $udp13
$ns attach-agent $n1 $udp14
$ns attach-agent $n2 $udp20
$ns attach-agent $n2 $udp21
$ns attach-agent $n2 $udp23
$ns attach-agent $n2 $udp24
$ns attach-agent $n3 $udp30

$ns attach-agent $n0 $null01
$ns attach-agent $n0 $null02
$ns attach-agent $n0 $null03
$ns attach-agent $n0 $null04

$ns attach-agent $n1 $null12
$ns attach-agent $n1 $null13
$ns attach-agent $n1 $null14

$ns attach-agent $n2 $null21
$ns attach-agent $n2 $null23
$ns attach-agent $n2 $null24

$udp10 set packetSize_ 1500
$udp20 set packetSize_ 1500
$udp30 set packetSize_ 1500
$udp12 set packetSize_ 1500
$udp21 set packetSize_ 1500
$udp13 set packetSize_ 1500
$udp23 set packetSize_ 1500
$udp14 set packetSize_ 1500
$udp24 set packetSize_ 1500

set cbr10 [new Application/Traffic/CBR]
$cbr10 attach-agent $udp10
$cbr10 set packetSize_ 1000
$cbr10 set rate_ 1.0Mb
```

```
$cbr10 set random_ null

set cbr12 [new Application/Traffic/CBR]
$cbr12 attach-agent $udp12
$cbr12 set packetSize_ 1000
$cbr12 set rate_ 1.0Mb
$cbr12 set random_ null

set cbr13 [new Application/Traffic/CBR]
$cbr13 attach-agent $udp13
$cbr13 set packetSize_ 1000
$cbr13 set rate_ 1.0Mb
$cbr13 set random_ null

set cbr14 [new Application/Traffic/CBR]
$cbr14 attach-agent $udp14
$cbr14 set packetSize_ 1000
$cbr14 set rate_ 1.0Mb
$cbr14 set random_ null

set cbr20 [new Application/Traffic/CBR]
$cbr20 attach-agent $udp20
$cbr20 set packetSize_ 1000
$cbr20 set rate_ 1.0Mb
$cbr20 set random_ null

set cbr21 [new Application/Traffic/CBR]
$cbr21 attach-agent $udp21
$cbr21 set packetSize_ 1000
$cbr21 set rate_ 1.0Mb
$cbr21 set random_ null

set cbr23 [new Application/Traffic/CBR]
$cbr23 attach-agent $udp23
$cbr23 set packetSize_ 1000
$cbr23 set rate_ 1.0Mb
$cbr23 set random_ null

set cbr24 [new Application/Traffic/CBR]
$cbr24 attach-agent $udp24
$cbr24 set packetSize_ 1000
$cbr24 set rate_ 1.0Mb
$cbr24 set random_ null

set cbr30 [new Application/Traffic/CBR]
$cbr30 attach-agent $udp30
```

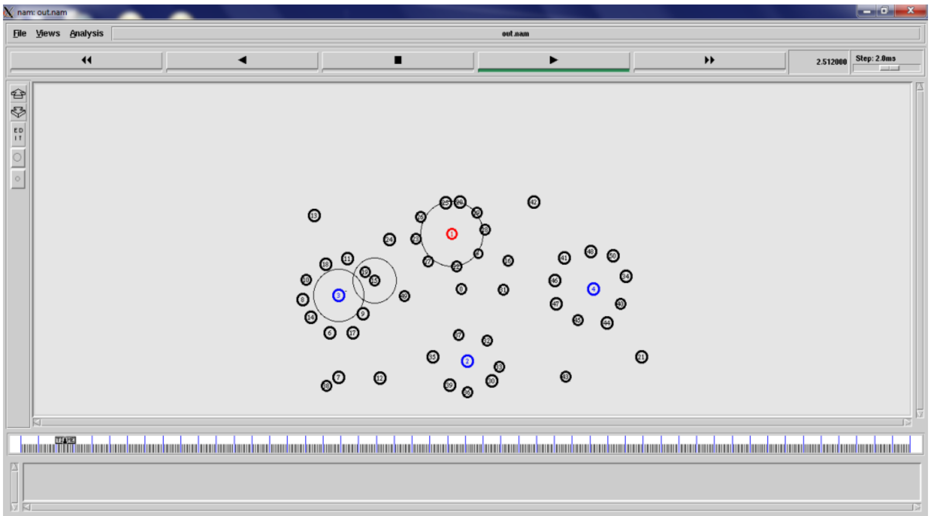
```
$cbr30 set packetSize_ 1000
$cbr30 set rate_ 1.0Mb
$cbr30 set random_ null

set energylist(0) 100
set energylist(1) 100
set energylist(2) 100
set energylist(3) 100
set MaxEnergyNode 0
set timer 0.0

$ns connect $udp10 $null01
$ns connect $udp12 $null21

$ns connect $udp20 $null02
$ns connect $udp21 $null12

$ns connect $udp30 $null03

proc setcluster {} {
	global energylist MaxEnergyNode
	if {$energylist(0)>=$energylist(1) && $energylist(0)>=$energylist(2)
&& $energylist(0)>=$energylist(3)} {
		set MaxEnergyNode 1
	} elseif {$energylist(1)>=$energylist(0) &&
$energylist(1)>=$energylist(2) && $energylist(1)>=$energylist(3)} {
		set MaxEnergyNode 2
	} elseif {$energylist(2)>=$energylist(0) &&
$energylist(2)>=$energylist(1) && $energylist(2)>=$energylist(3)} {
		set MaxEnergyNode 3
	} elseif {$energylist(3)>=$energylist(0) &&
$energylist(3)>=$energylist(2) && $energylist(3)>=$energylist(1)} {
		set MaxEnergyNode 4
	}
}


proc sendPackets1 {} {
	global ns cbr10 cbr21 cbr31 cbr41 timer energylist n1 n2 n3 n4
	$ns at [expr 0.0+$timer] "$n2 color blue"
	$n2 color "blue"
	$ns at [expr 0.0+$timer] "$n3 color blue"
	$n3 color "blue"
	$ns at [expr 0.0+$timer] "$n4 color blue"
	$n4 color "blue"
	$ns at [expr 0.0+$timer] "$n1 color red"
```

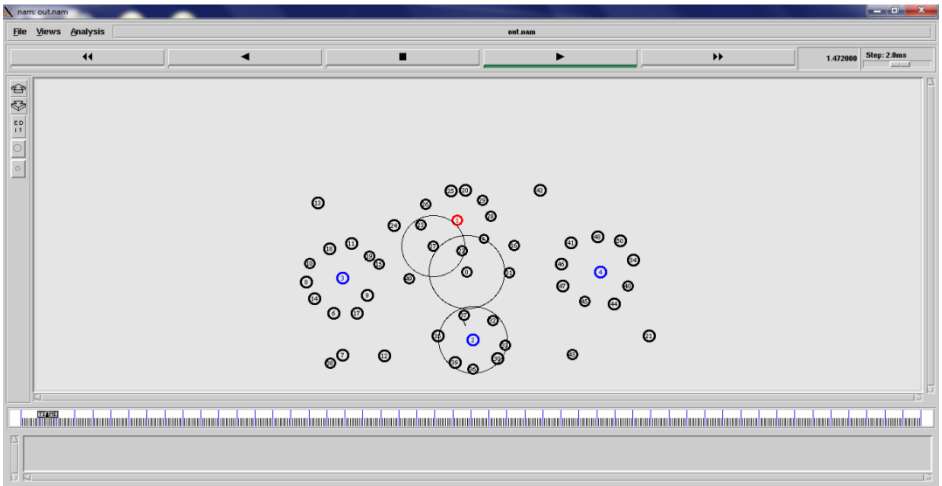
```
        $n1 color "red"
        $ns at [expr 0.0+$timer] "$cbr21 start"
        $ns at [expr 0.5+$timer] "$cbr21 stop"
        $ns at [expr 1.0+$timer] "$cbr10 start"
        $ns at [expr 1.5+$timer] "$cbr10 stop"
        $ns at [expr 3.0+$timer] "$cbr10 start"
        $ns at [expr 3.5+$timer] "$cbr10 stop"
        $ns at [expr 4.5+$timer] "$cbr10 start"
        $ns at [expr 4.8+$timer] "$cbr10 stop"
        set timer [expr $timer+5.0]
        puts "1 $timer"
        set energylist(0) [expr $energylist(0)-9]

}
proc sendPackets2 {} {
        global ns cbr12 cbr20 cbr32 cbr42 timer energylist n1 n2 n3 n4
        $ns at [expr 0.0+$timer] "$n2 color red"
        $n2 color "red"
        $ns at [expr 0.0+$timer] "$n3 color blue"
        $n3 color "blue"
        $ns at [expr 0.0+$timer] "$n4 color blue"
        $n4 color "blue"
        $ns at [expr 0.0+$timer] "$n1 color blue"
        $n1 color "blue"
        $ns at [expr 0.0+$timer] "$cbr12 start"
        $ns at [expr 0.5+$timer] "$cbr12 stop"
        $ns at [expr 1.0+$timer] "$cbr20 start"
        $ns at [expr 1.5+$timer] "$cbr20 stop"
        $ns at [expr 3.0+$timer] "$cbr20 start"
        $ns at [expr 3.5+$timer] "$cbr20 stop"
        $ns at [expr 4.8+$timer] "$cbr20 start"
        $ns at [expr 4.99+$timer] "$cbr20 stop"
        set timer [expr $timer+5.0]
        puts "2 $timer"
        set energylist(1) [expr $energylist(1)-12]

}
proc sendPackets3 {} {
        global ns cbr13 cbr23 cbr30 cbr43 timer energylist n1 n2 n3 n4
        $ns at [expr 0.0+$timer] "$n2 color blue"
        $n2 color "blue"
        $ns at [expr 0.0+$timer] "$n3 color red"
        $n3 color "red"
        $ns at [expr 0.0+$timer] "$n4 color blue"
        $n4 color "blue"
        $ns at [expr 0.0+$timer] "$n1 color blue"
```

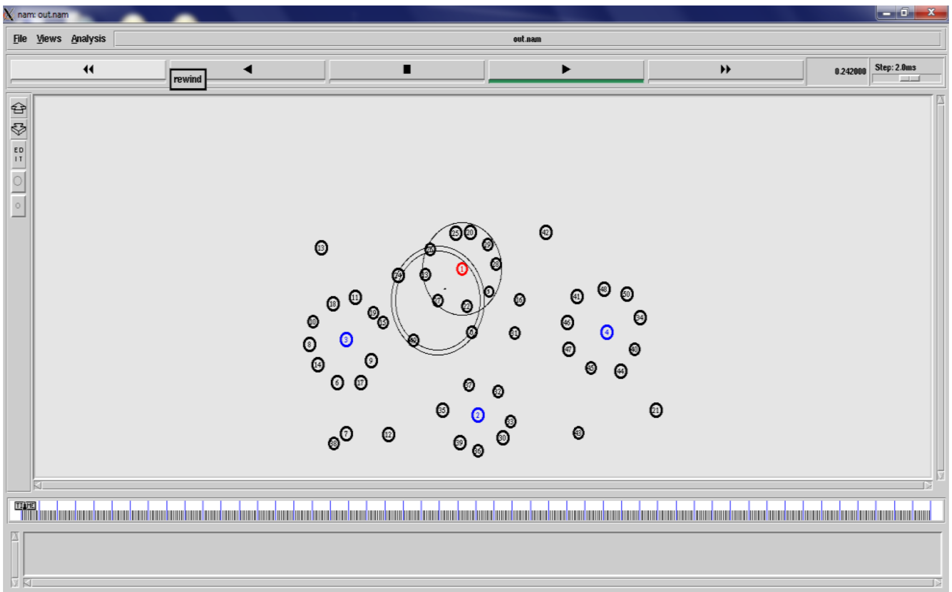
```
        $n1 color "blue"
        $ns at [expr 0.0+$timer] "$cbr13 start"
        $ns at [expr 0.5+$timer] "$cbr13 stop"
        $ns at [expr 1.0+$timer] "$cbr30 start"
        $ns at [expr 1.5+$timer] "$cbr30 stop"
        $ns at [expr 2.0+$timer] "$cbr23 start"
        $ns at [expr 2.5+$timer] "$cbr23 stop"
        $ns at [expr 3.0+$timer] "$cbr30 start"
        $ns at [expr 3.5+$timer] "$cbr30 stop"
        $ns at [expr 4.5+$timer] "$cbr30 start"
        $ns at [expr 4.8+$timer] "$cbr30 stop"
        set timer [expr $timer+5.0]
        puts "3 $timer"
        set energylist(2) [expr $energylist(2)-11]

}
proc sendPackets4 {} {
        global ns cbr14 cbr24 cbr34 cbr40 timer energylist n1 n2 n3 n4
        $ns at [expr 0.0+$timer] "$n2 color blue"
        $n2 color "blue"
        $ns at [expr 0.0+$timer] "$n3 color blue"
        $n3 color "blue"
        $ns at [expr 0.0+$timer] "$n4 color red"
        $n4 color "red"
        $ns at [expr 0.0+$timer] "$n1 color blue"
        $n1 color "blue"
        $ns at [expr 0.0+$timer] "$cbr14 start"
        $ns at [expr 0.5+$timer] "$cbr14 stop"
        $ns at [expr 2.0+$timer] "$cbr24 start"
        $ns at [expr 2.5+$timer] "$cbr24 stop"

        set timer [expr $timer+5.0]
        puts "4 $timer"
        set energylist(3) [expr $energylist(3)-8]
}


proc leach {} {
        global timer timer1 MaxEnergyNode energylist
        while {$timer<50} {
                setcluster
                if [expr $MaxEnergyNode==1] {
                        sendPackets1
                } elseif [expr $MaxEnergyNode==2] {
                        sendPackets2
                } elseif [expr $MaxEnergyNode==3] {
```

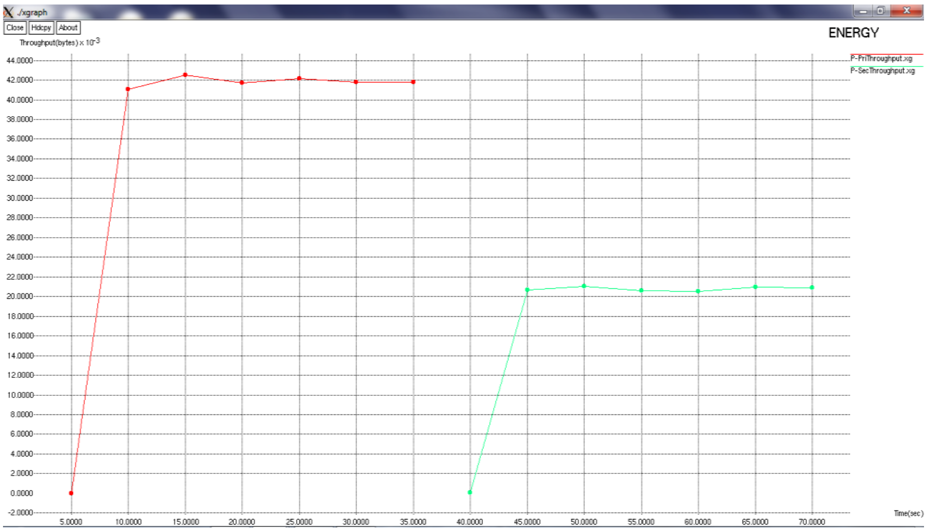
```
                    sendPackets3
                } elseif [expr $MaxEnergyNode==4] {
                    sendPackets4
                }
                puts "$energylist(0) $energylist(1) $energylist(2) $energylist(3) "
        }
}

leach
#===================================
#       Termination
#===================================
#Define a 'finish' procedure
proc finish {} {
        global ns tracefile namfile
        $ns flush-trace
        close $tracefile
        close $namfile
        exec nam out.nam &
exec xgraph -m -P -bg white -t PACKET_DELIVERY_RATIO P-PriPDR.xg P-SecPDR.xg -x Time(sec) -y Pdr(%)-geometry 640x580 &
exec xgraph -m -P -bg white -t PACKET_DROP P-PriDrop.xg P-SecDrop.xg -x Time(sec) -y pktdrop(pkt) -geometry 640x580 &
exec xgraph -m -P -bg white -t ENERGY P-PriThroughput.xg P-SecThroughput.xg -x Time(sec) -y Throughput(bytes) -geometry 640x580 &
exec xgraph -m -P -bg white -t END-TO-END-DELAY P-PriDelay.xg P-SecDelay.xg -x Time(sec) -y delay(ms) -geometry 640x580 &

exec xgraph -m -P -bg white -t PACKET-LOST gr2.dat -x Time_(sec) -y Pkt_(bytes) -geometry 640x480 &
exec xgraph -m -P -bg white -t DELAY VALUE CHANGE IN NETWORK gr3.dat -x Time(sec) -y Pdr_(%) -geometry 640x480 &
        exit 0
}

# Telling nodes when the simulation ends
for {set i 0} {$i < $val(nn) } { incr i } {
        $ns at $val(stop) "\$n$i reset"
}

# ending nam and the simulation
$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "finish"
$ns at $val(stop) "puts \"done\" ; $ns halt"
$ns run
```

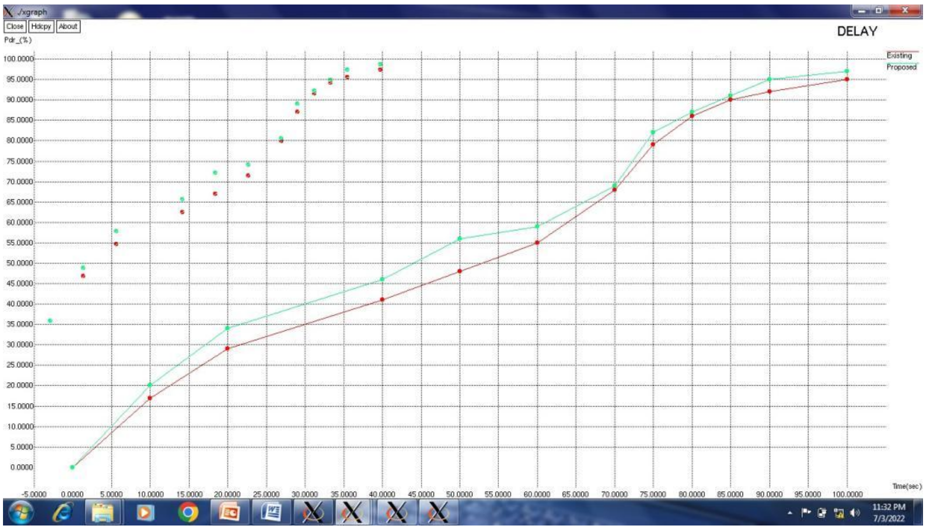
APPENDIX B (SCREENSHOTS)

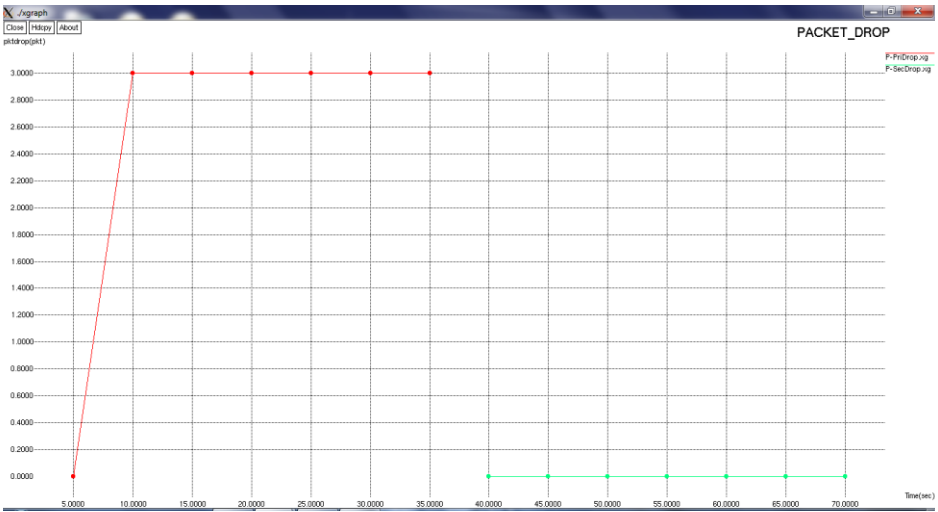


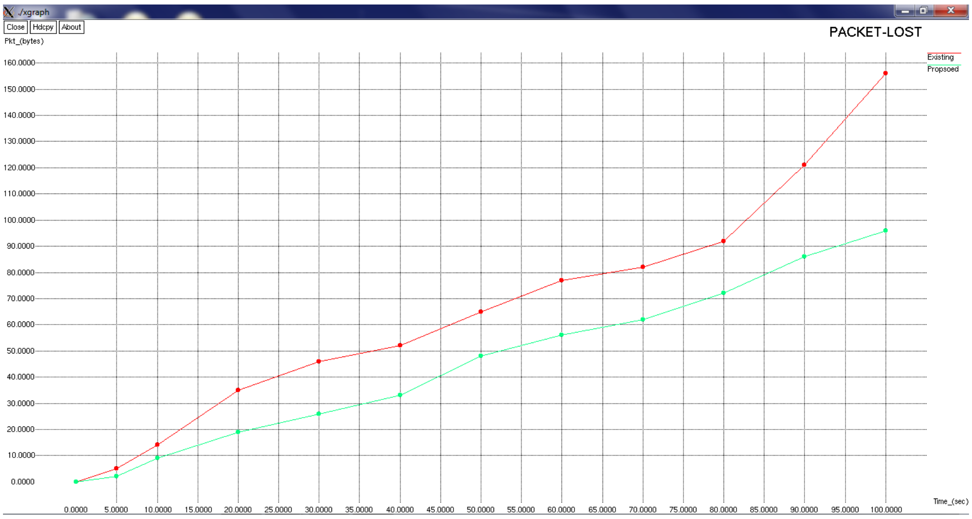


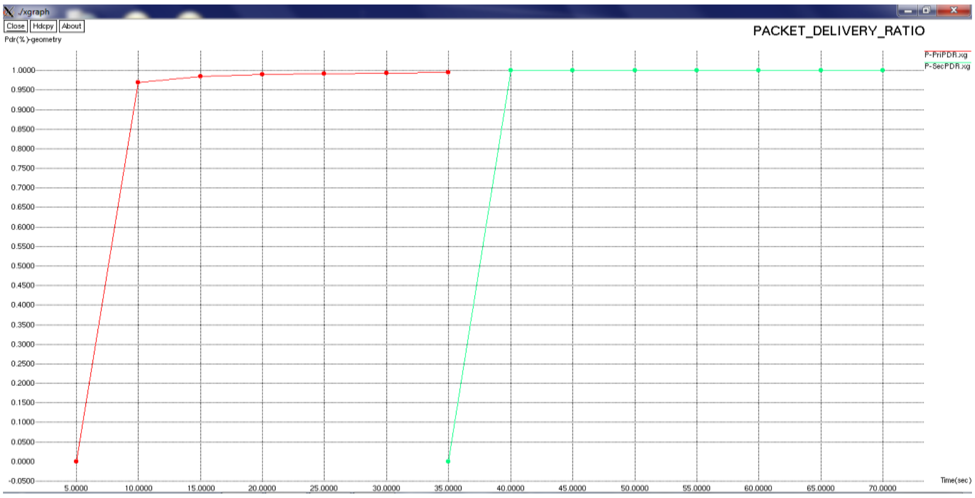



ENERGY
Throughput(bytes) x 10^3
P-PriThroughput.xg
P-SecThroughput.xg
Time(sec)


DELAY
Pdr_(%)
Existing
Proposed
Time(sec)


PACKET_DROP
pktdrop(pkt)
P-PriDrop.xg
P-SecDrop.xg
Time(sec)


PACKET-LOST
Pkt_(bytes)
Time_(sec)
Existing
Propsoed


PACKET_DELIVERY_RATIO
Pdr(%)-geometry
Time(sec)

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