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Highlights

Network Path Discovery

Embedded Sensor System

VoIP Packet Delay

An Efficient Algorithm

Discovering Thoughts, Inventing Future

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VoIP Packet Delay Techniques : A Survey

By R. Shankar & Dr. E. Karthikeyan
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Abstract- The continuous development in the field of communication have paved the way for Voice over Internet Protocol (VoIP). VoIP is a group of hardware and software that facilitates people to utilize the Internet as the transmission medium for telephone calls by transmitting voice data in packets using IP instead of using conventional circuit transmissions of the Public Switched Telephone Network (PSTN). At present, VoIP is becoming an important tool for quick communication across the world. There are several Internet telephony applications existing at present. The major disadvantage in VoIP is that the packet delay. In VoIP, the terminology jitter is used to refer the type of packet delay where the delay has a huge setback in the quality of the voice conversation. Several packet delay techniques were proposed in recent years. Some of the important packet delay techniques are discussed in the literature. This survey would definitely help the researchers to carry out their research for providing better communication in VoIP without any delay.

Keywords: voice over internet protocol (VoIP), packet delay, jitter, IP packet delay, time-division multiplexing (TDM), wifi.

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R. Shankar [α] & Dr. E. Karthikeyan[σ]

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I. Introduction

There are numerous attractive alternatives both to conventional public telephony and to charter lines for networking in these days. Among the most remarkable are networking technologies based on various kinds of voice transmission called Voice over IP (VoIP). Voice over IP (VoIP) refers to real-time delivery of packet voice across networks utilizing the Internet protocol. VoIP's request is based on its capability to make possible for voice and data convergence at an application layer [1, 2].

One of the classic problems with the accomplishment of packet voice over IP is the complexity of QoS guarantee. Voice quality is affected by delay, delay jitter and unreliable packet delivery all of which are usual characteristics of the essential IP-network service [3]. IP traffic is obviously treated as "best effort" and transmits on a first-come, first-served basis.These characteristics have supplied to large delays and large delay variations in packet delivery, which are the most significant concerns of packeted voice QoS requirement.

This technology provides new opportunities for the growth of new applications and educational services, chiefly through the potential for converging Voice with supplementary media and data. In the long-term, VoIP is expected to impact on some of the better developments in higher education, for instance, virtual universities, personality management and incorporation with enterprise-level services and applications [4].

The fundamental process carried out in a VoIP call is as given below [5]:

1. Transformation of the caller's analog voice signal into a digital format.
2. Compression and transformation of the digital signal into discrete Internet Protocol packets
3. Transmission of the packets through the Internet or other IP-based network
4. Reverse transformation of packets into an analog voice signal for the call recipient.

Recently, huge numbers of organizations, public and private, have begun evaluating IP technologies as they believe that IP-based systems present increased reliability and fault-tolerance. This is the primary stage of the creation of the 'converged network' in which a single network replaces the current set-up of twin, separate networks of voice (PBX) and data (LAN) [6]. This network possibly will be an organization's internal LAN, a leased network, the PSTN or the open Internet [7]. The compression process is carried out by a codec, a voice-encoding algorithm, which permits the call to be sent over the IP network inside the network's accessible bandwidth.

Packet delay is perhaps the most difficult constituent of network behavior to examine—with loss, for instance, the packet either shows up at the receiver or it does not, while with delay there are several shades of possibility and meaning in the time necessary for a packet to arrive. Similarly, delay variation is potentially the better source of information regarding the VoIP network, as one of the principle elements contributing to delay is queuing within the network, which is of vital importance in understanding how network capacities evolve over time [8].

Several packet delay techniques were proposed in recent years. Some of the important techniques are discussed in the following section.

II. Literature Survey

The difficulty of multiple-packet bundling to enhance spectral effectiveness in cellular networks is examined. The packet size of real-time data, like Voice over Internet Protocol (VoIP), is frequently very small. On the other hand, the general use of Time-Division Multiplexing (TDM) limits the number of VoIP users

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supported as a packet has to remain until it gets a time slot, and if only one small VoIP packet is placed in a time slot, capacity is wasted. Packet bundling can ease that problem by sharing a time slot between multiple users. A current revision of cdma2000 1xEV-DO has established the concept of the Multiuser Packet (MUP) in the downlink to conquer restrictions on the number of time slots. But, the effectiveness of packet bundling is not well understood, mainly in the occurrence of time-varying channels. Baek-Young Choi et al., [9] proposed a novel quality-of-service (QoS) and channel-aware packet bundling algorithm that takes advantage of adaptive modulation and coding. It reveals that optimal algorithms are Nondeterministic Polynomial time (NP)-complete, suggest heuristic approaches, and utilize analytical performance modeling to demonstrate the gains in capacity that can be attained from the packet bundling algorithms. It also reveals that channel utilization can be considerably increased by slightly delaying some real-time packets within their QoS requirements while bundling those packets with like channel conditions. It is authenticated through extensive OPNET simulations with an entire evolution-data optimized (EV-DO) implementation.

Yensen et al., [10] proposed a new algorithm for predicting audio packet play out delay for voice conferencing applications that use silence suppression. The proposed algorithm utilizes a Hidden Markov Model (HMM) to envisage the play out delay. Numerous existing algorithms are reviewed to show that the HMM technique is based on a combination of different desirable features of other algorithms. Voice over Internet protocol (VoIP) applications generates packets at a deterministic rate but different queuing delays are added to the packets by the network causing packet interarrival jitter. Playout delay prediction techniques lists audio packets for playout and challenge to make a reasonable compromise between the number of lost packets, the one-way delay and the delay variation as these criteria cannot be optimized concurrently. Particularly, the proposed HMM technique is revealed to make a good compromise among the mean end-to-end delay, end-to-end delay standard deviation and average packet loss rate.

James et al., [11] introduced voice over IP networks and services in ways that satisfy the voice quality expectations of our customers, we have been conducting laboratory studies of how VoIP transmission affects voice quality while also carefully monitoring and managing several field implementations of VoIP. This article reviews and gives a helpful progress report on the industry's development to VoIP. It also review the data on the voice quality consequences of packet loss, delay, speech coders, packet loss concealment algorithms, and the compression choice of suppressing transmission through silence. Since the common problem of echo has emerged frequently in the VoIP environment, it reviews this issue in a few details. Packet loss and delay variation sizes prepared on private VoIP networks are evaluated, and the data here are persuaded. It completes this case by making that the network planning tool recognized as the E-model is presently an inexact predictor of VoIP network presentation.

The widespread usage of mobile devices in the IP network has guide to a new attempt to pertain a Power-Saving Mode (PSM) to real-time traffic like Voice over IP (VoIP). Hyun-Ho Choi et al., [12] evaluated the performance of the PSM when the PSM is used for VoIP services of mobile devices. Obtaining the performance of each conversational party into explanation, it takes two different kinds of PSMs: one is employed through the talk-spurt periods and the other is employed through the mutual silence periods of two conversational parties. The presentation of each PSM is examined with respect to buffering delay, the possibility of packet drop, and power consumption of a mobile VoIP device. After that, the maximum bound of sleep interval in every period is gained, which reduces the power consumption of the mobile device avoiding violations of the Quality-of-Service (QoS) of VoIP. In the various network environments, the proposed PSM for VoIP considerably reduces the power consumption while fulfilling the end-to-end delay and packet drop probability restrictions of a VoIP connection.

Recently, there has been a remarkable increase in the popularity of VoIP services as the outcome of large growth in broadband access. The same Voice-over-Internet protocol (VoIP) service creates new challenges when arranged over a wireless mesh network, at the time of enabling users to create voice calls using WiFi phones. Owing to interference Packet losses and delay in a multiple-hop mesh network with limited capacity, it can considerably humiliate the end-to-end VoIP call quality. It converse about the fundamental requirements for efficient deployment of VoIP services for the mesh network. Ganguly et al., [13] presented and evaluated practical optimizing techniques that can enhance the network capacity, maintain the VoIP quality and handle user mobility efficiently. A real testbed and ns-2 provides insights into the presentation issues and reveals the level of enhancement that can be achieved by the proposed techniques. Particularly, the packet aggregation is discovered with the help of header compression that can raise the number of supported VoIP calls in a multihop network by 2-3 times. The proposed fast path switching is extremely efficient in preserving the VoIP quality. This fast handoff scheme attains almost unimportant disruption during calls to roaming clients.

VoIP (Voice over Internet protocol) technology has rapidly been increasing recently, which transmits voice packets by utilizing the User Datagram Protocol (UDP). VoIP quality is very hard to expect because it is

difficult to envisage the influence of packet delay, packet lose, packet error, etc. Bih-Hwang Lee et al., [14] proposed an embedded call admission control (CAC) mechanism by applying real-time transfer protocol (RTP) and the real-time control protocol (RTCP) for VoIP services over hybrid fiber/coaxial (HFC) networks. The proposed CAC mechanism is estimated by the impact of the different traffic loads in cable modem termination system (CMTS), which calculates how VoIP quality satisfies the user's requirements under different restrictions on cable networks. It confers about VoIP CAC mechanism for the upstream channel according to the Data over Cable Service Interface Specifications (DOCSIS) version 1.1 and chiefly considers G.723.1 voice packets at the transmission rate of 6.3 kbps. The performance size of the proposed embedded CAC mechanism is achieved under different network constrains, which consists of throughput, packet dropping ratio and call blocking ratio. It clearly gives effectiveness and fast method for CMTS to decide how many calls can be allowed.

It is recognized that measuring the one-way delay of Voice-over-IP (VoIP) packets is an intimidating task. The confront lies in the fact that the Internet implicitly implements the end-to-end principle. This means that the endpoints are anticipated to operate separately. Exclusive of a synchronized timing, it is hard for an endpoint to gauge the one-way delay. Ngamwongwattana et al., [15] presented the refined version of the novel VoIP measurement methodology called Sync & Sense of Periodic Stream that can overcome such a challenge. Sync & Sense is single in that it can virtually coordinate the transmission and reception timing of the VoIP session without the need of a synchronized clock. Therefore it reveals that Sync & Sense can accurately gauge the one-way network delay of the VoIP packets (without propagation delay). While time skew is very general in any system involving a clock, we the question arises on how Sync & Sense can deal with the time skew without the need of a synchronized clock.

In the context of the IEEE 802.16e standard, a Dual Power-Saving Mode (DPSM) algorithm for Voice over IP (VoIP) traffic whose voice codec supports voice activity detection is proposed by Lee et al., [16]. The proposed algorithm uses the indolence of the voice codec of every conversing party through mutual silence periods. Utilizing the suggested method, the length of the sleep intervals differs during mutual silence periods, while during talk-spurt periods it is permanent according to the VoIP packet generation ratio. The presentation of the DPSM algorithm for the average packet-buffering delay in the Base Station (BS) and the energy consumption of a Mobile Station (MS) is estimated numerically and authorized with the help of computer simulation. Therefore it shows that when the proposed combined method is used, the energy consumption of an MS is significantly less when a PSM that only uses sleep intervals of a permanent length is operating. This development in performance comes at the cost of better packet-buffering delay in the BS.

Capacity has been a significant matter for several wireless backhaul networks. The multihop nature and the huge per packet channel together access overhead which can guide to its low channel effectiveness. The problem may receive even badly when there are numerous applications transmitting packets with small data payloads, for example, Voice over Internet protocol (VoIP). Earlier, the utilization of several parallel channels and employing packet concatenation were taken care as independent solutions to these problems. On the other hand, there are unavailable work on the integrated design and performance study of a complete scheduler architecture joining these two schemes. Wei-chih Hong et al., [17] proposed a scheduler that concatenates small packets into large frames and sends them through multiple parallel channels with an intelligent channel selection algorithm between neighboring nodes. In addition the predictable capacity improvements, also obtain delay bounds for this scheduler. Depending upon the delay bound formula; Call Admission Control (CAC) of a wide variety of prepared algorithms can be achieved. It reveal the important capacity and resequencing delay improvements of this novel design with a voice-data traffic mixing instances, by means of both numerical and simulation results. It is revealed that the proposed packet concatenation and channel selection algorithms largely perform well in the round-robin scheduler in a multihop scenario.

TCP has usually been considered unsuitable for real-time applications. Nevertheless, popular applications like Skype use TCP since UDP packets cannot exceed through restrictive Network Address Translators (NATs) and firewalls. Encouraged by this observation, it examines the delay performance of TCP for real-time media flows. Brosh et al., [18] developed an analytical performance model for the delay of TCP. Some of the experiments are conducted to authenticate the model and to calculate the impact of various TCP mechanisms on its delay performance. Therefore it specifies that simple application-level schemes, like packet splitting and parallel connections, can decrease the delay of real-time TCP flows by as much as 30% and 90%, correspondingly.

Voice communications e.g., telephony are delayed responsive. Existing Voice-over-IP (VoIP) applications convey voice data in packets of very small size to reduce packet delay, causing very incompetent use of network bandwidth. Sze et al., [19] proposed a multiplexing scheme for improving the bandwidth efficiency of existing VoIP applications. By fixing a multiplexer in an H.323 proxy, voice packets from many sources are joined into single IP packet for transmission.

The receiver-end proxy returns the innovative voice packets of the de multiplexer before sending them to the end-user applications. The multiplexing scheme is completely well-matched with existing H.323-compliant VoIP applications and can be voluntarily deployed.

Speech communication using the Voice over Internet Protocol (VoIP) is very frequent today. The fundamental network channel may be the Public Switched Telephone Network (PSTN channel), satellite channels or cellular wireless channels to mention a few. The packetization of speech and its transmission through packet switched networks, however, initiate numerous impairments for example delay, jitter, packet loss and decoder clock offset, which disgrace the quality of the speech. Ogunfunmi et al., [20] presented an overview of the challenges and a description of the advanced signal processing algorithms used to combat these impairments and render the perceived quality of a VoIP conversation to be as good as that of the existing telephone system. An instance of a speech coder is also designed for packet-switched networks and converses the possibilities for hardware implementations.

Satellites are predicted to be balancing to prospect terrestrial networks in deploying multimedia communication systems. The use of geostationary multibeams and on-board processing gives a great chance for the immediate deployment of real time services such as IP telephony services over satellites. The effects of IP telephony move over satellite channels have not been examined in detail. The Cruickshank et al., [21] presented an overview of the VIP-TEN project architecture and the VoIP measurement campaign over the EuroSkyWay test-bed. The geostationary satellites can take VoIP traffic and present a good quality service in terms of packet loss and jitter, and average to poor quality in terms of packet delay. It also studies the delays in setting/joining audio conferences and multicast group organization over satellites.

In IEEE 802.11e-based WLANs, link adaptation mechanisms, which select the transmission rate of each node, aggravate unexpected and random variations on the efficient channel capacity. When these alterations are towards lower bit-rates, inelastic flows, like VoIP, it can undergo from sudden congestion, which outcomes higher packet delays and losses. A VoIP codec selection algorithm has been proposed by Sfairopoulou et al., [22] as a solution to this issue, which is triggered both by channel rate changes as well as in combination with a call admission control mechanism. An important enhancement in terms of hotspot capacity for VoIP calls can be attained by selecting the VoIP codec adaptively in a multi-rate scenario. By describing a new grade of service-related parameter, Qmacr, which captures the tradeoff among dropping and blocking probabilities and professed speech quality, the codec selection algorithm can be tuned to reach maximum capacity without strictly penalizing any of those variables, and therefore satisfying both technical and user quality requirements.

Considering voice as a leading telecommunication service, the performance of Voice over IP (VoIP) plays an important role in deployment of worldwide interoperability for microwave access (WiMAX) technology giving all-IP network services. Lin et al., [23] investigated the performance of a WiMAX-based VoIP established under the mobile Taiwan (M-Taiwan) field-trial funded program. To gain the objectives of the trial the measurement results are expressed in the form of Mean Opinion Score (MOS), packet loss, packet delay and jitters. For the worst-case scenario, the analyses were performed under a tough condition of both communicating devices, wirelessly associated to the same WiMAX base station under a heavy background traffic and interference. Ahead of the analysis, the field measurements verify an excellent performance when both communicating devices kept stationary and demonstrate an acceptable quality for the service when both communicating devices are on the move at a speed of 50 km/h.

The prologue of the IP multimedia subsystem on 3G cellular networks and the combination with other widely deployed wireless networks based on the IEEE 802.11 protocol family necessitate support for both mobility and quality of service. When mobile systems go across heterogeneous networks, ongoing real-time sessions are affected not only by handoff delay but also by various packet delay and bit rate. Bernaschi et al., [24] proposed a cross-layer mechanism that takes into account mobility at different layers of the network stack in order to yield better quality for VoIP, videoconferencing, and other real-time applications. Finally it expresses the cross-layer architecture, adaptation techniques and prototype implementation.

Table1 : An Overview of the Existing VoIP Packet Delay Techniques

Method	Technique Used
Baek-Young Choi et al., [9]	Novel Quality-of-Service (QoS) and channel-aware packet bundling algorithm
Yensen et al., [10]	New algorithm for predicting audio packet playout delay
Ganguly et al., [13]	Evaluated practical optimizing techniques
Bih-Hwang Lee et al., [14]	Embedded Call Admission Control (CAC) mechanism
Ngamwongwattana et al., [15]	Refined version of the novel VoIP measurement methodology
Lee et al., [16]	A Dual Power-Saving Mode (DPSM) algorithm
Brosh et al., [18]	Developed an analytical performance model

Sze et al., [19]	Multiplexing scheme
Ogunfunmi et al., [20]	An overview of the challenges and a description of the advanced signal processing algorithms
Bernaschi et al., [24]	A cross-layer mechanism

III. Problems And Directions

Although the above discussed techniques have practically provided some method to reduce the packet delay, but there is still no effective technique to completely reduce the packet delay. The following points should be taken into account for better communication without any delay.

- The major reason for packet delay is congestion. During the process of communication, several packets are delayed due to congestion in the network. So, in future, researchers should consider congestion as a serious problem and propose some technique to handle this congestion.
- The VoIP is not only loss-adaptive but also delay-adaptive. Specifically, they can have either a constant time, or adapt to changes in packet delay and fix the time accordingly. Such adaptive technique can keep track of packet delays, and reflect any change in packet delays.

IV. Conclusion

VoIP is presented on many smartphones and Internet devices so that users of portable devices may use phones, may set calls or send SMS text messages over 3G or Wi-Fi. The delay is identified from the start of the packet from which it is transmitted at the source to the end of the packet and then received at the destination. A constituent of the delay which does not differ from packet to packet can be unnoticed; hence if the packet sizes are equal and packets always obtain the same time to be processed at the destination then the packet arrival time at the destination could be utilized instead of the time the end of the packet is received. For future work, the above techniques plans to investigate the presentation of the packet delay in the VoIP applications.

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Contemporary Affirmation of Machine Learning Models for Sensor Validation and Recommendations for Future Research Directions

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Abstract- Wireless Sensor Networks (WSNs) are important and needed systems for the future as the notion "Internet of Things" has emerged lately. They're used for observation, tracking, or controlling of several uses in sector, health care, home, and military. Yet, the quality of info collected by sensor nodes is changed by anomalies that happen because of various grounds, including node failures, reading errors, unusual events, and malicious assaults. Thus, fault detection is a necessary procedure before it's used in making selections to make sure the quality of sensor information. A multitude of methods can be called multiple-changeable systems/agents. For example methods such as for example creating heating system, ventilation and air conditioner(HVAC) methods are changeable methods / agents . Multiple-changeable methods /agents such as for instance these commonly don't meet performance expectations imagined at design time. Such failings can be a result of a number of factors, for example difficulties due to improper installment, substandard maintenance, or products failure. These issues, or "faults," can comprise mechanical disappointments, management difficulties, design mistakes, and improper operator treatment.

Keywords: wiireless sensor networks (WSNs); sensor validation, sensor data fault proneness detection; detection effectiveness; detection efficiency; energy consumption.

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Abstract- Wireless Sensor Networks (WSNs) are important and needed systems for the future as the notion "Internet of Things" has emerged lately. They're used for observation, tracking, or controlling of several uses in sector, health care, home, and military. Yet, the quality of info collected by sensor nodes is changed by anomalies that happen because of various grounds, including node failures, reading errors, unusual events, and malicious assaults. Thus, fault detection is a necessary procedure before it's used in making selections to make sure the quality of sensor information. A multitude of methods can be called multiple-changeable systems/agents. For example methods such as for example creating heating system, ventilation and air conditioner(HVAC) methods are changeable methods / agents . Multiple-changeable methods /agents such as for instance these commonly don't meet performance expectations imagined at design time. Such failings can be a result of a number of factors, for example difficulties due to improper installment, substandard maintenance, or products failure. These issues, or "faults," can comprise mechanical disappointments, management difficulties, design mistakes, and improper operator treatment. As a result of complexity of such multi-varying methods/agents, it truly is relatively typical for problems to proceed unnoticed for extended periods of time, and simply recognized when they become critical enough to cause whole gear failure, extreme energy consumption, and/or satisfactory performance degradation to activate user criticisms. In this paper we introduced the contemporary affirmation of the recent literature on sensor validations using machine-learning approaches. In this critique, we condition the requirements to style successful and effective fault detection designs and present the troubles of problem detection in WSNs.

Keywords: wiireless sensor networks (WSNs); sensor validation, sensor data fault proneness detection; detection effectiveness; detection efficiency; energy consumption.

I. Introduction

Several public-service practical divisions, such as for instance Transport, Temperature Information Program are employing sensors to gather associated info.Within this respect the problem divisions use a group of sensors that gather preferred info.The info from these sensors can be used to look for the associated info. These details can be used to consider proper choices or steps. The info obtained in the sensors can be used some occasions to spend assets or even to consider delicate choices, which assists in operating the business within an effective and economical manner.

Over a period of moment because of several factors including climate, poor preservation, info obtained in the information noted by sensors will be fault-prone. This makes it vital that you retain these sensors in working order and ensure the parts are appropriate. The maintenance of these sensor models is pricey and it is performed manually. Routine re-preservation inspections and calibrations are expected to guarantee the correct working of these sensors. If there existed an automated process that may detect malfunctions in real time and alert the maintenance personnel it would be beneficial. Within this document we completed the contemporary acceptance of the current literature about machine-learning techniques made to calculate the fault-proneness of the sensors.

To discover a malfunctioning sensor utilizing ML approaches, the overall practice is to take notice of the sensor's productivity over a period of time of time for you to establish any substantial and / or systemic variations from the precise circumstances present that might reveal a sensor malfunction. It needs historic Alarm Information obtained in the site and it's particular nearby websites to master the patterns, to create Machine learning designs.

a) Building Models of Sensor Data using Machine Learning

Machine-Learning (ML) practices assemble versions depending on prior observations that may subsequently be used to predict new data. The model constructed is a result of a learning process that extracts beneficial details about the information technology procedure for the device utilizing the preceding findings. ML techniques take a set of information akin to the method (in cases like this the weather in a sensor) and

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develop a model of that method in many different strategies to anticipate that method. The ensuing type might be put on future data to try and estimate sensor prices. The ensuing forecasts are able to be in comparison to sensor prices claimed as well as in situations where you can find significant deviations; these sensors could be flagged as possibly malfunctioning.

We suggest to use many different ML procedures including classification processes (e.g., J48 Decision Trees, Naive Bayes and Bayesian Networks), regression processes (e.g., Linear Regression, Least Median Pieces) and Hidden Markov Models to attempt to call this information. In all cases we're trying to identify instances where sensors appear to have failed or are malfunctioning.

b) Machine Learning

Understanding can be defined in general as a procedure of getting understanding through encounter. We individuals begin the procedure of studying new points in the day we are born. This learning process proceeds throughout our existence where we try and collect more knowledge and attempt to improve what we have previously discovered through encounter and from tips collected from our setting.

ML calculations need a dataset, which make up the knowledge base, to construct a design of the domain. The dataset is a set of examples from the domain name. Each instance includes a set of characteristics which describe the properties of that example in the website. An aspect takes in a variety of ideals depending on its aspect kind, which may be discrete or constant. Distinct (or nominal) characteristics accept distinct values(e.g., car = Honda, weather = sunny) whereas continuous (or numeric) attributes take on numeric values (e.g., distance = 10.4 meters, temperature = 20^{o}F).

Each instance includes a set of input signal characteristics and an output attribute. The input signal aspects are the information directed at the learning algorithm and the output attribute contains the opinions of the activity on that info. The value of the output signal attribute is presumed to depend on the ideals of the input signal characteristics. The aspect combined with the worth put to it determine a characteristic, which makes an example a function vector. The model built by an algorithm may be viewed as a function that maps the input signal aspects in the instance to some value of the output signal attribute.

When found with the nude eye huge amounts of data might appear random, but on a closer evaluation, we may uncover relations and routines inside. We additionally get a penetration in to the mechanism that creates the info. Witten & Joe [2005] determine data mining as a procedure for detecting patterns in info. It is additionally referred to as the procedure for extracting associations from the given data. In general data mining is different from machine-learning in that the dilemma of the efficiency of learning a model is regarded along with the effectualness of the training. In data mining issues, we can have a look at the information creation procedure as the information and the domain name generated by the domain as the knowledge base. Thus, M L algorithms can be utilized to discover a model that describes the information generation procedure according to the dataset directed at it. The data given to the algorithm for assembling the product is called the training info, as the pc has been trained to discover from this data, and the design assembled is the outcome of the educational process. This product can now be utilized to call or classify previously hidden illustrations. New illustrations used to evaluate the model are called a test established. The accuracy of a product can be approximated from your distinction between the predicted and real worth of the mark aspect in the test set.

Calling weather problems also can be regarded as a good example of data mining. Using the sensor Data amassed from a spot for a certain period of time, we obtain a design to forecast variables such as temperature at a given moment based on the input signal to the product. As climate conditions are inclined to follow routines and are not entirely haphazard, current meteorological readings can be used by us together with these obtained a number of hrs earlier at a place and also readings obtained from nearby places to call an ailment for example the heat at that location. Hence, the information examples which are used to build the model may feature preceding and current hour's readings from a set of neighborhood places as input characteristics. The variant that is to be forecast at one of these simple places for the present hr is the objective characteristic. The type and variety of conditions which can be comprised in a instance is determined by the properties of the ML algorithm utilized and on the variable we are attempting to predict.

i. *Classification Algorithms*

Algorithms that categorize certain example in to a couple of discrete classes are called classification algorithms. These algorithmic rules perform on an exercise set-to produce a design or a couple of rules that categorize a specified input signal into one of a set of discrete output signal values. Although some of the categorization calculations demand every one of the input signal also to be distinct inputs can be taken by many categorization algorithms in any type, distinct or constant. The output is always in the kind of a distinct worth. Selection trees and Bayes internets are examples of classification calculations.

In order to employ classification calculations on our weather example we have to convert the output signal attribute in to categories. That is normally

completed by discretization, which will be the process of splitting a constant variable in to categories. Inputs aspects can be made as continuous if the algorithm relates to them or they are able to be converted into discrete values determined by the algorithm.

ii. *Regression Algorithms*

Algorithmic rules that develop a model according to equations or numerical procedures on the values obtained by the input traits to generate a continuous worth to represent the output are called of regression algorithms. The input to these algorithms may consider equally continuous and distinct ideals according to the algorithm, whereas the output signal is a continuous worth. We explain in more detail the regression calculations which were utilized in this dissertation below.

II. Contemporary Affirmation of the Recent Literature

a) Sensor validation using machine learning

Matt SmithMatt et ing [1] have demonstrated that artificial neural networks can be good predictors of sensor data for some sensors. They also illustrated a fuzzy clustering affirmation process that has been defeated.

i. *Sensor Validation using Artificial neural networks*

Artificial neural networks (ANNs) are applications intended to mirror the arrangement and function of the human brain. Both are manufactured from layers of neurons. Genuine neurons, as seen on the left-hand side of fig. 1 on the subsequent page, obtain input signal from each neuron in the previous layer through their dendrites. Depending on the state of the inputs received, the neuron may subsequently fire its own output signal to the next layer through its axon.3 Likewise, the artificial neuron, receives input in the neurons in the previous layer, which it utilizes to compute a measured amount f, as in equation (1).

$$f = \sum_{i=0}^{N} w_i x_i \tag{1}$$

1. The closing worth of the end product is the worth of an activation function, g, with f as a disagreement. This is typically taken to be either a solely linear perform or the logistic perform, as seen in equation (2)

$$g = \frac{1}{1+e^{-f}} \tag{2}$$

2. The range of the logistic operate is [0,1]. It truly is just like the system stage perform, but with a "softer" transition from 0 to AT LEAST ONE. It really is meant to mirror the firing of an actual neuron.

The system step function is a better approximation of this, because it truly is easier to work with computationally but the logistic function is used.

ANNs are ordered into layers. A network normally consists of three levels: concealed layer, input layer, and output layer. First, input is fed by the input signal layer to the concealed layer. The input signal layer does no computations; consequently, it is not actually consists of neurons. There is one node for each output. Next, the hidden layer receives from the input signal layer and output signal to the output signal layer. That is where many of the computations are done. The initial function of neurons in the hidden layer is ordinarily the logistic function. The variety of neurons in the hidden layer is chosen by an individual. Having more neurons affords better precision, but raises computational complexity. The concealed layer may include several levels of neurons within itself. Finally, the end product layer does a final round of calculations to generate the final end product of the network.

We wanted to utilize ANNs to predict information with a regression design. Our system was to use 85% of the information points we'd to train the network and fit the model. The remaining 15% percentage were used to examine the version created throughout training. We employed the main-mean-square malfunction between the network output and the real sensor data for these factors as our metric.

ii. *Sensor validation Fuzzy clustering*

Fuzzy clustering is a modification on classical set assumption. In conventional set theory, whether an element x of the universe of conversation X is a member of a given set A is specified by the characteristic function, x, of A,

$$\chi_A(x) = 1 \text{ iff } x \in A \quad 0 \text{ iff } x \notin A \tag{3}$$

In additional words, an element moreover is a member of a set or it is not. Fuzzy set assumption, on the other hand, allows for a range of membership values given by the membership function

$$\mu_A(x) : X \to [0,1] \tag{4}$$

When μ is zero, x is not an constituent of A. When it is one, x is entirely a member of A. For values among zero and one, x can be said to be "sort of" a constituent of A.

The dissimilarity between conventional sets and fuzzy sets preserve is seen in fig. 2. The upper half is a predictable set A inside a universe of discourse. The universe is crisply divided into regions of A and NOT A. In the fuzzy expanse in the lower half of the figure, though, there is a gradient of membership in A seen by the desertion out of black.

b) Machine Learning Approach to Pattern Detection and Prediction for Environmental Monitoring and Water Sustainability

Erika Osborne et ing [2] released an strategy that utilizes Gaussian processes and a general "fault bucket" to recapture a priori uncharacterized problems, along having an rough way of marginalizing the possible faultiness of all findings, which provided an increase to an effective, flexible algorithm for the detection and automated modification of errors. The probabilistic character of the technique is ideal for reporting uncertainty approximations to individual workers. The tactic also can be implemented to discover patterns, additional than faults, which are of excellent environmental significance. This design attempted to assault the problem of modification, design detection, and prediction in water observation signals.

This design depended on Gaussian processes (global Positioning System) due to their flexibility and extensively demonstrated effectivity at modeling non-linear distributions. This issue has been approached by preceding work along similar lines by creating statement models that establish the hoped-for possible fault types a priori [4], but this is usually an unreasonable premise in tremendously variable or poorly understood surroundings. In "fault bucket" strategy, the specification of precise fault designs just isn't necessitated. In this way, this model can simultaneously recognize flaws and robustly make forecasts in the existence of sensor problems. The result is an effective and fast technique for data-stream prediction that can manage a wide variety of problems without demanding important domain name-particular knowledge

c) A Machine Learning Approach for Fault Detection in Multivariable Systems

Ying Guo et ak [5] offered a model that pertains to systems and techniques for discovering problems in multiple-variable systems/brokers. The strategy is especially appropriate for detecting faults in heat, venting and airconditioning (HVAC) methods and will be described in regards to that model but non-limiting embodiment. The fault detection approach is dependant on record machine learning engineering. This is reached by learning the steady nature of regular HVAC functioning, and then using the mathematical relationships between organizations of measures determine problems in all subsystems which is why sensor advice is accessible, regardless of the specifics of the install and to identify anomalous deviations in the norm. The approach designs the dynamical sub-systems (representatives) and series data in HVAC method. These versions (agents) are assembled via a studying procedure from some instruction info of normal running HVAC systems. The educated models (brokers) can subsequently be employed for automatic fault detection. Our algorithm may catch the truth that time flows ahead by utilizing directed graphical models (representatives), it is flexible to environment modifications and is dependable in HVAC techniques. The strategy was tested predicated on actual information from commercial HVAC techniques. We can efficiently detect several common faults. The experimental answers are all really positive.

Using the adaptive learning approach requiring just obligatory sensors' data, this method provides a few advantages over rule based techniques. Particularly, the amount of expert, setup and customization knowledge demanded to implement such techniques on distinct HVAC systems is greatly lowered. The outcomes obtained by using the procedures establish that this algorithm has the property of versatility and robustness. Better fault detection results when the creating situation and environment properties adjustments, while conventional approaches are usually not adaptable to these changes automatically can be achieved by current purpose.

A variety of fault detection and diagnostic(FDD) techniques for multiple-changeable methods/brokers are understood, and their use offers several advantages [6][7]. Acting and by detecting on problems in multi-varying systems/agents substantial energy savings can be realized. Moreover, if minor errors are detected before getting significant problems, the beneficial service life of equipment can be prolonged, care costs may be decreased, and mending may be planned when suitable (averting outages and over-time work) [8][9].

Farther, and again using a HVAC program through instance, discovering problems permits for better control of temperature, humidity, and venting of occupied spaces. This, in turn, may enhance worker productivity, invitee/customer comfort, and/or merchandise quality control. Many current fault detection techniques for multi-changeable systems /brokers are rule-established [10][11][1 2][13]. The fault detection system originates an answer to a breach of these principles creates a threat profile, integrates and interprets incoming info in accordance with a predetermined set of principles, and autonomously. Rule-based methods are, however, restricted insofar they've been very particularly produced for/customized to some unique method and are very tough to update, change, or conform as to an alternative method. Also, rule-based systems usually fail miserably if conditions beyond the limits of the understanding comprised in them are encountered.

Even though less-common, another category of fault detection methods employed for multiple-varying systems/brokers are model-based systems [14][15][16]. Design-established techniques use analytic statistical models to identify problems. As with guideline-based techniques, nonetheless, model-based techniques have numerous limitations. By way of example, product-based techniques are computationally intensive and

normally complicated, and a sizeable amount of proficient function is necessitated to produce a design for an unique system. Also, to be able to create an useable model many inputs must explain the system being modeled and the beliefs of some of the required inputs might not be readily accessible.

Along with the above limits, many multiple-changeable techniques/agents are installed in different structures/environments. This normally indicates that rules or analytic models created for a unique method can't be easily applied to an alternate system. As a result, the challenging process of setting and determining guidelines or creating analytical statistical models should be tailored to each individual constructing/environment. Moreover, the project of setting the thresholds employed by such techniques to raise alerts is involved, and prone to producing fake alarms. Additionally, building states such as structure of the internal structures layout and actually outside variables (such as for instance shading and the growth of vegetation) often change after the program setup/initialization of a fault detection system, which may need guidelines/designs that have been initially suitable to be re-visited and updated.

d) Application of Machine Learning in Fault Diagnostics of Mechanical Systems

A diagnostic system based on Bayesian Networks (probabilistic graphical models) is offered. Unlike standard diagnostic strategies, in this procedure rather than concentrating on program residuals at one or a couple working points, analysis is done by assessing system behavior patterns over a window of functioning. It is shown how this approach can ease the dependency of diagnostic methods on precise system modeling while maintaining the desired features of fault detection and diagnosis (FDD) resources (problem isolation, robustness, adaptability, and scalability) at an acceptable degree. For instance, the process is used to problem investigation in HVAC techniques, a region with significant modeling and sensor network restrictions. The application of Bayesian networks in problem diagnostics has been examined in some areas [18], [19], [20]. They may be centered more on trigger-effect-association tactics. What's distinct here is the manner Bayesian systems are applied for diagnostic functions.

e) A Machine Learning Approach for Identifying and Classifying Faults in Wireless Sensor Networks

Kenji Tei et 's[21] developed a record strategy to discover and determine errors in a WSN. As it is vital to execute accurate retrieval activities in particular, this function focused on compartmentalization and the recognition of system and data problem kinds. Our strategy uses Hidden Markov Models (HMMs) to capture the problem-free dynamics of an surroundings and dynamics of defective data. It then performs a structural evaluation of these HMMs to determine the variety of program errors and data affecting sensor measurements. The strategy was validated using real information got from over one month of samples from motes used in an genuine living lab.

HMMs have been extensively researched in fault detection systems [22], [2 3], [24], [25], [26]. In [24], the writers utilize a Markov sequence to classify normal against irregular activities by contemplating varied measurements. In [25], a HMM is learned to determine errors against internet-based and web servers programs. In [26], writers examine the precision of a Markov chain- centered strategy and determine that Markov chains execute well in fault detection. HMMs present a better medical appliance than fundamental Markov versions.

In [27], the writers present a method depending on pattern-recognition that's additionally combined with a finite-condition HMM. The strategy provides an excellent technique for modeling temporary context in observation errors in elaborate dynamic systems. In [28], the writers utilize a HMMs method for intrusion detection, utilizing distributed observation across multiple nodes. The writers of [29] current an innovative powerful, machine learning based technique for automatically detecting errors in HVAC systems. As well as powerful Bayesian Networks and HMMs, data combination can be employed to join fault detection outcomes from multiple problem versions so that they can attain a more accurate fault detection outcome. The strategy in [29] grows HMMs to understand probabilistic relationships between organizations of points throughout both standard and defective operation. HMMs are effectively.

f) Automatic Detection of RWIS Sensor Malfunctions using Machine Learning

Aditya Polumetla et 's [30] offered a product that can predict climate at a given RWIS place using the current advice with that place and encircling places (notice Figure 1.1). We use M L algorithms including regression, classification and HMM systems to build the designs to predict weather conditions at a selected trial of RWIS web sites in the state-of Minnesota. We utilize these compare them with the values noted by the RWIS sensors to identify possible failures and foreseen values. Of the climate conditions reported by RWIS models we focus on calling visibleness, rainfall sort and heat. We hypothesize that the versions we assemble can correctly detect deviations in the estimated sensor readings which will allow us to identify sensor malfunctions.

III. Conclusion and Future Research Directions

Despite these existing investigation efforts, the diagnosis, isolation, and settlement of the instrument faults in a powerful program stays a difficult dilemma. In the use of the car engine, as an example, the needs for

reduced emissions and greater fuel-efficiency has powered the growth of complex power-train systems including the turbocharger and the dual-camera varying valve-teach. The launch of added parts into the traditional engine enables the exploitation of innovative burning methods, which additionally raises the significance of additional sensing elements for example the ethanol sensor in ex-fuel vehicles for the advancement of committed managements. In the mean-time, using additional sensors additionally features program sophistication, and hence increases difficulties in diagnosis.

Because of the cost limitations in most applications, the use of a components redundancy approach is restricted. Furthermore, despite accumulated program information, the additional parts and feeling factors expose uncertainness in to the program.

So, considerable attempts are demanded to increase the existing model-based diagnostic system or understanding-based professional program. With advances in simulator and measuring technologies, the data-driven approach has presented guaranteeing possibilities in various domains including modeling, optimization, controls, and identification. Nonetheless, as a result of dearth of a thorough comprehension of the prospective program, such an approach can encounter difficulties in compensation and the identification of faults. Moreover, the prerequisites of real time program monitoring, for example the On Board Investigation (OBD) requirements in auto applications, boosts additional problems due to the restrictions of online memory and computation abilities. So, tactics that could integrate the existing first-theory knowledge into the data driven approaches are vital to take care of the recognition, isolation, and damages of instrument faults in a powerful system with increasing complexity.

The goal of the proposed study would be to explore procedures that may execute quantitative appraisal of sensor performance in damages and a sensor network of the outcomes of its destruction on system manage and identification. Without using copy sensing equipment, the technique plans to utilize the inserted analytic redundancies for isolation and the detection of faulty sensors, even in the existence of failures in the tracked program. With a quantitative evaluation of the operation of each sensor within the network, the measuring of a flawed sensor may be reconstructed and its effects on the controller as well as other measured variants may be compensated, hence improving the reliability of the target program.

In order to accomplish a quantitative and independent assessment of the performance within a sensor network and its tracked method, future research may be directed in regards to overcome the subsequent difficulties:

- Identify the fundamental analytical redundancies in the target system making use of sensor measurements and handle signals observed throughout regular procedures rather than making use of unique input signal.
- Isolate the entangled dynamics of the sensor(s) and the observe system,
- Eliminate the authority of a fault in one sensor on additional sensors.
- Isolate of the effects of a responsibility in the sensor network and one in the monitored system on the calm measurements.

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Computer Network Performance Evaluation based on Datarate and Number of Clients PerServer using OMNeT++ Simulation Environment

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GJCST-E Classification : *C.2.1*

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Abstract- We present the performance of Computer network using OMNeT++ network simulation framework and Nclient application module from INET framework for our experiment. Present paper is the study of how datarate is affecting the performance of Computer Network. Main aim of the study is to find out the best configuration network setup to get optimum Network throughput. The performance of the Network is measured in terms of throughput.

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I. Introduction

Computer Networks have changed the human life at home and offices too. Innovations and improvements in the domain as well as related areas make various things possible which were never thought of the reality. Computer Networks make it all possible. As different network setups and different configurations are used by the organizations to make their networks functional. With the help of the study carried out in the current paper it is tested that what would be the best Network configuration to set up the efficient and effective network in the organization. The performance of the various Network configurations is measured using simulation environment. We preferred OMNeT++ (Objective Modular Network Testbed) object oriented modular discrete event network simulation framework with INET framework. There are two reasons why we proceed with this framework those are OMNeT++ is specifically suitable for modeling and simulation of discrete event approaches and another is OMNeT++ conveniently mapped into entities communicating by exchanges of messages. INET consists of several simulation application models. We use Nclients network application with basic HTTP network setup from INET to carry out our experiments. It consists of client server environment with variable number of clients.

Performance evaluation parameters are set through initialization (INI) and Network Description (NED) files and in our experiments those files are basic HTTP.ini and Nclients.ned and result of the experiment is collected through answer (ANF) file. We setup the experiment to evaluate the network performance in terms of effects of datarate on the network performance and effects of number of clients per server in the Network. The network performance is evaluated in terms of server throughput. Throughput is number of bits transferred per second from server or to the server.

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II. Related Work

Much of the research work has been carried out to evaluate the performance of wired and wireless Computer networks using different parameters and different methodologies. Here we are considering contribution papers in the area of wired networks. One such paper "Real-time Performance Evaluation of Line Topology Switched Ethernet" is the paper published in International Journal of Automation and Computing" in October 2008 by Fan Cen, Tao Xing & Ke-Tong Wu present new procedure to calculate the end to end delay in switched Ethernet using network calculus. The researchers applied this procedure to assess the real-time performance of line topology switched Ethernet. The outcome of the paper shows that the results are matching with the result of simulations and the maximum end to end delay in the network linearly increases with the packet length and switch number. These are the key factors impacting the delay.

Research paper entitled "High Data Rate Video Transmission Using Parallel TCP Connections: Approaches and Performance Evaluation" by HON-HING WAN & YU-KWOK published in The Journal of Supercomputing, 35, 119-139, 2006 present a detailed quantitative study on Parallel multithreading TCP in that multiple connections, managed by a scheduler, are used to handle a single client request. Using simulation environment with NS-2 simulator research proved that there exists an optimal unlimber of TCP connections for handling a video streaming request. However, such an optimal values is critically affected by other factors such as the scheduling algorithm used and the network bandwidth available. A simple AIMD approach in

managing the parallel connections can lead to significant performance gains.

Esma Yildirim – Tevfik Kosar in their Research Paper titled "End-to-End Data-Flow Parallelism for Throughput Optimization in High-Speed Networks" published in Journal of Grid Computing (2012) 10:395-418 proved that the end-to-end transfer throughput in high-speed networks could be improved dramatically by using data parallelism that takes into account the end-system capacities such as the cpu load, disk access speed and NIC capacity over the nodes. The model presented in this study provides the parallelism parameters such as the optimal number of streams per stripe, number of stripe per node and number of nodes dynamically. The experimental results conducted using various settings indicate the accuracy of the model and close-to maximal throughput values. The model also gives very good results with immediate sampling especially for large file sizes.

"Development of Simulation Model in Heterogeneous Network Environment: Comparing the Accuracy of Simulation Model for Data Transfers Measurement over Wide Area Network" published by Mohd Nazri Ismail and Abdullah Mohd Zin in Information Technology Journal 7 (6): 897-903, 2008 evaluated network performance with delay parameter using simulation model. They showed that Network delay rate will directly affect the network performance. In network management, by monitoring and analyzing network delay one can monitor the performance of the network. It also proves that Network delay rate also plays an important role in benchmark setting and network troubleshooting.

III. Research Methodology

We are using Simulation environment with OMNeT++ framework to carry out our experiment. We have used Nclient application form INET to simulate our research. There are three basic setup provided under Nclients in INET those TelenetApp, File transfer and basicHTTP module. Out of these we choose basicHTTP module with TCPBasicCliApp and TCPGenericSrvApp modules. TelenetApp generates very low traffic.

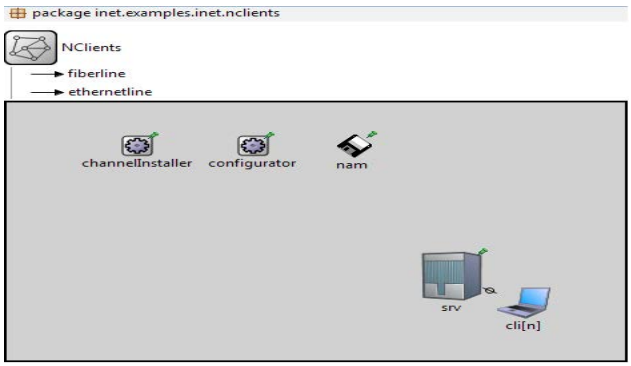

Figure 1 : Nclients.Ned: Client Server experimental setup configuration

To measure the performance of the present network we use thruputMeter modules. This module is placed between TCP and TCPApp layer. We required two modules to collect result for incoming and outgoing traffic to the server. Our client and server are the StandardHost modules provided in the INET. We have modified the StandardHost with thruputMeter and modified structure of standardHost along with thruputMeter is show in figure 2 below. The result of the experiment is collected in excel file from the default .ans file. .ans file in OMNeT++ gives two types of results vector and scalar. Vector results are recording of time series data and scalar results are supposed to record a single value per simulation run. We have considered scalar result as avg. thruput for our analysis purpose, Throughput of both thruputMeter i.e. thruputFrom & thruputTo related to the server.

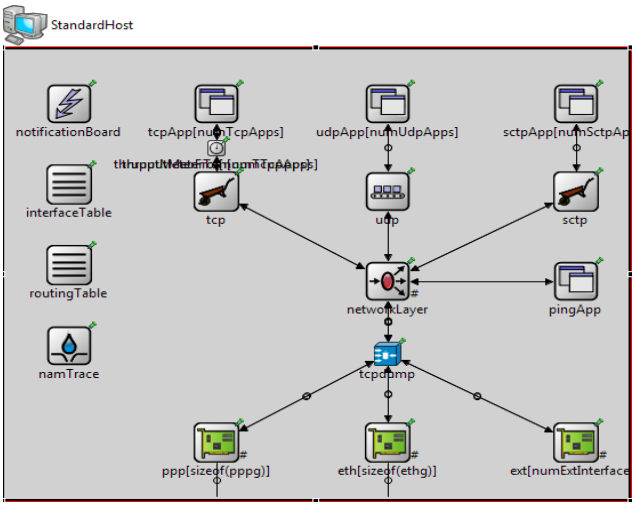

Figure 2 : StandardHost with thruputMeter module between tcpApp & tcp

We collect the reading of the simulation experiment by two ways:

1. We Kept datarate constant and changed the number of clients on the server and avg thruput scalar values are collected for respective experiments.
2. For specific client setup on a server we change the datarate and collect the scalar avg thruput in excel files.

For our experiment we kept datarate variation between 10Mbps to 100Mbps with the interval of 10Mbps and clients variance from 10 clients per server to 150 clients per server with the interval of 10 clients. We have kept the packet size=536bytes and delay= 0.1us unless and until mentioned. We have run each simulation experiment for n=500s (simulation seconds). We collected the throughput results by running the simulation experiment 10 (datarate variance from 10Mbps to 100Mbps with the interval of 10Mbps) ×15 (no of client variance from 10 clients to 150 clients with the interval of 10)=150 times.

IV. Result Analysis

Throughput values of the simulation experiment is collected in excel file. We have collected results at 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 Mbps with 10, 20, 30…….130, 140, 150 clients per server. Our result shows that throughput values for the server and to the server both maximum and minimum are at 10Mbps. Maximum throughput value form the server is 7074.765479 bps (bits per second) at 10Mbps with 150 clients on a server while minimum throughput value from the server is 642.7703018 bps at 10Mbps with 10 clients on a server. Throughput value to the server is maximum at 10Mbps with 130 clients on a server and the value is 1394.613963 bps while minimum value is 108.6925672 bps which is at 10Mbps with 10 clients on a server.

a) At Constant Datarate

We analyze the trend of throughput from the server by keeping datarate constant and changing the number of clients from 10 number of clients to 150 clients per server with the interval of 10 clients.

By analyzing the results of the experiments we can understand that average throughput from the server is increases with increase in the number of clients from 10 number of clients till 110 number of clients per server, it falls with 120 number of clients on a server. For remaining number of clients i.e 130, 140 and 150 number of clients on a server the throughput form the server is increases from 120clients to 130clients and it will be same for 150clients but shows down trend at 140clients. This trend of throughput from the server is same for all the datarate i.e. from 10Mbps to 100Mbps. Experimental readings shows that the highest throughput value from the server is with 150 clients on a server, it means at specific datarate if we increase the number of clients it will give the highest value at the maximum number of clients but at 100Mbps the highest throughput value is with 130 clients on a server.

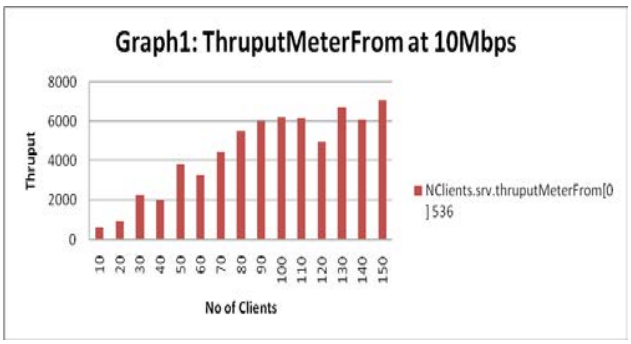

Figure 3 : Throughput From server at 10Mbps

By analyzing the experimental readings for throughput to the server we came to know that throughput to the server is increasing with increase in the number of clients on a server at specific datarate. Maximum throughput to the server at each datarate interval withing the range of 10Mbps to 100Mbps is given with the 130 number of clients.

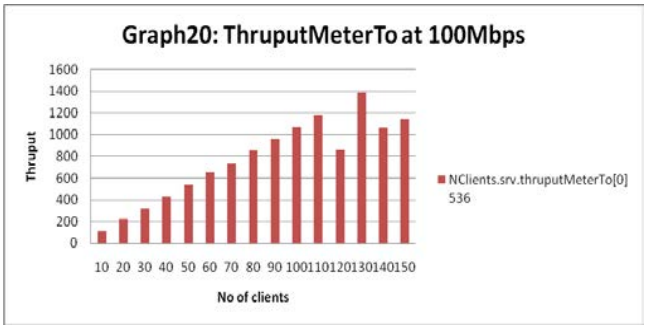

Figure 4 : Throughput To the server at 100Mbps

b) With Constant Number of Clients

Now we analyze the trend of throughput from the Server by keeping number of clients constant and changing the datarate from 10Mbps to 100Mbps.

Observations of the experiments shows that

i. Throughput from the server with number of clients 10,20,30,40,50,60 are having the same type of throughput pattern; which is increasing with increase in the datarate; it is highest at 100Mbps and lowest at 10Mbps.
ii. Number of clients 70, 80 & 90 the throughput form server shows the lowest throughput values at 10Mbps and it remain same for all next intervals of datarates i.e. 20, 30, 40, 50, 60, 70, 80, 90 & 100Mbps.
iii. With 100 number of clients on a server we got maximum throughput from server at lowest datarate i.e. at 10Mbps and for remaining datarates it shows same level of throughput which is less than 10Mbps readings.
iv. Throughput from server with number of clients 110 on a server shows lowest throughput value at 10Mbps it will increase bit more with 20Mbps and remain same at 30 and 40Mbps, for next interval i.e. at 50Mbps it increase more and remain same till last datarate interval i.e. at 100Mbps.
v. Throughput from server for number of clients 120 on server shows the same level of throughput pattern at 10Mbps,20Mbps & 30Mbps at 40Mbps it show increase in the throughput and remain same for next interval reading from 50Mbps to 100Mbps.
vi. Throughput from the server with 130 number of clients on a server gives maximum throughput value at 10Mbps & lowest at 20Mbps; bit increase is there at 30Mbps and remains same like the reading at 30Mbps for rest datarate intervals.
vii. Throughput from the server with number of clients 140 on a server gives lowest value at 10Mbps and increases with bit stabilization in subsequent intervals giving highest throughput values at 60, 70, 80, 90 & 100Mbps.
viii. Throughput from server with number of clients 150 on a server gives highest value at 10Mbps and it decreases with increase in datarate value intervals from 20Mbps to 70Mbps and remain at same level for 80, 90 & 100Mbps.

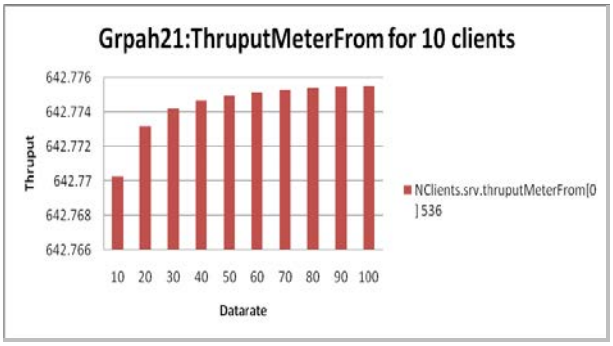

Figure 5 : Throughput From server for 10 number of clients on a server

By analyzing the experimental readings for throughput to the server we came to know that throughput to the server is showing following type of behavior.

i. The throughput to the server is increasing steadily with increase in datarate for the number of clients 10, 20, 30, 40, 50 & 60.

ii. Number of clients with 70 on a server gives maximum throughput to the server at 10Mbps, it falls down for 20Mbps and remains same for all datarate intervals from 30Mbps to 100Mbps.

Number of clients with 80 & 90 on a server gives exactly similar pattern of throughput to the server giving minimum value of throughput at 10Mbps; increase throughput at 20Mbps and shows the same level of throughput to the server from 30Mbps to 100Mbps.

iv. The throughput patterns of throughput to the server for number of client 100 on a server is same like the pattern of number of clients 70 on a server giving maximum throughput at 10Mbps and remain constant at 20Mbps to 100Mbps.

v. The throughput pattern to the server for the number of clients 110 is showing the lower value at 10Mbps and remain same for 20, 30 & 40Mbps after increase in the throughput value at 50Mbps it will remain same for rest of the datarate intervals.

vi. Number of clients 120 gives lowest throughput to the server at datarate 20Mbps & 30Mbps. Throughput to the server is higher than this which is recorded at 10Mbps while higher throughput to the server is recorded at 40Mbps and it remains the same for rest of the datarate intervals.

vii. Throughput to the server with 130 number of clients is giving maximum throughput at 10Mbps it decrease steadily till 30Mbps and remain same for next successive datarate intervals like 30Mbps.

viii. Throughput to the server with 140 number of clients on a server is giving minimum throughput value at 10Mbps and maximum value at 20Mbp; From datarate 30Mbps to 60Mbps it shows it shows decreasing throughput to the server and remain same like 60Mbps for 70,80, 90 & 100Mbps.

ix. With Number of Clients 150 the throughput to the server is maximum at 10Mbps and second highest values it gives at 30, 40, 50 & 60Mbps. It gives lowest value at 70Mbps and remain the same for 80, 90 & 100Mbp.

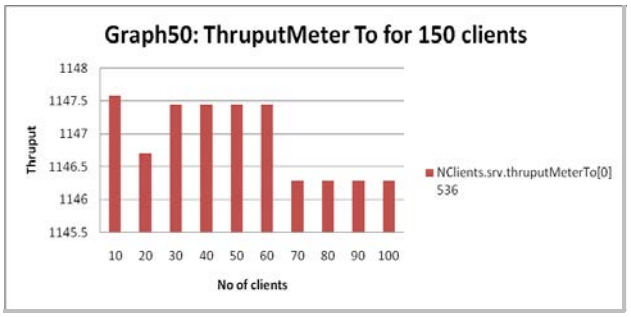

Figure 6 : Throughput To server for 150 number of clients on a server

V. Conclusion

Analysis of the result shows that the performance of the network evaluated through throughput of the server shows that maximum throughput from the server is with 150 clients on a server at 10Mbps datarate and minimum throughput is at 10Mbps with 10 number of clients. Through put value to the server is maximum at 10Mbps with number of clients 130 while minimum throughput is at 10Mbps with 10number of clients on a server. Throughput results from the server and to the server are varying on the basis of datarate changes and on the basis of network load interms of number of clients on the server.

VI. Acknowledgment

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Embedded Sensor System with Wireless Communication for Greenhouse

By Kalpana Lamba, Sunil Joshi, Chitra Gautam & Shashikant Sadistap
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Abstract- Greenhouse environment is unpredictable, irregular, nonlinear, multi-parameter and volatile structure. To gain high and quality yield it is necessary to control the greenhouse environment according to crop requirement and for that design and analyze the embedded sensor system with wireless communication for greenhouse is prerequisite. The blueprint of system is such that it is compatible to technically less proficient farmer of developing countries. The system is designed with DAQ card for data acquisition and analysis that is compatible with Graphical User Interface LabVIEW which helps the user to easily monitor and analyze the state of greenhouse environment. Based on the data analysis any farmer can take decisions like, when to irrigate the crops and when to enable the cooling system. Actions based on the data analysis from the system may lead to better crop yield and less wastage of the resources. To make the system energy efficient a data averaging energy efficient algorithm is used in software. By analyzing the recorded data received from sensor node, an efficient strategy for node placement is designed to cover maximum area of greenhouse.

Keywords: greenhouse, LabVIEW, DAQ card, wireless communication, embedded sensor system , energy efficiency , node placement.

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I. Introduction

Recently for scientific and research community Wireless Sensor Networks have come to the front position. The exploit of wireless sensors and the opportunity of assemble them into network have exposed many research concern and have highlighted new customs to handle with certain dilemma(Awasthi, 2013). The accessibility of elegant, efficient and economical sensors measuring a broader range of environmental factors has allowed continuous time monitoring of the environment for genuine purposes (Arun & Sudha, 2012). This task was not feasible in past because former monitoring was based on wired sensors which require manual data downloading and laboratory analyses.

Temperature, humidity, light intensity and soil moisture are the common essential factor for the yield and quality of crop growth(Mampentzidou, Karapistoli, & Economides, 2012).

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By constantly supervise these environmental factors the farmer can enhance understanding of how each factor influence growth of yield and how to handle utmost fruitfulness of crop and to achieve remarkable energy savings.The greenhouse yield depends on various different aspects. For selected environmental variables, the farmer can set the reference values, and then the greenhouse automation system intention to maintain the variables in these limits (Deore & Umale, 2012).

A WSN is a structure consists of sensors, radio frequency (RF) transceivers, microcontrollers and power resource(Galluzzi & Herman, 2012). In this paper, an embedded sensor system is designed using DAQ card for data logging, XBee Pro transceiver module and sensors for monitoring temperature and humidity of greenhouse environment. The software part of the system is designed and programmed using LabVIEW.

II. Literature Review

A key part to the design and implementation of any system is an in depth knowledge and solicitous understanding of the attribute that influence that specific system. For that motive, systematic literature studies require to examine the available wireless sensor networks for environment monitoring.

The idea of (Lee, Hwang, & Yoe, 2010) is to choose a sensor network MAC protocol, which would be optimal to farming site with good power efficiency and admirable transmission delay concert. For that total 2,500 sensor nodes involve with star network topology in which sink node in the center and the physical shape of sensor nodes is grid. The simulation result shows that the energy performance of LPMAC is to some extent improved than X-MAC and S-MAC.

To accurate determination of crop growth in greenhouse, the (Song, Gong, Feng, Ma, & Zhang, 2011) proposed the system based on AVR Single Chip microcontroller and wireless sensor networks. In this paper Modular design thought is adopted, First it solves Energy supply problem of sensor node. Secondly it design funnel effect (Due to imbalance of load distribution) of greenhouse WSN system. Monitoring & Controlling system is developed in which author use as sensor node (HSM 20G) PIC 18F452 as microcontroller, signal is transmitted through ZigBee module, transceiver used is Tarang F4 ZigBee module is connected to the

host computer through RS-232, LABVIEW software is used to analyze the data.

In the research paper (Marimbi, Munyaradzi, Nyambo, & Mashonjowa, 2012) author design a model, this integrates optimum node position and data aggregation to observe the combined effect on the efficiency of the WSN, in terms of latency, power consumption and utilization, network lifetime. Also the different topologies model designed and estimate through simulations to come up with the best model that achieves optimum placement to minimize the number of nodes without compromise on the data as well as incorporating data forwarding and aggregation.

The author (Sengunthar Gayatri & Mehul, 2012) presents a survey report on present Greenhouse Monitoring and control systems. Base on the review of multiple papers the author proposes a pioneering Greenhouse automation system for multiple greenhouses which can be controlled from the middle location wirelessly. For that it suggests a standard architecture which can be functional for many other computerization applications.

The authors of this paper (Mampentzidou et al., 2012) survey and review number of research papers related to WSN on various applications like operating system used, power supply and node platforms. Based on that information they provide a generic guideline for less proficient farmers for deploying WSN in their field or greenhouse. Potatoes taken as object crop for one season (about 4 months) in 100 m2 area with Mica2, TmoteSky or Micaz type node platform, microcontroller, radio transceiver, memory size or type all are depends on node platform. User can use various sensing parameters on single sensor node but normally one sensor node is placed in 1 m2 area. For continuous power supply needs can use rechargeable batteries and solar panel. IP67 case is use for waterproofing of hardware device.

This research paper (Kumari & Devi, 2013) proposed a hybrid communication (means wired and wireless both) system for modernized agriculture. The whole green house farm can be controlled by LAN Network. Every sensor node will be coupled with the various sensors, solenoid valves to control the water flow of the plants, ARM Microcontroller LPC2138 based on Cortex M3., used communication standard like CAN bus for wired system and ZigBee for wireless system, Ethernet for online controlling and supervising the environmental parameters. The software of whole system was encoded in Embedded C and realize in Proteus with JAVA background.

This paper (Jao, Sun, & Wu, 2013) use MicaZ motes, MDA300CA data acquisition board, and EC-5 soil moisture sensors as hardware and TinyOS 2.1.1 open source embedded operating systems as a software to make WSN. In this paper solar panels and LiFePO4 18650 rechargeable batteries are used as power source to construct realistic applications. Author use sand soils with different water contented.

III. Factors Influencing WSN Design

WSN designs commonly influenced by factors such as operating atmosphere, transmission media, energy consumption, manufacture costs and physical size (Kumar, 2000). When designing a WSN system essentially considers these factors. The next sections describe these factors and their impact on the functioning of the system.

a) Manufacture Costs

WSN may have more than a hundred nodes, and for commercialization the cost of a single node should not go beyond a few dollars (Akyildiz, Su, Sankarasubramaniam, & Cayirci, 2002).Two key factors, initial deployment cost and total cost of ownership are important for consideration.

b) Physical Size

Smaller nodes can placed in locations that are more feasible and used in number of scenarios, like in node-tracking scenario, tiny nodes will result in the ability to track more objects(Joo, Park, Pyo, & Chae, 2008).

c) Operating Atmosphere

WSN can deploy ingenerous as well as extremely hostile atmosphere like a residence, industrial unit, on machines, battlefield, ocean beds, combat zone, disaster areas, noxious areas(Marimbi et al., 2012) etc.

d) Data Aggregation

Reducing the number of surplus data in effective way in the system called data aggregation (János & Matijevics, 2010). It can define as the process of merging data from different sensor nodes according to a definite function such as maxima, minima or average.

e) Area Coverage

Area coverage is the all time primary assessment metric for a wireless sensor network. To increase a system's value to the end user, it is always beneficial to have the skill to deploy a network over a bigger physical area(Younis & Akkaya, 2008).

f) Energy Consumption

Energy consumption in a sensor node can divided into three parts, sensing, processing and communication (Hoblos, Staroswiecki, & Aitouche, 2000). The largest part of its energy consumed during communication because both start-up and active states of transceiver unit consumes huge energy(Alippi, Anastasi, Di Francesco, & Roveri, 2009).

IV. Hardware Setup

The hardware part of the system consists of two modules, one is server and other is client. Server side consists of XBee receiver and computer system having installed LabVIEW receiver program on it. The client side includes RTD PT100 temperature sensor, SY-HS220 humidity sensor, Advantech USB 4711A DAQ card having inbuilt screw terminal board, XBee Pro transmitter module and a computer system having installed LabVIEW transmitter program. Now the following subsections describe the hardware devices used in the system.

a) USB 4711A DAQ card

The USB-4711A consist true plug & play data acquisition module. There is no longer need to open the chassis to install DAQ modules. Just plug in the module, and then get the data. It's easy and efficient. Reliable and rugged enough for industrial applications, yet inexpensive enough for home projects, the USB-4711A module is the perfect way to add measurement and control capability to this system(manual, 2013). The features of this device includes Supports USB 2.0, Portable, Bus-powered, 16 analog input channels, One - bit resolution AI, Sampling rate up to 150 kS/s, 8-ch DI/8-ch DO, 2-ch AO and one 32-bit counter, Detachable screw terminal on modules and lockable USB cable for secure connection included(advantech.com, 2014).

b) XBee Pro Wireless transceiver

XBee is the brand name from Digi International for a family of form factor compatible radio modules based on the 802.15.4-2003 standard designed for point-to-point and star communications at over-the-air baud rates of 250 Kbit/s(Zhang, 2011). The XBee radios can all be used with the minimum four numbers of connections power (3.3 V), ground, data in and data out (UART), with other recommended lines being Reset and Sleep.In API mode the data is wrapped in a packet structure that allows for addressing, parameter setting and packet delivery feedback, including remote sensing and control of digital I/O and analog input pins(Digi, 2009). Features of the XBee Pro also includes no configuration needed for out-of-the-box RF communications, common XBee footprint for a variety of RF modules, fast 250 kbps RF data rate to the end node, 2.4 GHz for worldwide deployment and sleep modes supported for extended battery life(http://www.digi.com, 2009).

c) SY HS 220 Humidity Sensor

This sensor module converts relative humidity (30-90%RH) to voltage and can be used in weather monitoring application. The specifications (SYHITECH, 2013)for this device are given below

Rated Voltage:	DC 5.0
Current Consumption:	≤3.0 mA
Operating Temperature Range:	0-500C
Operating Humidity Range:	30-90 % RH
Storage Humidity:	Within 95% RH
Storage Temperature:	30-85oC
Standard Output Voltage: (at 250C 60% RH)	DC 1,980mV
Accuracy: (at 250C 60% RH)	±5% RH

d) RTD PT 100 Temperature Sensor

The resistance that electrical conductors exhibit to the flow of an electrical current is related to their temperature. A PT 100 is a precision platinum resistor that exhibits 100Ω at 00C. It has a positive temperature co-efficient so as the temperature rises, so does the resistance(Rhomberg, 2013).

V. Software Design Of System

This section will cover an introduction to LabVIEW, transmitter and receiver part of the designed system.The software part of embedded sensor system is designed in LabVIEW (Laboratory Virtual Instrumentation Engineering Workbench). It is a programming environment in which user can create programs using a graphical notation (connecting functional nodes via wires through which data flows); in this regard, it differs from traditional programming languages like C, C++, or Java, in which program is written with text(Fang & Wang, 2011). LabVIEW is written on graphical structure.

a) Transmitter Mode

In transmission mode the software is developed to acquire data from sensor nodes and to transmit it to server computer. The front panel and block diagram of program designed in LabVIEW is as shown Fig.1 and Fig.2 respectively.

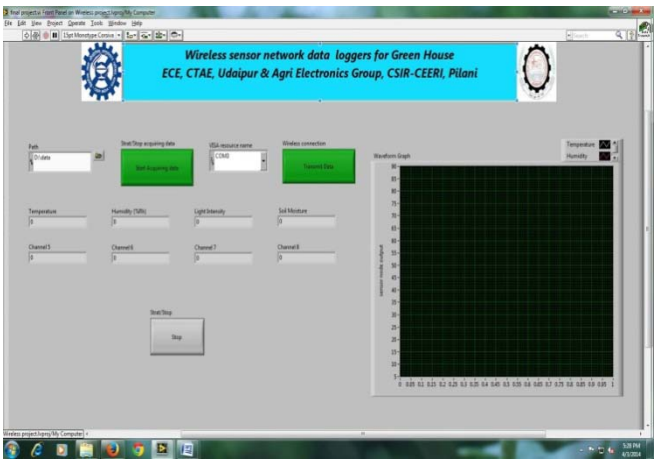

Figure 1 : Front Panel of transmission mode

The software program of transmission mode is developed for 8 channels. Digital and graphical value of

sense data is displayed by front panel. At there user first select the COM port and then define the path of file that store the history of data. The received data is continuously stored in history curve for further data analysis.

The block diagram of the system designed for data logging by DAQ card, averaging the sensed data by algorithm and storing data in history curve. The history curve can display by block diagram by single click. The sensed data is stored in .doc file

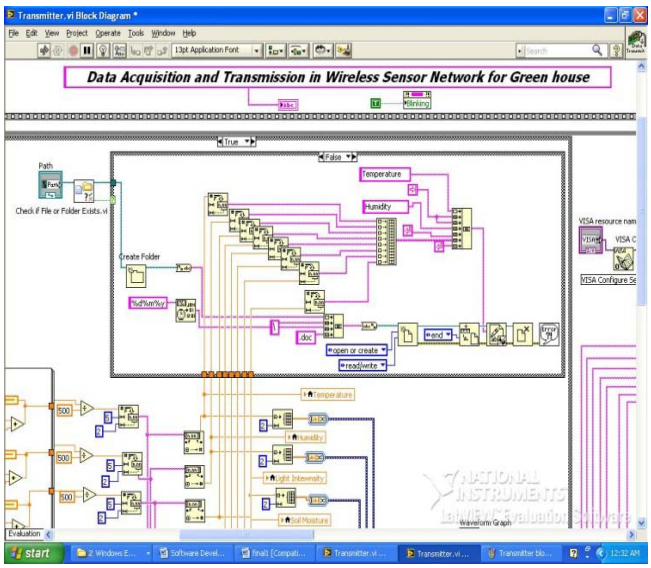

Figure 2 : Block Diagram of transmission mode

b) Receiver Mode

In receiving side program is developed to receive data at server computer from remote client computer. With the help of XBee Pro the transmitted data is received at remote location and LabVIEW program is stored that data in .doc file by history curve for further analysis. The block diagram of program designed in LabVIEW is as shown Fig.3.

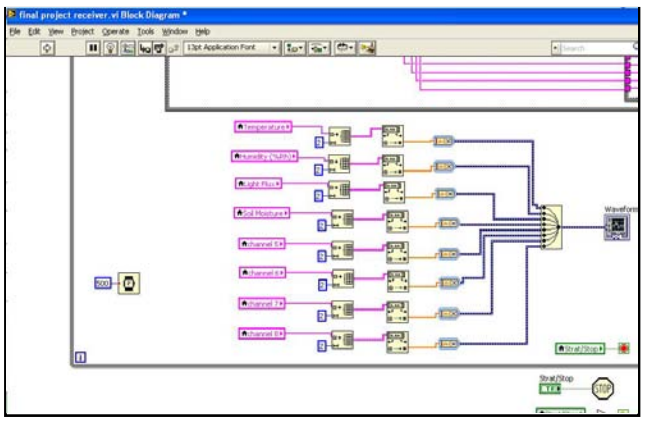

Figure 3 : Block Diagram of receiver mode

VI. Working Of The Proposed System

As discussed in above sections, the proposed system is having two modes, Server mode or receiver mode and Client mode or the transmitter mode.

Transmission mode is used to take the environmental data through the sensors from the remote location and send that data through the wireless XBee. Data transfer, energy efficiency and sensors data analysis are the main part in which the whole software based. For the energy efficiency and data analysis the software part used the algorithm and store and sends the data. For the energy efficiency concern the sensors are programmed by the software as like they transferred data after 2 min every time and then go to the sleep mode. It saves the energy and increases the efficiency of the system. At the same time the software shows the data trend curve of the sensors data, records the sensor data and send that data on the server location where the receiver program is running.

Same time receiver mode (at server location) is used to pick the sensor data through the wireless XBee, which is sent by the transmission mode software (from remote location). The receiver program logs that sensor data into the computer for analysis purpose and according to requirement it shows the history curve also.

VII. Results And Discussion

The finally developed system (hardware and software part) is placed in the Green house of size, 30 feet X 45 feet for the field trials. Some of the field trials are shown in Fig.4: shows that RTD-PT 100 temperature sensor and SY-HS 220 humidity sensor are connected through the Advantech DAQ card 4711A. As shown in figure there is no need to external power to run system because all system is working on 5V that is fulfilled by USB connected to computer system. XBee and Advantech DAQ card 4711A is connected to PC by USB that is used to transmit the sensed data with the help of software.

Figure 4 : Connections of Hardware Design

The system is used to store data into the *.doc format (current date) into the MS Word file. All the

analysis work completed, which are shown by figure 5 and figure 6, that shows the temperature sensor (RTD) data and Humidity sensor (SY HS220) data day by day which are transmitted and stored into the word file. The software data are compared with the standard data and the obtained results are same. All the data analyzed day by day which is shown in the graphical form listed in Fig.5 and Fig.6.

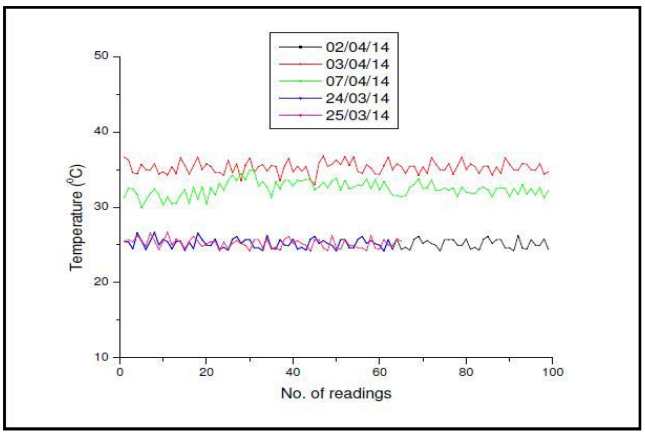

Figure 5 : Combined Temperature Curve

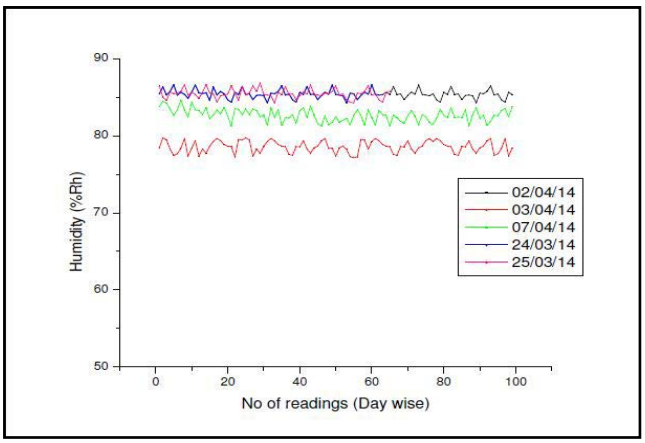

Figure 6 : Combined Humidity Curve

VIII. Conclusion

In this research work wireless sensor network is used to transfer and receive the data through the XBee proand the sensors like RTD PT100 temperature sensor and SY-HS 220 humidity sensor. All the results are shown through the graph, which are shown in Fig.5 and figure 6The graphs show the daily temperature variations and humidity variations in the green house. This project is very useful for maintaining the green house temperature and humidity. The add-on features can also be used in future to detect, analyze and control the environmental parameters in green houses at large scale. The software is tested for basically two environmental parameters in green house but it can further increases up to 8 parameters to detect the environmental sensor data like light flux, pH, CO2, soil temperature and soil humidity etc.

This research work also used the energy saving basics by the data averaging algorithm designed in LabVIEW. The software store and control the sensor node data analyze the data and provide sufficient information on front panel to the user. The software program controls the transmission and receiving mode for travelling the data from remote location to server location. The software acquires the sensor node data after every 2 min. and transmits through the wireless sensor network to the receiving end at server location, where the receiver program receiving the data and storing that data for further analysis.

On the basis of analysis of stored sensor node data an efficient node placement strategy is designed that cover maximum possible area of used greenhouse. In this strategy data monitoring system use only one sensor node and a small pulley system for movement of sensor node that make system more reliable and cost effective.

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Network Path Discovery Mechanism for Failures in Mobile Ad hoc Networks

By Jitendra Moond, Dharm Singh & Naveen Choudhary
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Abstract- Mobile Ad-Hoc Networks (MANET) are form of wireless networks in which nodes can configure by themselves in free and dynamic manner to form temporary network topology. These networks do not have any fixed infrastructure and any centralized administration. Routing is the most challenging task in MANETs as the network topology keeps on changing due to mobility of nodes. Routing involves task of discovering route to destination node for a source to send data packets. In MANET, as there is no fixed infrastructure, nodes act as routers or packet forwarding devices. Ad-hoc On Demand Distance Vector (AODV) routing protocol used for routing in MANETs is considered most suited for such networks and is selected for introducing a new approach for path discovery. AODV looks for route only when any of the node is having data packets ready to be sent to some destination. But under node mobility and variable node density the performance of AODV reduced. In this paper a Network Path Discovery AODV protocol (NPDAODV) is proposed, which considers node speed, signal strength, distance between nodes and queue occupancy while discovering network path. Also the newly proposed protocol is compared with AMAODV, an earlier work. Network Simulator (NS2) is used to perform the comparative simulations to study the proposed work.

Keywords: *MANET, AODV, NPDAODV, AMAODV, NS2, RREQ, RREP, RERR.*

GJCST-E Classification : *C.2.1*

Strictly as per the compliance and regulations of:

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I. Introduction

In past many years wireless networks have attracted researchers, due to their wide scope applications ranging from mobile communication to wireless ad-hoc networks. Wireless technology have provided many standards for wireless networks, like 802.11 standards family. Many routing protocols have been developed, some for general and some for specific scenarios like vehicular ad-hoc networks (Mor, 2013). Still the majority of research work done in the field of networks concentrates wireless networks only.

Among all the wireless networks, Mobile Ad-Hoc Network (MANET) (Macker and Corson, 1997) is the one which has attracted majority of research people. In contrast to the infrastructure based networks nodes in are self- configuring, self-managing and self-organizing. Also due to absence of fixed infrastructure nodes are involved in receiving and sending packets which are not relevant or are of no use to them. Which means they act as routers or packet forwarding devices. Nodes are free to move in any direction, as the basic feature of wireless networks. Due to this free and random movement of wireless nodes many issues arise in any MANET scenario. It leads to frequent topology changes, higher consumption of energy, frequent and abrupt rise in control traffic to maintain the neighbor information (Daniel et al., 2012) . Due to topology changes the paths between any two nodes vary and future path may be of longer length, as shown in Figure. 1.

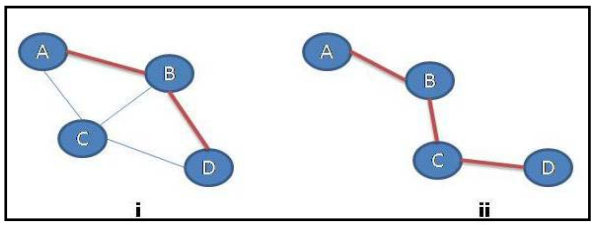

Figure 1 : MANET topology change due to mobility

Thus due to mobility of nodes the major challenge lies in the routing the packets from one node to another. At this point, the routing protocols comes into the picture. Routing protocols specifies the nodes that how to communicate with each other and provides information to select a path and send packets from source node to any destination node. It is the routing protocol using which nodes defines specific choice of path between any two nodes. In the past years many routing protocols have been suggested for wireless networks and for MANETs as well.

II. Routing Protocols

Here Based on their basic working mechanism these routing protocols can be classified in three categories (Moond and Singh, 2013). Proactive routing protocols uses tables to store the information of neighboring nodes as well as other nodes, managed by every node. If any source node have data ready to be sent, it consults these tables to follow the next hop towards the desired source. But in scenarios having high mobility these tables keeps on updating and they generally hold a path which may not be actually used.

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Example of this type includes Destination Sequenced Distance Vector (DSDV) routing protocol.

Reactive routing protocols are considered best suited for MANETs (Moond and Singh, 2013). Unlike proactive routing protocols they do not maintain any information regarding current topology. They look for routes only when any node have data ready to be sent to some source node. At that time source node generates control packet which returns complete path or establishes a path between source and destination. Examples of this type includes Ad-hoc On-Demand Distance Vector (AODV) and Dynamic Source Routing (DSR) routing protocols.

Third type of protocols considers a mixture of good feature of both the above types and some advanced information like knowing the position of nodes prior to routing using Global Positioning System (GPS). These are called as hybrid routing protocols. Examples of these includes Zone routing protocol (ZRP).

III. Working of Aodv

Ad-hoc On-Demand Distance Vector (AODV) (Perkins et al., 2003) is considered as most suited routing protocol for MANETs. As it do not maintain routes at all times between any two nodes in the network. Instead it only looks for routes between two nodes when the source node have data packets ready for forwarding. The initial time required by this protocol may be high, as data packets have to wait till the path is searched and setup. But this protocol saves the MANETs from routing load which may occur at times of high mobility ultimately saving the power, bandwidth and processing capability. The whole process of path establishing is in two phases.

a) Path Discovery Phase

In route discovery process, a node in the mobile ad hoc network dynamically discovers a fresh or stored route to other node in the network. The path so discovered may be in the direct radio transmission range of the node, or uses one or more nodes of topology as intermediate nodes. In AODV protocol, the source node having data packets ready to be sent, broadcasts a Route REQuest (RREQ) packet to all its neighbors. If any of the neighbors has a stored route to reach the destination, it sends a Route REPly (RREP) packet. If no route is found in their tables, the neighbors rebroadcast the RREQ packet after updating some of the fields in it. Following this process at each node, some of the RREQ packets reaches the destination. The destination node, on reception of a RREQ packet, sends back a RREP packet, which traverses back the path followed by the RREQ packet.

The Figure. 2. below explains the process of route discovery phase.

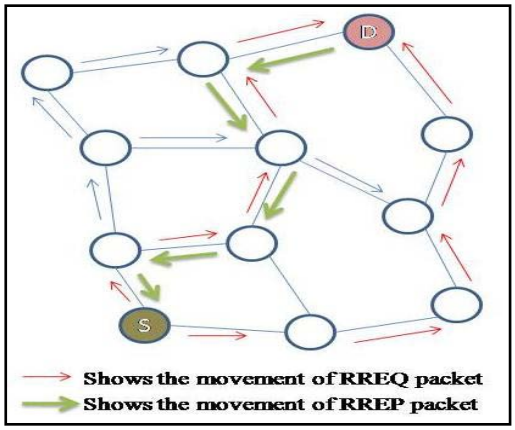

Figure 2 : Path discovery process

b) Path Maintenance Phase

AODV protocol also has some the mechanisms for situations when, a route is never discovered or RREP packet is lost on its way back to source node. In these circumstances the source node is obliged to start another route discovery process by sending new RREQ packet, after a time-out. AODV also uses a route maintenance process, which comes in effect to monitor the steadiness of a route currently in use and informs the sender node if any errors occurs. If any intermediate or destination node notices breakage in the route in use, it sends a Route ERRor (RERR) packet informing about the broken link. At this stage the sender node reinitiates the route discovery processes in search of a new route to the destination. The Figure. 3. below explains the process of route maintenance phase.

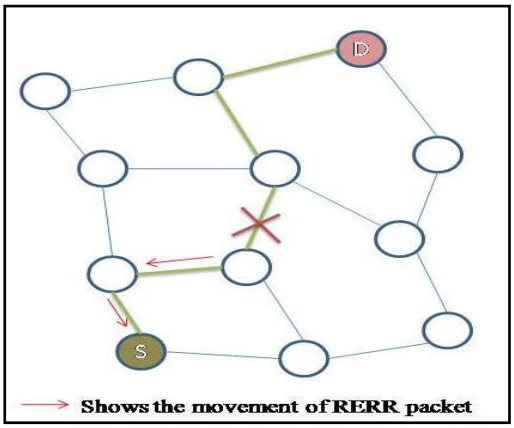

Figure 3 : Path maintenance process

Every routing protocol have its own features and some disadvantages also. Likewise AODV also have some challenges to face under some specific situations, like:

1. Routing overhead incurred by control packets.
2. Repeated route establishment under high mobility of nodes.
3. No alternate path availability in case of link break.
4. No provision of avoiding congested links.
5. No QoS provisions.

IV. Proposed Work

The proposed work concentrates on path discovery process of AODV and thus a new routing protocol termed NPDAODV is proposed. In the proposed work firstly, the RREQ packet is added with four new fields viz. rreqdist, nodespeed, sigstr and node_que. The Figure. 4. below shows the new packet format of RREQ in NPDAODV.

Type	J	R	G	D	U	Reserved	Hop Count
RREQ ID							
Destination IP Address							
Destination Sequence Number							
Originator IP Address							
Originator Sequence Number							
rreqdist							
nodespeed							
sigstr							
node_que							

Figure 4 : New RREQ Packet Format for NPDAODV

At time when a node is looking for a path to destination node, it will broadcast a RREQ packet, initially having null values in new fields. As the neighboring nodes receive this packet they will update the fields including the new fields, before forwarding it. Thus as this packet travels its way towards the destination, every node this packet traverses will add the four values to the packet. When the destination will receive its first RREQ packet, the NPDAODV allows the destination to wait for another RREQ to arrive. Now the destination node compares the four values in both the packets to select the best and a RREP is sent using the selected RREQ packet. Thus, using NPDAODV a stable and long existing path is discovered and selected.

V. Simulation Environment

In this section the simulation environment for performing the simulations, are discussed in brief. Network Simulator (NS2) is used to perform simulations.

a) Random Waypoint Mobility Model

This model is used broadly in protocol development and performance assessment for MANET (Ahmad and Mata-ur-Rehman, 2010). In this model, the position of each node is selected randomly within user defined area and the node moves to a selected position in linear fashion with constant random speed, which is also user defined and is uniformly distributed between [0, Max Speed]. The node stops for a time called pause time before starting the next movement in next direction. Pause time is also user defined at the time of initialization.

The nodes in this model move in a linear direction, except when it has reached the boundary of specified area, where it reflects and changes its direction in sharp turn. This model leads to constant topology change, pause time and defined max speed have added effect on mobility of nodes. If the max speed is kept low and pause time is defined high, the topology remains relatively stable, whereas if max speed is high and pause time is small, the topology is highly dynamic. Problems with this model are that nodes take sharp turn and abruptly comes to halt due to pause time.

b) Two Ray Ground Propagation Model

The radio propagation models are used to predict the received signal power of each packet (Fall and Varadhan, 2011). A receiving threshold is defined for the physical layer of each node. When a packet is received. its signal power is determined and if it is below the receiving threshold, it is treated as error and is dropped by the MAC layer.

The best means of propagation between two nodes is the line of sight path. The two ray ground propagation model considers both the direct and ground reflection path as shown in Figure. 5. Previous simulations as shown that this model gives more accurate prediction at a long distance than free space model.

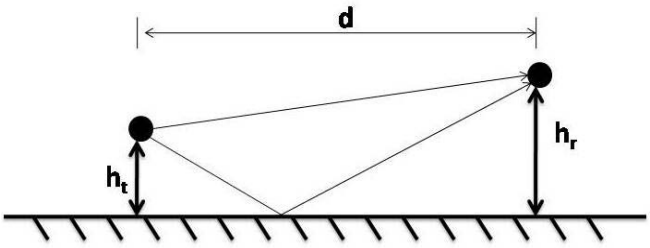

Figure 5 : Two Ray Ground Propagation Model with its Direct Ray and the Reflection

The received power at a distance is estimated by,

$$P_r(d) = \frac{P_t G_t G_r h_t^2 h_r^2}{d^4 L}$$

where Pt is the transmitted signal power, Gt and Gr are antenna gains of transmitter and the receiver respectively. L is the system loss and ht and hr are the heights of the transmitter and receiver antennas respectively. The equation shows that the received power decreases fast as the distance increases.

c) Generating Traffic and Movement Patterns

For generating traffic patterns in simulations, a utility cbrgen.tcl is used. This utility is capable of generating CBR and TCP traffic. In this paper we have used CBR traffic.

For generating node movement in a fixed area NS2 provides a utility named, setdest. This is an inbuilt utility in NS2 and follows the random waypoint mobility model (Fall and Varadhan, 2011).

d) Simulation Parameters

The simulation parameters used for evaluating the performance of both the routing protocols are as listed in Table I. Two scenarios are used to evaluate the performance, which are, effect of increased node mobility and effect of increase in number of nodes

Table 1 : List of Simulation Parameters

Parameters	Value
Simulation Time	100s
Topology Area	1000 X 1000m², 1500X1500 m²
Number of Nodes	10 to 100
Speed	10 to 50 m/s
Transmission Range	250m
Traffic Type	CBR
Packet Size	512 b
Pause time	0.0 and 1.0
Number of Connections	5

VI. Results and Discussion

In this section the proposed protocol, NPDAODV, is compared with the existing AODV routing protocol using the NS2 simulator (Fall and Varadhan 2011) and by selecting the scenarios having varying node mobility and number of nodes. Three scenarios are created, in first the node speed is changed from 10m/s to 50m/s, keeping the other parameters same and in second the number of nodes is varied from 20 to 100 keeping the other parameters same. In third scenario the proposed protocol is compared with AMAODV using packet delivery ratio.

a) Scenario 1

As the speed of nodes changes from 10 m/s to 50m/s, the number of packets received decreases than number of packets sent due to frequent link failure caused by node mobility. But NPDAODV performs better than AODV as shown in Figure. 6.

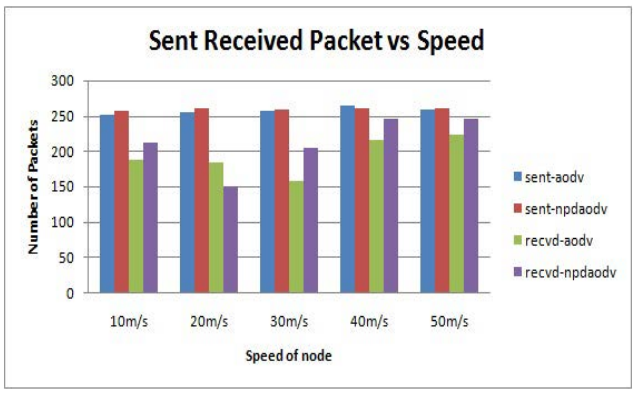

Figure 6 : Number of Packets Sent-Received vs speed

As a result of more number of packets received by NPDAODV, the throughput and packet delivery fraction results are better than AODV, which can be clearly analyzed in Figure. 7.

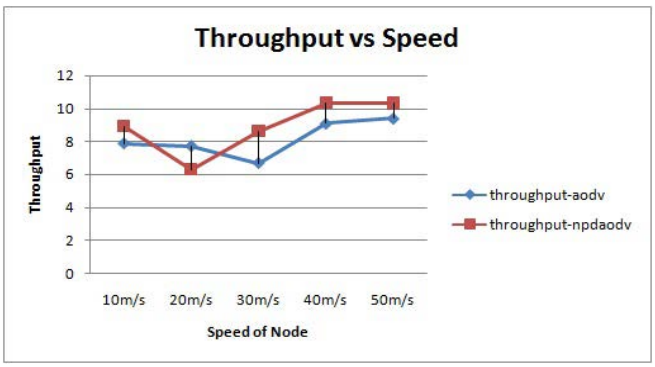

Figure 7 : Throughput vs Speed plot

Also to verify the notion of long lived and stable path the routing load for both the protocols is compared, which shows that routing load in NPDAODV is decreased significantly compared to AODV, as shown in Figure. 8.

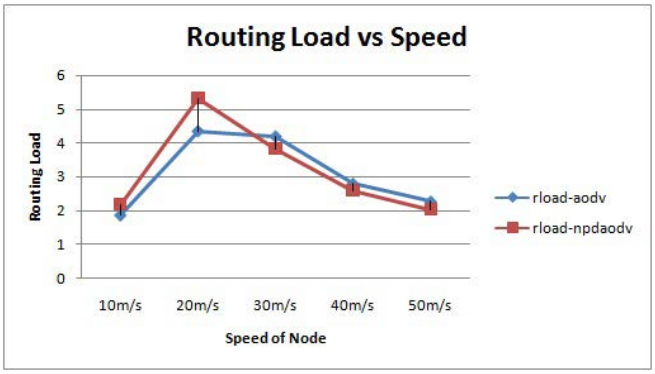

Figure 8 : Routing Load vs Speed plot

As the path discovered by NPDAODV is stable under variable node speed, as discussed above, the path selected may not be the shortest path, as in the case of AODV. This notion can be easily verified by the Figure. 9. showing the number of packets forwarded during the entire simulation. The forwarded packets are the packets which are forwarded by intermediate nodes to act as router or packet forwarding nodes.

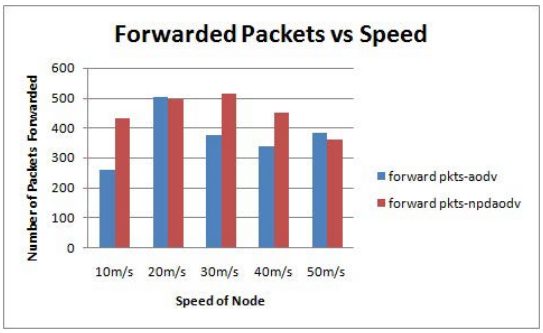

Figure 9 : Forwarded Packet vs Node Speed.

b) Scenario 2

In this scenario the number of nodes is varied from 20 to 100. As the number of nodes increases under higher node mobility (Node Speed 30m/s) the two

routing protocols perform more similarly, whereas NPDAODV performing marginally better than AODV. The number of packets sent and received by both the protocols is shown in Figure. 10.

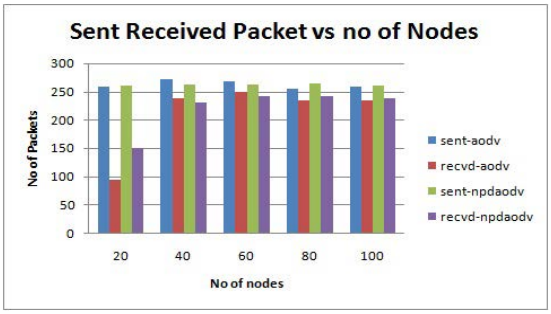

Figure 10 : Number of Packets Sent-Received

Again as a result of more number of packets received by NPDAODV, considering to number of packet sent, the throughput for NPDAODV is also better than AODV protocol. The plot in Figure. 11. clearly shows this.

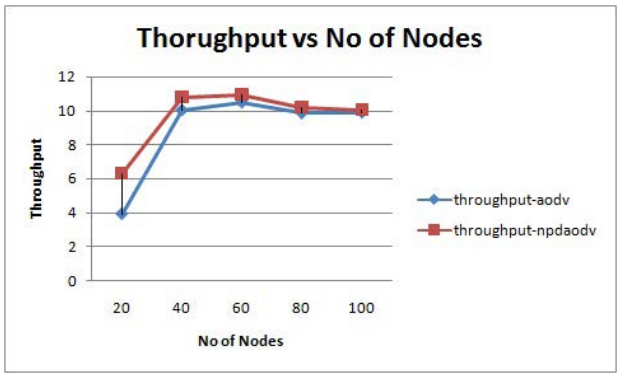

Figure 11 : Throughput vs Varying Number of Nodes plot.

The routing load for both the protocols under this scenario is also comparable, but again at times the NPDAODV routing protocol have lower routing load than AODV, which again justifies the notion of long lived path. This is shown in Figure. 12. The results are comparable due to the increased availability of nodes to discover path with the increase in number of nodes in the topology.

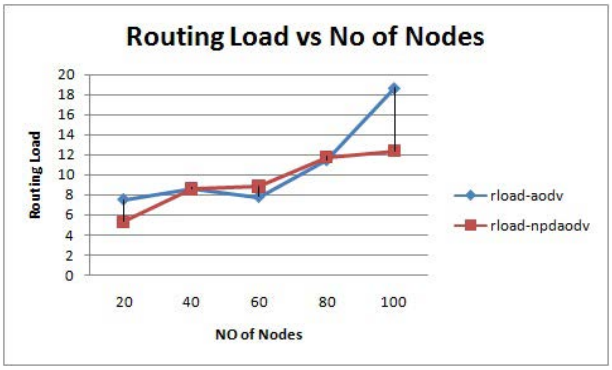

Figure 12 : Routing Load vs Varying Number of Nodes plot.

Also the results for number of forwarded packets are comparable due to same reason mentioned as above. But again at some time the number of forwarded packets for NPDAODV is higher, which reveals that the path discovered may not be shortest path, as shown in Figure. 13.

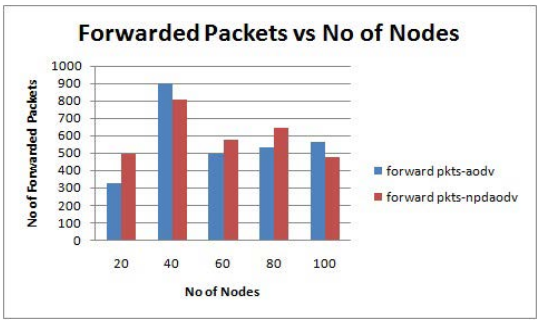

Figure 13 : Forwarded Packet vs Varying Number of Node.

c) Scenario 3

In this scenario we have compared our proposed work with an earlier work suggesting AMAODV (Ahmed et al., 2012) and with AODV. For this scenario some simulation parameters have been changed, like, number of nodes is kept between 10 to 50, maximum connections is kept 30, area of topology is 1500 X 1500 m2 and rate is kept 2.0.

Here in this scenario we have taken Packet Delivery Ratio (PDR) as one parameter and on that basis it is concluded that NPDAODV performs better than AMAODV and AODV, as shown in Figure. 14.

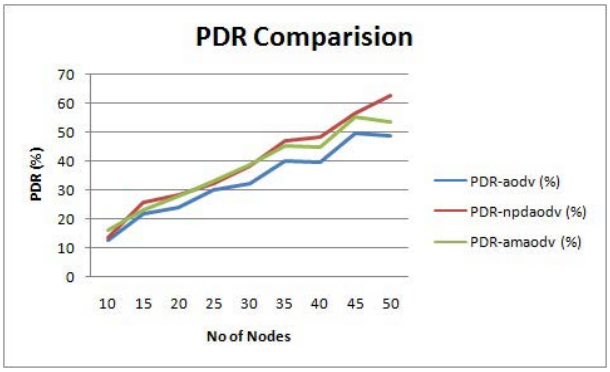

Figure 14 : Comparison for PDR (%) between AODV, AMAODV and NPDAODV.

VII. Conclusion

Ad-hoc On-Demand Distance Vector (AODV) is considered the most suitable routing protocol for Mobile Ad-hoc Networks (MANETs). Still using the notion of least hop count to select a path may not be suitable for MANETs having high mobility, which leads to varying distance between nodes and thus leading to frequent link failure in paths. This lead to the motivation for proposing NPDAODV, in which distance between nodes, signal strength, speed of node and queue size at node are taken in consideration during the path discovery phase.

The proposed protocol shows improved performance over AODV by receiving higher number of packets, by showing higher throughput, lesser routing load when speed of nodes is varied from 10 - 50 m/s. Higher throughput by incurring lesser routing load shows the discovery of long lived path for communication between nodes. Also similar results are obtained when number of nodes is varied from 20 to 100, by means of simulations using NS2. NPDAODV is also compared with AMAODV, in which it shows slightly better performance when packet delivery ratio is considered.

It can be concluded that NPDAODV shows better performance for failures in MANETs generated due to high mobility, thus leading to better performance of the network. In future, this protocol will also be tested for energy consumption in the network.

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An Efficient Algorithm for Optimization of Power with Computational Security in MANETS

By T. Sukumar, V. Vaishnavi & P. Varsha
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Abstract- The major issues associated with MANETs include the precious battery power of the nodes and security threats from compromised nodes inside the network. The introduction of an additional dynamic node may optimize the power, but however it leads to jamming and interference and thereby reducing the efficiency of the network. Since MANETs have a highly dynamic topology, they are vulnerable to active and passive adversaries. We aim to optimize the network power with added security features and propose a new algorithm "Power with Computational Security (PCS Algorithm)" to overcome the above mentioned drawbacks. The PCS Algorithm employs a dynamically computed "Power Threshold" to achieve efficiency. Also, We make the network secure by introducing a "Security Provider" which consists of dealer phase and combiner phase to ensure all the security requirements are met. Thus, We achieve power efficient and secure data transfer with minimal information and thus it minimizes the mobility, resource and prior-trust relationship constraints.

Keywords: *Ad-hoc, power, MANET, energy and security.*

GJCST-E Classification : *C.2.0*

Strictly as per the compliance and regulations of:

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T. Sukumar [α], V. Vaishnavi [σ] & P. Varsha [ρ]

Abstract- The major issues associated with MANETs include the precious battery power of the nodes and security threats from compromised nodes inside the network. The introduction of an additional dynamic node may optimize the power, but however it leads to jamming and interference and thereby reducing the efficiency of the network. Since MANETs have a highly dynamic topology, they are vulnerable to active and passive adversaries.

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I. Introduction

A mobile ad-hoc network (MANET) is a kind of wireless ad-hoc network, and is a self-configuring network of mobile routers (and associated hosts) connected by wireless links – the union of which form an arbitrary topology. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet [1].

The set of applications for MANETs is diverse, ranging from small, static networks that are constrained by power sources, to large-scale, mobile, highly dynamic networks. The design of network protocols for these networks is a complex issue. Regardless of the application, MANETs need efficient distributed algorithms to determine network organization, link scheduling, and routing. However, determining viable routing paths and delivering messages in a decentralized environment where network topology fluctuates is not a well-defined problem. While the shortest path (based on a given cost function) from a source to a destination in a static network is usually the Optimal route, this idea is not easily extended to MANETs. Factors such as variable wireless link Quality, propagation path loss, fading, and multi-user interference, power expended, and topological changes, become relevant issues. The network should be able to adaptively alter the routing paths to alleviate any of these effects. Moreover, in a military environment, preservation of security, latency, reliability, intentional jamming, and recovery from failure are significant concerns. Military networks are designed to maintain a low probability of intercept and/or a low probability of detection. Hence, nodes prefer to radiate as little power as necessary and transmit as infrequently as possible, thus decreasing the probability of detection or interception. A lapse in any of these requirements may degrade the performance and dependability of the network [3] and [4].

a) Routing Protocols for MANETs

A routing protocol is the mechanism by which user traffic is directed and transported through the network from the source node to the destination node [2]. Objectives include maximizing network performance from the application point of view while minimizing the cost of network itself according to its capacity. The application requirements are hop count, delay, throughput, etc; resources residing at each node and number of nodes in the network as well as its density, frequency of end-to-end connection, frequency of topology changes [7] and [8]. The basic routing functionalities for mobile ad hoc networks are:

- *Path generation:* This generates paths according to the assembled and distributed state information of the network and of the application.
- Assembling and distributing network and user traffic state information.
- *Path selection:* This selects appropriate paths based on network application state information.
- *Data Forwarding:* This forwards user traffic along the selected route.
- *Path Maintenance:* Maintaining of the selected route.
- Energy/Bandwidth efficiency.

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II. System Architecture

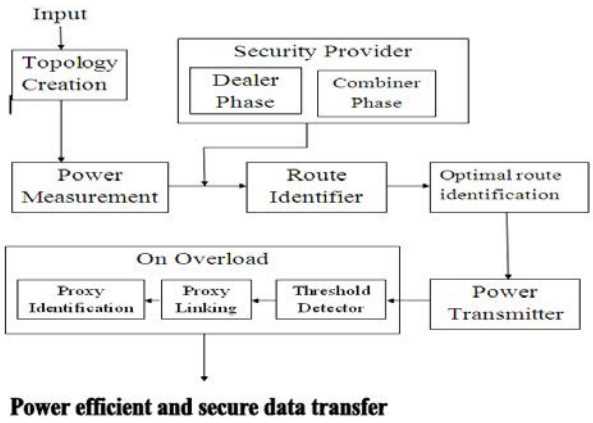

Figure 2.1 : Power Optimizer and Route Identifier Architecture

III. Module Design

a) Topology Design

The first module consists of the basic input details and the processing involved with it to create the network. It requires accurate input data to design the topology of the network. The input details that needs to be specified by the user includes the number of the nodes involved in the design followed by other attributes such as the speed of the data transfer and also the power associated with each node.

On the correct specification of the required details, the topology of the network is generated using the NS2 simulator as shown in Fig.2.2

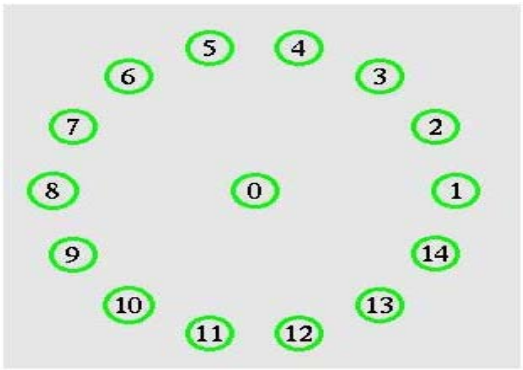

Figure 2.2 : Sample Topology

b) Power Measurement

Every node in the network constantly measures its own power level and keeps track of it and checks for the overload condition. This power measurement helps to keep an overall check of the various nodes available in the network and their respective power levels. Since the nodes in a MANET environment are always in motion, it further helps in recognizing nodes that remain within the range of transmission.

c) Route Identifier

The route identifier is a module that plays an important role in transmission of packets from the source to the destination. For every transmission between a particular source and destination, the route identifier almost immediately generates all the possible paths that can be followed by the source to reach its desired destination. Thus it provides the source with multiple choices to follow. However, in a MANET scenario, since the nodes are mobile, the possibility of predicting the correct route becomes an issue. But the route identifier generates the list on an approximate note and leaves it to optimal route identifier to choose the finally route. Thus, the route identifier merely lists down all the possible routes from a source to its destination.

d) Optimal Route Identifier

The optimal route identifier works as the final authority that decides the final route the source opts to reach the destination. The route identifier aids this cause and list down all the possible routes available and the optimal route identifier analyses the best possible path with respect to the shortest distance and the path that involves the nodes that have enough individual power levels that they can efficiently transmit the information from one end to the other.

e) Packet Transmitter

This module is the fourth module in the PCS Algorithm wherein the nodes route the packets to their destination. This module will execute in the source module. This is of high priority as we are transferring the packets without any loss of information and minimal power consumption being our primary goal.

The source node and its connectivity details along with the path must be known so that the packets can be routed. While transferring the packets it must be made sure that we get acknowledgement for the data sent so that it can be made sure that packet has been delivered to its destination.

The source and the destination node must be alive so that the packets are reached in correct order and safely. Once the packets are delivered in correct sequence, acknowledges must be sent. Also, the power level of the nodes must be checked out so that any node in the path of the packet route does not break down.

f) On Overload

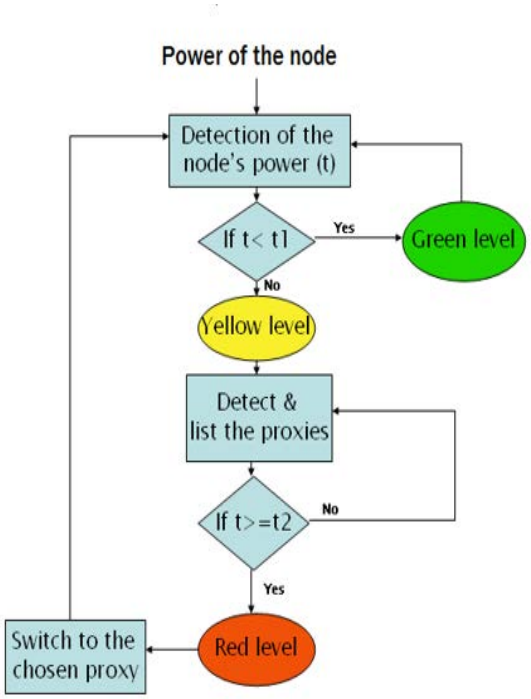

Figure 2.3 : Overload scenarios

This is the most important module of the project as the core job of the PCS algorithm is to route packets through a different path on power failure. The value t in fig 4.4 represents the power level of the individual node. The threshold levels t1 and t2 represents the yellow and red which means that the node is reaching the alarming power levels. This is of the highest priority and depending upon the overload, three cases must be executed. Threshold detection must start when the particular nodes' power level starts drooping. Searching the adjacent nodes must be based on the nodes' power level and also the shortest path and it must display a list of possible paths. Finally, the optimum path must be chosen in such a way that it is both nearer to the source node and also conserves power.

We define three threshold levels: green, yellow and red. As long as the node's power level remains good enough to receive new requests and transmit them, it remains in the green level and continues it process and also keeps a check on its power level simultaneously. Once the initial threshold level is reached, it enters the yellow level, and immediately starts searching for the nodes nearby that can act as a proxy and provide an alternative path. But it can still take receive new requests and process them. But once the power level reaches below the second threshold value, it enters the red level, and requires an immediate replacement with the chosen proxy. Thus, the overload condition is met and is substituted with a proxy node and a new path to continue the processing.

g) Security Provider

The second major issue is addressed by assuming that all nodes in the network have a unique identification associated with them. We assume that there exists a broadcast channel among all nodes in the MANET and if some data is broadcast, each node reads the same value. Hence the attacker cannot try to confuse by sending two different values to different nodes. Every node will be authorized, authenticated, non-repudiated, confident and computationally secure. It involves two phases. A Dealer Phase in which the sender shares a secret among all participating nodes and a Combiner phase where a coalition of size greater than or equal to k constructs the secret. A combination of Chinese remainder theorem, Asmuth Bloom secret sharing scheme and Verifiable secret sharing is used to overcome this problem [6].

The motivation of Threshold cryptography is to share the secret value among multiple individuals called participants (or shareholders) that are engaged in encryption or decryption. The objective is to distribute the secret value in a distributed architecture. This architecture follows the dynamic topology of the networks, in which the participants reside. The secret value is redundantly split into n pieces and is distributed among participants such that t or more than t pieces can recover the original secret value. This is secured message transmission (SMT) between two nodes over n multiple paths in MANET. There are various applications of MANETs, in which TC may be implemented. Applications include coordinating efforts of military attacks in the battlefield or in disaster-struck area, establishing wireless connectivity among various home appliances, and establishing communication among wireless devices such as laptops.

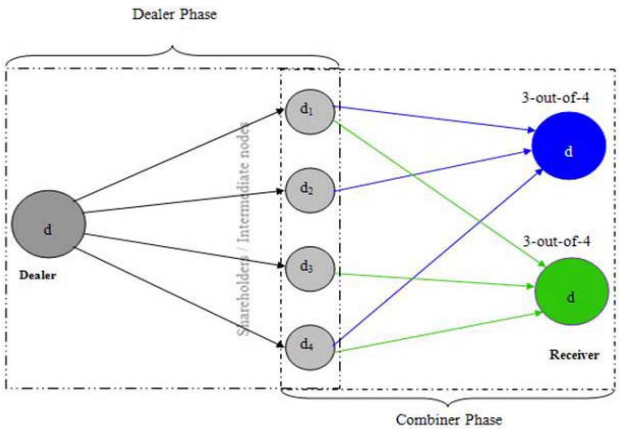

Figure 2.4 : 3 out of-4

Fig.2.4 shows an illustration of secret sharing and coalitions. From the Figure 3-out-of 4, it is clear that for retrieving the message, at least three pieces of shared secret values are required. Hence, the size of coalition is three or more. In this example, the secret value d is split into four parts (n = 4) in the dealer

phase. Then, these split values are broadcast to the participating nodes. After receiving the t (= 3) splitted secret values, the receiver then adds them up and finally retrieves the original secret value.

The benefits of using this kind of secret sharing scheme is that there is no need to know the private and public key components in case of regular RSA[5]. Regular RSA-TC approaches shows that signature generation and verification increases time exponentially when key size is doubled. Also it is computationally secure to generate and distribute consistent shares and it is secure to combine the shares in the reconstruction phase. In VSS, the entire participating node can verify its share in the dealer phase and no node can lie about its share in the combiner phase. Neither the dealer nor the participating nodes can cheat in this scheme. Regular RSA-TC implementation shows that the signature generation and signature verification time increases exponentially when key sizes are doubled. The energy, bandwidth, and storage constraints are important in MANET. So, the RSA-TC implementation is not extremely beneficial for MANETs.

IV. Implementation

a) Algorithm

The PCS algorithm consists of two sections namely the power part and the security provider section. The power section is used to transmit the packets in an energy efficient way. The security provider has two sections namely the dealer and the combiner phase. The algorithm will be defined in detail in the following sections.

b) Power optimizer

To make sure that the packets are transmitted in a power efficient way, we define three levels of threshold value namely the Red, Green and Yellow. The Green level defines that the nodes power is sufficient enough to carry on with the transmission and that no more packets will be lost. The Yellow level means that the nodes power is subsequently falling and that after some point in time it cannot transmit any more packets. It is at this stage where we start searching for proxy node which can carry on the transmission on its behalf. Finally when the Red level is reached, the proxy node is activated, thus reducing the load on the overloaded node and also making a power efficient transmission.

Pseudo code:

START
Nodes n, threshold values t1, t2.
Detection of individual node power t.
If t<t1,
Then green level: continue with the transmission
Else
Yellow level: Detect and list the set of proxy nodes.
Again check if t<t2,
Then continue with the searching of proxy
Else
Red level is reached: switch to the proxy
Continue with the monitoring of power levels.
END

c) Security Provider

All nodes in the MANET have a unique identification. We assume that there exists a broadcast channel among all nodes in the MANET and if some data is broadcast, each node reads the same value. Hence the attacker cannot try to confuse by sending two different values to different nodes. Every node will be authorized, authenticated, non-repudiated, confident and computationally secure. There exists two phases in security provider where the first one being Dealer phase wherein the sender shares a secret among all the participating nodes. Second phase is the Combiner phase where a coalition of size greater than or equal to k constructs the secret.

i. Dealer phase

To share a secret d among a group of n nodes, the dealer does the following:

1. A set of pair wise relatively prime integer's m0 < m1 < m2 <, ...< mn,. where m0 > d is a prime, are chosen such that : $\prod^{t}_{i=1} m_i > m^2_0 \prod^{t-1}_{i=1} m_{n-i+1}$
2. Let M denote $\prod ti=1$ mi. The dealer computes y = d + Am0 where A is a positive integer generated randomly subject to the condition that $0 \le y < M$.
3. The share of the i-th node, $1 \le i \le n$, is $y_i = y \bmod m_i$.

ii. Combiner phase

Let us assume that S is a coalition of t nodes required to reconstruct the secret. Let Ms denote $\prod_{i \in s} m_i$.

1. Let $M_{S\backslash\{i\}}$ denote $\prod_{j \in s\ j \neq i} m_i$ and $M`_{S,i}$ be the multiplicative inverse of $M_{S\backslash\{i\}}$ in $Z^i_m$ i.e. $M_{S\backslash i}\ M`_{S,i} \equiv 1 (\bmod m_i)$.
2. First the i-th node computes: $u_i = y_i\ M`_{S,i}\ M_{S\backslash\{i\}} \bmod M_S$
3. The nodes then compute $y = (\Sigma_{i \in S} u_i) \bmod M_s$ for $i \in S$, solve y in Z_M using CRT.
4. It is required to compute the secret d using d = y mod m_0. According to CRT, y can be determined uniquely in Z_M since $y < M < M_S$ the solution is also unique in Z_M.

If all shares are valid, the participating node can obtains secret d by using the reconstruction procedure of Asmuth- Bloom Secret Sharing Scheme otherwise, malicious nodes are disqualified.

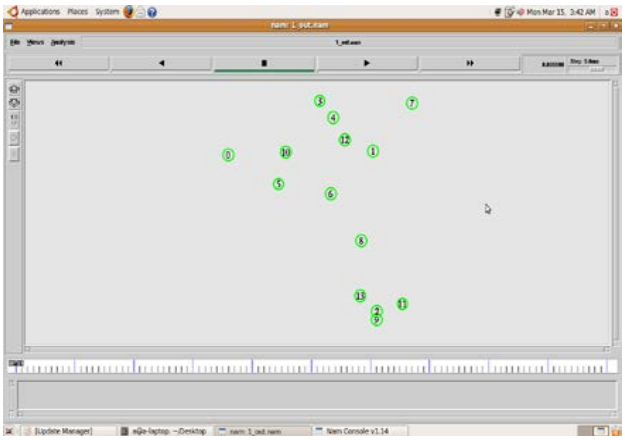

Figure 3.1: Topology Creation

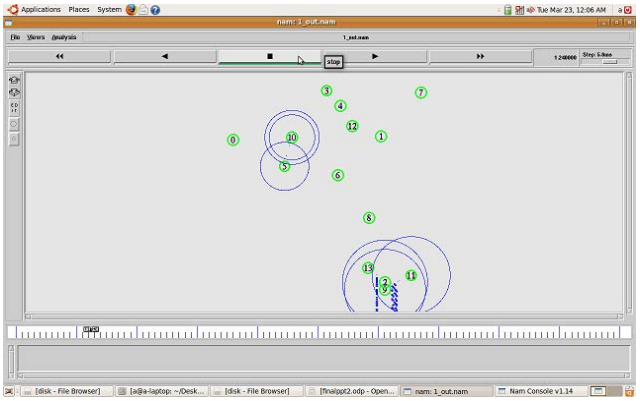

Figure 3.2 : Node 10-5 and 13-11

This figure explains two things: the power overload condition and the work of malicious node. Here the circles represent the transmission range and the small falling thing represents the loss of packets. Here node 10 is transmitting to node 5 which represents normal transmission. Also node 13 wants transmits to 11. But according to the security provider algorithm, it is detected that node 2 is malicious and hence it does not transmit the packets. Since node 2 is found out to be malicious, node 13 starts looking out for alternate way of transmitting to 11 which will both be power efficient and secure way.

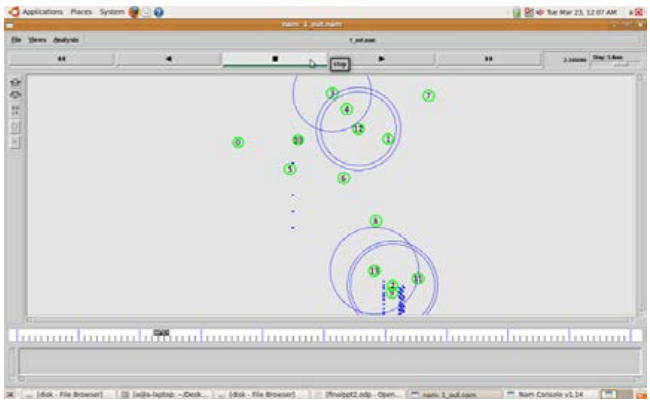

Figure 3.3 : Node 5 is overloaded

The node 13 is searching for the alternate way of transmitting the packets. But the main thing to be noted here is node 5 is overloaded, i.e. it can no more transmit any packets. Node 5 has attained the yellow threshold level. Node 5 now searches proxy node to receive all its packets. If this is not done then the packet starts losing its way. Also, now node 12 wants to transmit to node3. According to the PCS algorithm it searches for the path which is secured and discovers the path as 12-4-3 which is in accordance with the PCS algorithm.

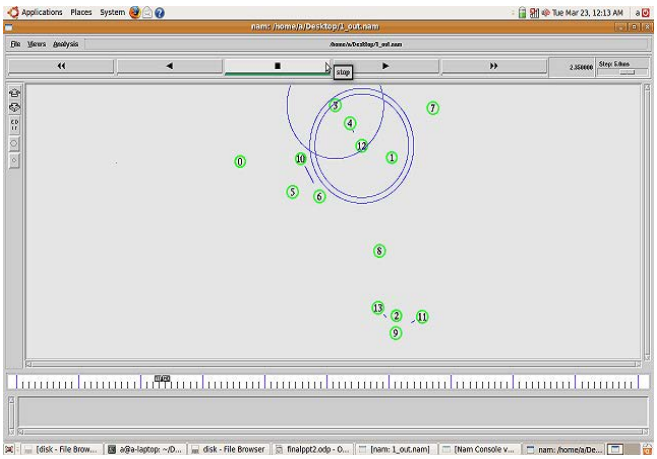

Figure 3.4 : Nodes 10-6 and 13-9-11

Since node 5 is overloaded, it finds out suitable proxy which is nearby and has the power to carry out transmission. Thus it locates 6 as the proxy node. Thereafter node 10 transmits the packets to node 6. Since node 2 is malicious and node 13 sends the packet to 9 which then forwards the packet to node 11. Thus the malicious node is removed and also the overloaded node is taken off from its overloaded conditions. Node 10 will transmit to node 6 until node 5 is charged and gets back its power.

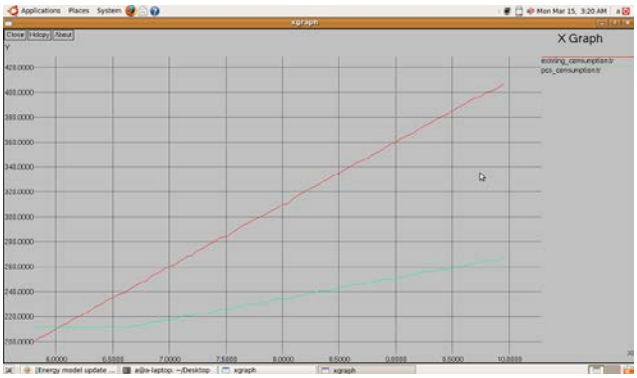

Figure 3.5 : Comparison of Existing and PCS algorithm

The performance of PCS algorithm is studied by plotting the x-graph. The nodes are put under different load conditions at different point of time. The outputs are analyzed using the trace files. The power levels are

plotted against the number of nodes to which packets are forwarded and the x-graph is plotted. The graph shows that pcs algorithm is way efficient than the existing method. Initially for less number of nodes the existing algorithm may seem efficient but as the number of nodes increases the performance levels drops down. In a network generally the nodes will always be overloaded. Hence the new methodology seems to fit in the place perfectly.

V. Conclusions

The performance of PCS algorithm is studied under NS2.30. Effective simulations are carried out many times for different traffic and the trace files are studied. TCL scripts are written to find out the throughput. A comparative study of the proposed and the existing technique has been depicted using an X-Graph which is plotted to show the power consumption on overload conditions. The graphical results show that it results in a power efficient and secure data transfer. The proposed algorithm has the following benefits associated with it:

- With the introduction of the concept of threshold and proxy, the interference is considerably reduced and hence the capacity of the network is increased.
- It comes across as a suitable replacement to the traditional routing schemes as it aims at a energy cum security approach to meet the existing problem,
- In addition, there is no need to know the private and public key components in case of regular RSA and thus it becomes more difficult to crack.
- It is also computationally secure to generate and distribute consistent shares.
- Additionally it's secured by combining the shares in the reconstruction phase.

a) *Future Work*

The PCS algorithm is almost two times more efficient than the existing technique. But however it can be further enhanced to improve upon the efficiency level and be applied to a broader spectrum. The following are the suggestive methodologies that can be improved further:

- The performance of the nodes with respect to the power efficiency can be improved with the introduction of multiple proxy nodes.
- This concept of simulation can be further extended to a multicast routing environment.
- The security can be further ensured by embedding ID based cryptography in the present scheme and thereby making the network a safe haven.
- Efficient modeling of the power consumption characteristics of wireless networks using simulation tools requires accurate WLAN model. Here we have shown that the insight obtained from NS2 simulation is of greater value while designing and analyzing the energy models.

VI. Acknowledgment

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Administration Rules Listed Before Submitting Your Research Paper to Global Journals Inc. (US)

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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