Energy Efficient Data Transmission using Relay Node for Mobile Ad hoc Network

***K.Thamizhmaran[1], Dr.A.Charles[2]**
[1]*Department of ECE, GCE, Bodinayakkanur, Tamil Nadu, India,
tamil10_happy@rediff.com
[2]Department of ECE, GCE, Bargur, Tamil Nadu, India, maryarputhamcharles@gmail.com
*Corresponding Author

Abstract - Today most of young researchers focused infrastructure less network called MANET that mobile nodes communicate in the emergency world through wireless link with all the nodes acts as transmitter, receiver and router, this self configured network having some issues to degrade network performance like traffic, delay, energy, security attacks, etc.,. In this article our new technique called Energy Efficient based Relay Node Selection Randomly (EE-RNSR) for MANET specially designed energy issue compare to existing routing protocols because of when solve energy problem automatically network lifetime will be increased when node life increased automatically delivery ratio and also throughput will be increased due to reduces of energy utilization, so here we discussed some of valuable research work they conclude the importance of energy efficient. This work outcome tested with various parameters using one of leading simulation model called Network Simulator (NS2).

Keywords: Wireless; Ad hoc; MANET; Energy; Security; Parameters; Ns2;

I. Introduction

Today MAGIC world (**M**obile **M**ultimedia **A**ny where **A**ny time **G**lobal **M**obility **S**upport **I**ntegrated **W**ireless **S**olution **C**ustomized **P**ersonal **S**ervices) of wireless communication is wide range of service need for today human life for information sharing: such as conference, official and unofficial meeting, classes and time management because of increasing population needs also increased. There are two types of wireless network Infrastructure (base station based) and Infrastructure less network (base station based) that means cellular network and ad hoc network: wireless ad hoc network also classified different types of temporary network such as mobile ad hoc networks, wireless sensor networks, wireless mesh network and vehicular ad hoc networks that developed especially safety with quick emergency communication and traffic management etc.,. A mobile ad hoc network is collection of separate autonomous mobile nodes that connect and communicate through air links figure 1 show simple diagram of mobile ad hoc network.

Figure 1 A simple diagram of MANET

MANET having some unique characteristics is given below:

- Self organization nodes that update routing information when automatically change the topology because of distributed networks.
- Peer-to-peer that one–to-one communicate directly.
- Multi hop which nodes contain multiple base stations this is main advantage of this MAGIC world MANET because of every intermediate node act as router.
- Dynamic due to a node move any direction due to structure of network via wireless link.
- Low power because of limited battery capacity of mobile nodes in the network.
- Auto configured due to dynamically due to change the topology.
- Limited security if a node can join anywhere, any place both active and passive nodes.
- Inefficiency because of quality output when communicate all the time in this network will be actively working like TX/RX/CH also easy to implement and easy to disconnect the network figure 2 show characteristics of network

Figure 2 characteristics

Energy is the one of most issuing parameter because of increasing network lifetime and node life time due to improve battery compare to others parameter, energy is one of the importance risk based task because all other characteristics must depends of energy. Many of existing researcher form reputed institutions, research centers and industrials published more articles with analysis own idea outcome based on some of leading parameters such as throughput, end-to-end delay, packet delivery ratio, quality of service, power control, energy efficient routing, multipath routing, network traffic Control, bandwidth and loss detection and recovery and etc., all the researchers focused and update routing for work above areas to solve the issues. MANET need for router to communicate and data transmission from source to destination using routing protocol with static and dynamic routing protocol, this protocol is depends on very importance two division called distance vector and link state routing. MANET routing protocols classified there are three types first routing is proactive or table driven (all time each nodes they will ready to data transmission because of switch on and broadcast packets to all the times either communication or non-communication within the network other nodes for route request and route replay) but there is more routing overhead, second types is reactive or on-demand routing protocol (data transmission based on needs they will switch on and broadcaster packets for mobile nodes otherwise switch off that means sleep mode) still having main disadvantage is high latency because when nodes communicate that time only network going to switch on nodes, than they start to broadcast and third moreover last type is hybrid routing protocol this one combination of two leading types of routing protocols called table driven and on-demand that short distance communication to

used proactive and long distance communication for reactive routing protocols with in networks, reduces impact of drawbacks of proactive and reactive routing protocols but main disadvantage of this protocol is more complex than other protocols figure 3 shows some of ISO approved protocol figure 3 as shows routing protocols.

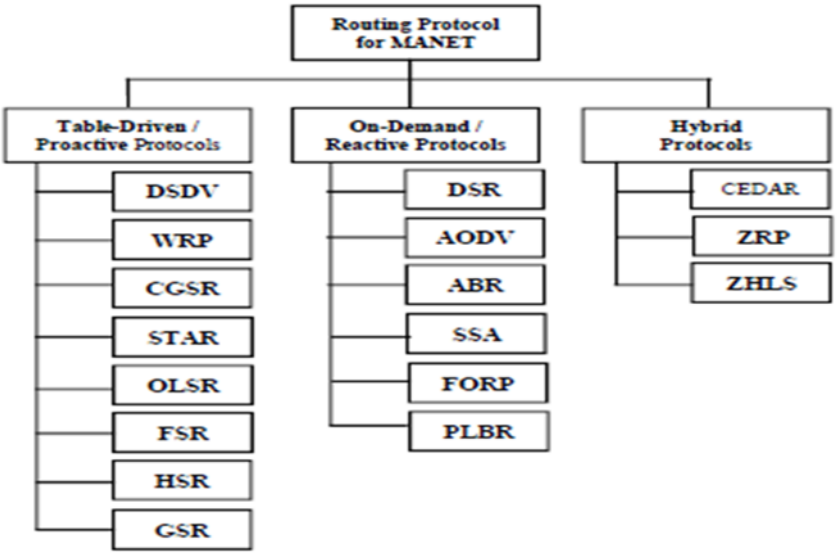

Figure 3 Routing Protocols

Although these research papers contribute one of most leading mobile ad hoc network issue is energy; we discussed existing suggested technology for energy because of when reduced delay and retransmission also avoided misbehavior automatically throughput maximized so node lifetime and network life time will increased due to increasing remaining energy reason for limited power. Very importance states to consume energy to transmit/receive and Sleep. Maximum energy affected in two layers, data link layer and network layer.

II. Background Work

In this section we discussed various energy based existing research work with outcome of advantage to developed system and drawbacks of different designs, In section III implement new developed design, In section IV discussed arrangement of simulation configuration and section V tested, compare outcomes of proposed and existing routing protocols and the last and summary will be discussed section VI.

Jithra Adikari et al, (2010) who discussed single and double scalar multiplications as the most computational intensive operations in ECC based cryptosystems which aim at minimizing the scalars' density of nonzero digits. Proposed scheme present three novel algorithms such as hybrid binary ternary form, hybrid binary-ternary joint form and reduced hybrid binary-ternary joint form for both single and double scalar multiplication. Finally, the experiment results showed that the algorithms were almost always faster than their widely used counterparts. Moreover, this algorithm increased energy consumption because hybrid binary-ternary number system increase the average running time of network, when attack misbehaviour nodes, remaining energy will increased also delay increased. For increasing node life time we need to minimizing energy utilization so only to improve hole network life

time and communication duration will be increased in this aspect one of the researcher is strongly suggested efficient model called PEER protocol that improve maximized energy by ***Jinhua Zhu and Xin Wang [2011].*** Proposed new protocol efficiently working because of reduced routing overhead and overcome node mobility issues, PEER protocol accurate analytical model due to various factors. Performance of PEER protocol better output compare to existing scheme minimum total reliable transmission power better outcomes with various factors like arrival rate, packet size, different seeped, different density and routing over head. Over all network remaining energy 25.67% is increased and minimum total reliable transmission power than existing design. Although PEER work on better output of few network conditions only, misbehaviour attack not consider due to when affected active via malicious or selfish node over all network performance will be decrees also cluster condition not considered. In the same year other hand one of active researcher ***Javad Vazifehdan [2011]*** is proposed good research article this work also focused and work energy-aware routing that mains-powered devices keeping the hop count of selected routes minimal this network simulated heterogeneous power supplies. Result analysis of suggested technology provided best outcomes because of find one of minimum selected routing, minimizing energy cost and reducing end-to-end delay due to decreasing number of selecting paths automatically reducing cost and time delay because of reducing hop count. Even though this design adapt only heterogeneous network, not suitable for other network due to other network easily drop packets and increasing time delay, conjunction and throughput so automatically reduced remaining energy of this designed protocol. ***R. Madhan Mohan and K. Selvakumar [2012]*** is proposed new power control routing is called Power Control Ad hoc On-Demand Distance Vector (PC-AODV) this idea implement to one of recent hot research issue of power control in ad hoc networks. Result shows two on-demand routing protocols namely proposed power control reactive protocol and traditional reactive, this network simulate using 100 nodes and 1000 meters network area, PC-AODV achieve better performance and same network with same time also new system increased 15% of remaining energy than AODV so in this aspect network lifetime will be improved packet delivery ratio increased 8% than AODV and reduced 13% of end-to-end delay than AODV. Based on the all the result PC-AODV better than AODV using network simulator 2, even through malicious attack and fake nodes cannot consider when enter misbehaviour node totally collapse the active networks. ***Wang et al, (2013)*** have proposed Distributed energy Adaptive location based Cooperative Medium Access Control (DEL-CMAC) to improve the performance of the MANETs in terms of network lifetime and energy efficiency. Furthermore, they projected DEL-CMAC protocol under various conditions even for high circuitry energy consumption in comprehensive simulation study. Finally, the energy utilization of nodes is reduced with the possibility of link breakage within the network because DEL scheme all the node actives monitor in network in every time but for large network cannot support new protocol due low security and network throughput will be reduced. Most of the young researchers working in the field of mobile ad hoc energy efficient based networks but this author think differently and proposed one of efficient techniques called Frame Error Rate (FER) this design work on three main layers such as physical layer, medium access control layer and network layer. Proposed FER energy efficient routing protocol consumption more energy of available for both types of routing like traditional routing and our novel opportunistic routing correspondingly this

both energy efficient routing protocols designed based on very old traditional efficient shortest path scheme called dijkstra shortest path algorithm. Simulation outcomes of developed model more accurate because of FER that work on multi-hop routing, both traditional routing and our novel opportunistic routing maximize remaining energy due to decreases of end-to-end delay also reduced network complexity. Moreover packet delivery ratio not satisfied and not suitable to cluster network and also isolated network not considered by following author ***Jing Zuo, et.al [2014]. Baojun Huang et al, (2015)*** proposed Efficient Remote User Authentication with Key Agreement Scheme Using ECC, technology evolution identity authentication in the network that is becoming more and more significant. Simulation results shows performance comparison of three different phases such as Registration phase, Login and authentication phase and Password change phase through network simulation 2, proposed scheme was much more secure and practical as the secure universal access control mechanism also increased delivery ratio and remaining energy than other existing schemes. The scheme suffers from offline password guessing attack and impersonation attack. Moreover, new scheme could not achieve perfect user privacy and encryption decryption will take more time to communicate between the nodes of the network. ***Parth Patel et al, (2016)*** proposed approach; Hybrid EAACK (HEAACK) is designed to tackle three of six of six weaknesses of watchdog scheme presence of malicious attacks. HEAACK is capable of finding the malicious nodes as compared with the existing scheme with different scenario through simulation. HEAACK was the proposed system which added cryptography mechanism giving a secure network and thus the rate of data manipulation and network overhead decreases. Moreover, the malicious node increases the network remaining energy, average delay and also key exchange problem has not been solved. One of my best research article ***K.Thamizhmaran et al, (2017)*** is proposed enhanced acknowledgement based research work EA3EAK. This work mainly focused to reduced routing conjunction during to detect malicious attackers and find alternate route with secure communication paths; help with one of most accuracy hybrid cryptograph called MARS4 which combine RSA & MAJE4 cryptograph. MARS4 act as secure routing also reducing time delay, utilization energy, increased packet delivery ratio and throughput with help of enhance adaptive 3 acknowledgement not only this merits solved key exchange issue. Moreover this concept not suitable for all the environments whenever mobility high automatically performances will be decrees. Recent published energy efficient research work proposed by ***Neha et al, (2018)*** they designed clinched using directional antenna are to find destination location, antenna focusing, signal power and distance calculations. Simulation result show improved energy savings using re-configurable directional antennas and an associated algorithm. However, developed system reduced throughput due to increased packet drop because of misbehaviours. ***K. Anish Pon Yamini et al, (2019)*** proposed new energy efficient system called transition state MAC protocol compared with existing models static power consumption MAC protocol and dynamic power consumption MAC protocol that coordination to mobile devices with communicate among themselves with no information from administration. Result in better performance of the networks until the node's energy is capable of handling control messages than old method. Performance of cooperative MAC protocol for both conserving node energy to utilize available node also reduces the total energy consumption minimum 14% than DPCMP and minimum 24% than SPCMP with

traffic falls almost 45% than SPCMP and 27% than DPCMP. Although an isolate misbehaviour attack is still not overcome, slight increase in network overhead and reduces remaining energy of mobile nodes. ***N.S. Saba Farheen and Anuj Jain, (2020)*** is discussed predicting the mobile node position and routing based on predicted positions helps to establish routing path with much longevity. In this work a node location prediction based on the temporal and spatial characteristics with respect to its neighbourhood is applied to estimate the probable locations using a hybrid model. Result analysis above routing protocol improved network performance with multi path routing is fine tuned based on the spatial temporal results to improve the effectiveness and reliability of routing through NS 2, the packet delivery ratio was found to be higher in the proposed solution compared existing design, moreover remaining energy and malicious node detection and correction not considered. Most recent publishing article ***Nobuyoshi Komuroa and Hiromasa Habuchi, (2021)*** developed effective nonorthogonal Code Shift Keying Spread Spectrum (CSK/SS) ALOHA design that access routing protocol investigated for MANET without carrier sensing function techniques. Result of above system to improve throughput and delay under MANET environment with one of the multilevel modulation systems for the spread spectrum technique with increasing the number of bits per frame. Proposed method numerical results show than Mos=8 and Mcon=3 achieved the highest throughput, combination Mos=8, Mcon=4 and Mos=32, Mcon=1 than existing spread ALOHA method. Although conclude from the numerical results that the new nonorthogonal system energy conception and security attack not considered above model. ***V. Nivedita and N. Nandhagopal, (2021)*** one more most recent article focused trust calculation solving problem is going to proposed efficient multi-hop relay dependent better data transmission model is called Random Repeat Trust Computational (RRTC) that suggested technology provide better quality of mobile nodes and their services buffered the primary route and alternate to route for efficient data transmission. Research outcomes of this developed model to improve quality of network with help of random repeat trust computational method also increasing the security level because different stage of trust evaluation due to avoid the false trust issue so possible to detect attacker more than 30%. Even through malicious node detection and energy issues is did not considered. Moreover, the above authors introduced various energy efficient routing protocols to detect minimizing utilization energy, increases network and node lifetime during varying nodes with topology size of communication is successfully tested, but there are yet many challenges that need to be solved, such as all the schemes fail to detect malicious node, congestion and energy in changing transmission range and topology with different environment of network. Furthermore, decide to implement new energy efficient routing algorithm to increasing remaining energy and also maximized throughput with test various environment named energy efficient based relay node selection randomly (RNSR) to use surpassing weaknesses of above developed work.

III. Proposed Scheme

Part of In this research writing we discussed our new developed design which improves remaining energy in same network in terms of reducing end-to-end delay, so special designed for mobile ad hoc network called Energy Efficient based Relay Node Selection Randomly (RNSR) compare to existing developed model as shown in figure 4.

Energy Efficient based Relay Node Selection Randomly (EE-RNSR) for MANET:

- ➢ RNSR processing starts with help of different state node levels.

✓ Idle: node can't send and receiving it's simply stays idle node that consume more energy.

✓ Transmit: node can throw out data, hello message or acknowledgement packets using transmitting energy.

✓ Receive: node can accepting various packets from other nodes using receiving energy.

✓ Sleep: node can going to off state so no energy used (idle, transmit and receive) due to no transmission.

✓ Pre-Idle: It's a virtual state during transformation from inevitably idle state.

✓ Pre-Transmit: It's a virtual state that inevitably transmits state.

✓ Pre-Receive: It's a virtual state that inevitably receives state. Our design aim going to develop an algorithm that uses energy for communication and control packets. The design of energy protocol assumptions is characterized as follows:

- Same initial energy for all nodes.
- Energy of node's is below above depends on threshold from the relaying process.
- Current state of all the node energy level must update its post each transmission.

- ➢ Source node sends hello packet with active nodes from S to D through active intermediate nodes.

✓ Selection of active nodes

- Every single sending intermediate node.
  - Transmission capacity
  - Receiving capacity
  - Finding misbehaviour nodes

Flow Chart of Relay Node Selection Randomly (RNSR) for MANET:

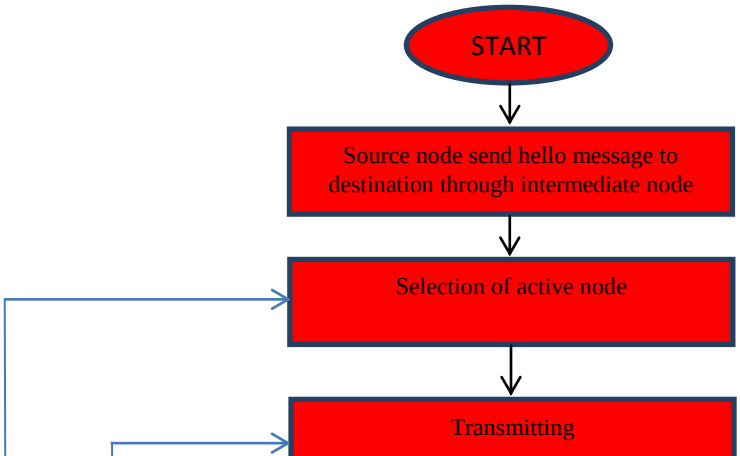

Figure 4 Flow Chart of RNSR

(Before transmit the data packed find malicious node for trust path)

- So sender nodes require transmitting packet to destination with above following characteristics.
- The entire receiving node need to sends ACK packet ID to initial via same route with details of characteristics.
- If source node receives this node details such as acknowledgement packet from destination node.
- Each sender done following process with predefined time period, successfully completion of this process maximum number of misbehaviors will be identified and detected after the original data to target.
- If user S, N_1, N_2, N_3, N_4, N_5…….. D.

During the transmission any link breakage or not receiving ACK packet, once find same procedure and follow step2.

IV. Simulation configurations

Performance of routing protocol of MANETs in an open environment is evaluated for in this section, the MANET protocols are simulated using this network simulator 2.34 by varying the number of nodes. The IEEE 802.11 distributed coordination function is used as the

medium access control protocol and the traffic sources are used to user datagram protocol. The simulation parameters are specified below table 1.

Table 1 Simulation Parameters

Parameters	Values
Simulation area	700m * 700m
Protocol	EE-RNSR
Number of nodes	60
Average speed of nodes	0–25 m/sec
Mobility model	Random Waypoint
Number of packet senders	30
Transmission range	250m
Constant bit rate	2 (Packets/Second)
Packet size	512 Bytes
Initial energy/node	100 joules
Antenna model	Omni directional
Simulation time	500sec

In order to distinguish different packet types in different schemes in RNSR, 2 b of the different types of packets is used. Details of different packet types are listed in Table 2

Table 2 Packet Type Indicators

Packet type	General Data	ACK Packet	Dropped Packet	RNSR Packet
Packet flag	00	01	10	11

V. Result and Discussion

In this emerging research work, the misbehaviour nodes are possible to provided warning acknowledgment packets, this way, the network lifetime will be decrees due to utilization energy will increased because of malicious nodes simply drop all the packets that they receive and send back forged positive acknowledgment packets to their previous nodes whenever necessary. This is a common method for attackers to degrade network performance while still maintaining their reputation. The proposed approach RNSR is designed to tackle weaknesses of traditional routing protocol.

Table 3 simulation result of end-to-end delay vs number of nodes

RP/NN	10	20	30	40	50	60
DSR	0.51	0.47	0.42	0.34	0.27	0.20
RNSR	0.34	0.30	0.25	0.21	0.16	0.08

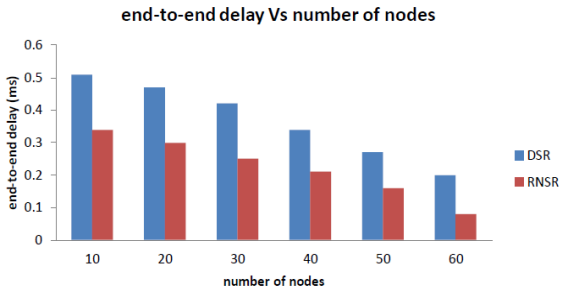

Figure 5 end-to-end delay Vs number of nodes

The end-to-end delay performance of the proposed RNSR and existing dynamic source routing protocols are compared. RNSR has reduced end-to-end delay with the number of nodes increased compared to the existing protocol. According to figure 5 and table 3, the proposed scheme RNSR surpasses the performance of DSR in minimizing average end-to-end delay by 14.5%, when there are 10 to 60 nodes in the network. As the proposed relay node selecting randomly scheme motioned two different short routes and minimum link breakage path every time frequently update the table, it is possible to minimize the delay.

Table 4 simulation result of packet delivery ratio vs number of nodes

RP/NN	10	20	30	40	50	60
DSR	0.38	0.34	0.30	0.28	0.24	0.20
RNSR	0.54	0.49	0.44	0.39	0.34	0.29

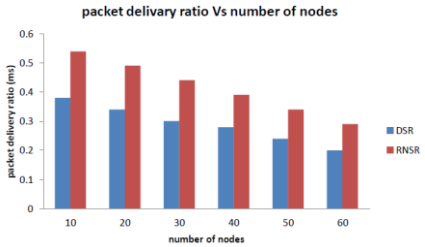

Figure 6 packet delivery ratio Vs number of nodes

Simulation results are obtained by varying the number of nodes from 10 to 60. The performances of the proposed RNSR and the existing DSR are compared. Figure 6 and table 4 shows the proposed model with improved packet delivery ratio, when number of nodes is increased from 10 to 60 compared to the existing method. It is clear that out of RNSR design surpasses DSR performance by 16%, 15% respectively, when there are 10 and 20 of nodes in the network. From the results, it is concluded that the randomly selection based scheme is able to detect malicious node with avoid link breakage and also fine minimum distance route in the presence of false misbehaviour nodes, so delivery ratio increased from start to end of the network with proof from above statement receive more packets from active nodes.

Table 5 simulation result of routing overhead vs number of nodes

RP/NN	10	20	30	40	50	60
DSR	0.08	0.14	0.18	0.29	0.34	0.4

RNSR	0.05	0.11	0.15	0.23	0.31	0.37

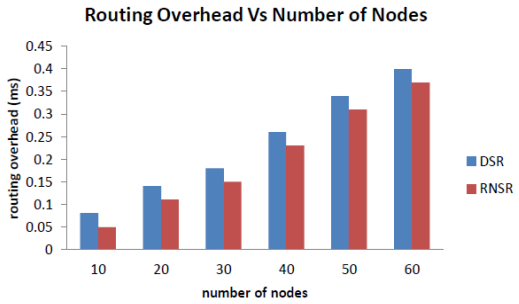

Figure 7 routing overhead Vs number of nodes

Figure 7 and table 5 compare the routing overhead performance of the proposed RNSR and existing on-demand routing protocol scheme. RNSR has reduced routing overhead with the number of nodes from 10 to 60 when compared to the existing method as show in figure 6 suggested new method has the reduce routing overhead by 23.4% than DSR, although suggested scheme requires to avoided unwanted passive nodes reason of this decreasing conjunction from throughout network due to selection two active relay nodes with randomly.

Table 6 simulation result of remaining energy vs number of nodes

RP/NN	10	20	30	40	50	60
DSR	0.86	0.78	0.73	0.69	0.65	0.61
RNSR	0.98	0.92	0.87	0.83	0.79	0.75

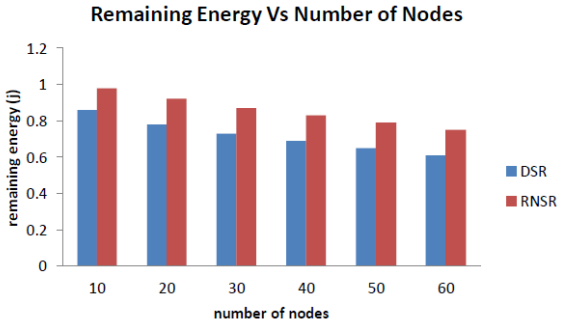

Figure 8 remaining energy Vs number of nodes

Simulation results of figure 8 and table 6 compare the remaining energy of the proposed the existing models. Figure 8 shows that suggested system reduces remaining energy when the number of nodes varied from 10 to 60 compared to the existing system. It is clear that the proposed RNSR decreases the remaining energy by 16% with the number of nodes 40 than dynamic source routing, due to increases duration of whole network life time period because of node life time is improved because of randomly selecting relay node detected misbehaviour node, packet drops and link breakage nodes it is possible to decrease remaining energy. From all the above figures and tables it is clear that the comparison of the proposed relay based randomly selection energy efficient routing protocol RNSR and existing dynamic source routing protocol schemes, shows the end-to-end delay, routing overhead will be

reduced and packet delivery ratio, remaining energy is increase with the increase in the number of nodes from 10 to 60.

VI. CONCLUSION

In packet drop link breakage and security is main drawback of mobile node due to reduce remaining energy and packet delivery ratio so in this research paper mainly discussed, so we developed the energy efficient scheme called RNSR relay based random section model. So acknowledgement based transmission becomes essential and is very safe with high security. In this research, a proposed routing protocol named energy consumed RNSR with random selection work, the simulation results minimizing average end-to-end delay by 14.5% when there are 10 to 60 nodes in the network, packet delivery ratio performance by 16%, 15% when there are 10 and 20 nodes in the network respectively, 10% to 40% when compared to the existing method and suggested new method has the reduce routing overhead by 23.4% when there are 10 to 60 nodes in the network and it is clear that the proposed RNSR decreases the utilization energy by 16% with the number of nodes 40 through the network simulation 2. Finally developed new model not only reduces overhead, but also solves packet dropping problem using relay algorithm. To increase the merits of this research work, there is a plan to investigate the following issues in our future research.

- The same concept can be tried to implement in satellite to reduce more congestion in the route and also to save more energy.
- The possibilities of adopting the cluster based network to eliminate the requirement of redistributed end-to-end delay can be examined.
- The performance of EE-RNSR can be tested in real time network environment instead of software simulation.

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