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Cooperative and fresher encounter algorithm for reducing delay in MANET

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ABSTRACT

In Mobile Ad-hoc Networks (MANET), the route discovery is the chief problem for the nodes. In this paper Cooperative and Fresher Encounter Algorithm (CFEA) for Reducing Delay in MANET is proposed. The route discovery problem has been overcome by FResher Encounter algorithm. It is a simple algorithm for discovery the routes in efficient manner in the MANET. The node has the memory of past route details that communicate with remaining nodes. The node prefers to find the intermediate node instead of finding the destination node, that intermediate node keeps the knowledge of recently encounter the destination node. Then the intermediate node communicates with the node which is encountered the destination node recently, and the process is continued until the destination is attained. The main advantage of the scheme is reducing the process time.

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1. INTRODUCTION

MANET considers three routing objectives: maximize packet delivery ratio, maximize network energy lifetime, and minimize average end-to- end delay. MANET extends three routing metrics: link stability on each link, energy cost on each node, and mean queuing delay on each node. MANET is used in military applications when the soldiers needed the data from sender to the missile ship, fighter plane and tankers [1].

In MANETs each mobile node acts as a router and host. Hence, it doesn't need any communication support for transfer data packets among mobile nodes. MANETs routing are base on inimitable addresses in the network [2]. The source mobile node indicates the destination address. The network routing service creates a route path that contains multiple intermediate mobile nodes between the source and destination. Data Packets are routed through intermediate nodes and every node forwards the packets according to destination address [3].

Mediuma Access Control (MAC) Protocols for wireless networks can be classified as coordinated and uncoordinated MAC protocols based on the collaboration level [4]. In uncoordinated protocols such as IEEE 802:11, nodes contend with each other to share the common channel. For low network loads, these protocols are bandwidth efficient due to the lack of overhead. However, as the network load increases, their bandwidth efficiency decreases. In coordinated MAC protocols the channel access is regulated. Fixed or dynamically chosen channel controllers determine how the channel is shared and accessed. Coordinated channel access schemes provide support for quality of service (QoS), reduce energy dissipation, and increase throughput for dense networks. The main function of protocol is to find the shortest path between the source and destination. The QoS requirement is to satisfy the end-to-end delay, capable to operate in the

low energy constraint and bandwidth. The efficiency can be improved by meet the entire requirements of QoS like delay [6]. The Dijkstra's algorithm is used to approach the multiple objective routing hurdles [5]. The advantages of this method are increasing the network lifetime and consume very less energy.

In the energy Consumption Optimization in MANET method, Efficient Power Aware Routing (EPAR) protocol is used. This protocol increases the lifetime of the network of MANET. The capacity of a node is identified by EPAR by its remaining battery power, also by the usual energy exhausted in dependably forward data packets over a particular link. EPAR select the path by using a mini-max formulation that has the biggest packet capacity at the least remaining packet transmission capacity [10].

However, in this protocol frequently link failures occur owing to it can not handle high mobility nodes. To overcome this problem the Cooperative and Fresher Encounter Algorithm (CFEA) is introduced in this paper. In general route discovery mechanism, the source node itself finds the path to the destination. The major drawback in general mechanism is that if node is in mobility stage then the transferred data packet will be lost. To avoid this problem, FRESH algorithm is used. The main objective of CFEA is to transfer the packets from source to destination without link failure also improves the energy efficiency.

In [7], routing method is based on Ant colony optimization, virtual coordinates and clustering techniques. When a packet is transport from source to destination, it follows external and internal connected gateways. This method is to design the energy efficient with low overhead. Inter-Domain routing protocol is introduced based on bee's communication to handle a dynamic topology. The Ant based multipath backbone routing protocol [9] is to overcome the problem of overhead and traffic overflow. When the source wants to transfer data towards destination, it select the several route with maximum path preference probability using swarm based ant colony optimization technique. The path is preferred based on bandwidth, delay and next hop availability. At route discovery, the nodes found the faults and skipped that path. The network load distributes the data traffic equally from source to destination.

In [8], Mobility based Energy Efficient Multicast Protocol (M-EEMC) is proposed. While other techniques are only focused on energy efficient and consumption but in this technique M-EEMC protocol is used to reduce the energy dissipation. This protocol is a mixture of both mesh and tree based routing method. The Energy efficiency is improved by eliminates most of the redundant data receptions. Enhanced Co-Operative Game Theory (ECGT) is proposed to save the node in the network during distortion even at earlier stage. Thus, this technique is reducing the network delay and also minimizes the loss factor [14].

Prediction based Link Stability Scheme [11] to builts a route path among stable link nodes thus it expands the lifetime. This scheme computes the node by signal strength, stability path, and mobility factor. In [12], the connected Link stability strength is evaluated based on local stability metric and relative stability metric. This metric provide extend lifetime and minimize reroute frequency. Link-state QoS routing protocol [13] is used to set up sustainable and stable route among nodes in MANET. This scheme, calculate the node stability by Bienaymé–Chebyshev inequality represents the probability factor. This probability factor checks node mobility degree relation to its neighbor. This scheme also measures the availability and durability of the route path. However this scheme does not consider the energy factor in MANET. QoS Routing Protocol [15] selects the route path based on network delay and link state. This scheme diminishes the packet drop rate and provides better reliable data transmission. However, this scheme create computation complexity also, it increase the network delay.

2. COOPERATIVE AND FRESHER ENCOUNTER ALGORITHM

The FRESH meant for FResher Encounter SearcH. This algorithm is mainly proposed for reducing the route discovery cost. In this scheme, we improve the energy efficiency the forwarder node is selected by the Energy Drain Rate, Link Break Degree, and Cooperative node.

The function of the FRESH algorithm is to search the intermediate node instead of destination node. The source node does not need any knowledge of the intermediate nodes. Simply, the source node transfers the data to the intermediate nodes. The intermediate nodes transfer the data to the nearest node that encountered the destination so far additional recently. This process will continue until the data reaches the destination node. It mainly depends on the mobility of the nodes. In general route discovery mechanism, the source node itself finds the path to the destination. The major drawback in general mechanism is that if node is in mobility stage then the transferred data packet will be lost. To avoid this problem, FRESH algorithm is used. The FRESH algorithm is primarily introduced for the application of mobility of the node. There is little limitation in the FRESH algorithm; they are limited energy source, co-operative of the intermediate nodes.

Figure 1 explains the Architecture of CFEA. The Energy Efficiency and the FRESH algorithms are the key factor of the proposed method. The Energy Drain Rate, Link Break Degree, Cooperative node are the terms of an energy efficiency technique.

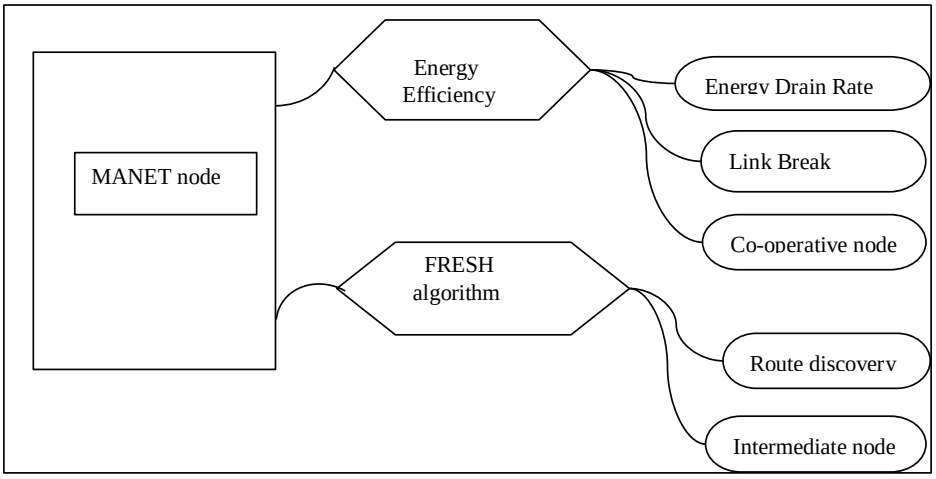

Figure 1. Architecture of CFEA

To transmit the data packets, the intermediate node must have the adequate energy. If the energy level is low when transmitting the data packet then the data would be lost. For successive transmission, the necessary energy level should be needed.

During transfer of data packets, the intermediate nodes must be cooperative. Otherwise, the data could not be transfer efficiently. By analysing the FResher Encounter SearcH algorithm, the first preference could be given for an intermediate node which has the lesser mobility range, high remaining energy and higher co-operative ratio.

Energy drain rate indicates the energy utilizing rate of a node. The lifetime of a node cannot be predicted by its remaining energy even though the residual energy of a node is high; the energy accumulation rate may be higher. The longer lifetime of a node need not required the high remaining energy it's all about in the energy drain rate. The energy drain rate computation for each node β_i is given below.

$$\beta_i = \begin{cases} 1, \dfrac{EA_i}{RE_i} < EA_{thr} \\ 0.1, \dfrac{EA_i}{RE_i} \geq EA_{thr} \end{cases} \quad (1)$$

$$EA_i = \frac{1}{N-1} \sum_{k=i-N+1}^{l} EA_k(t) \quad (2)$$

Where, RE_i → Remaining energy
EA_i →Energy accumulation Rate
EA_{thr} → Energy accumulation Rate threshold
N→Network Node Count

The value of least energy drain rate can be used to route selection. Also, link break degree L_i is utilized to reflect the stability of each link on the route.

$$L_i = \frac{1}{(1+e^{-10(p_i - p_o)})} \quad (3)$$

Where,
p_i→Node link probability
p_o →Link break probability threshold

The value of least energy drain rate with node with lesser link break probability than Link break probability threshold is choosen as a route node selected. Here, p_i contains of three link break probability based on three types such as standard link that represents the node communicated directly, an associated cooperated link represents the link connection among two nodes and an independent cooperated link represents does not link among two nodes.

Thus obtain the link break probabilities for an associated and independent cooperated link from above cases respectively. The node should have low energy drain with stable link break degree. If the node satisfies the condition then taken as an intermediate node else repeat the process until a node selected as an intermediate node. Figure 2 explains the Flowchart of CFEA. It explains the flow path of the process and conditions for choosing the route path.

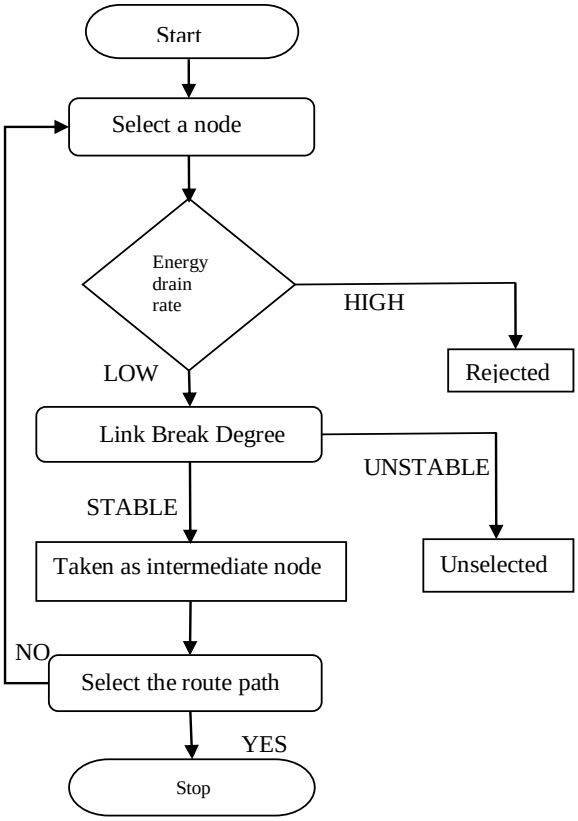

Figure 2. Flowchart of CFEA

3. RESULTS AND ANALYSIS

The performance of RPIR is analyzed by using the Network Simulator version-2 (NS2) [16]. The nodes are distributed in the simulation environment in the communication network. The simulation of the proposed CFEA has 50 nodes deployed in the simulation area 800×800m.

3.1. Delivery Rate

The Delivery Rate (DR) of packet is represents the ratio of amount of delivered packets from source to amount of packets received by the destination. It is evaluated by the 4. This evaluation demonstrates the efficiency of the proposed method in the network. The Figure 3 shows the DR of the proposed scheme CFEA is higher than the DR of the EPAR. The CFEA can minimize the incidence of link break thus increases the data transmission in the network.

$$DR = \frac{Amount\ Packets\ Received}{Amount\ Packets\ Send} \quad (4)$$

Figure 3. DR of EPAR and CFEA

3.2. Loss Rate

The Loss Rate (LR) represents the ratio of amount of packets Loss to the amount of packets sent. The formula 5 used to compute the LR. The LR of the proposed scheme CFEA is lower than the existing scheme EPAR in Figure 4. The LR of EPAR is high due to it consider only energy factor does not consider the link stability. But, the CFEA select the route node by link staility and energy drain rate thus it reduce the LR in the network.

$$LR = \frac{Amount\ Packets\ Dropped}{Amount\ Packets\ Send} \tag{5}$$

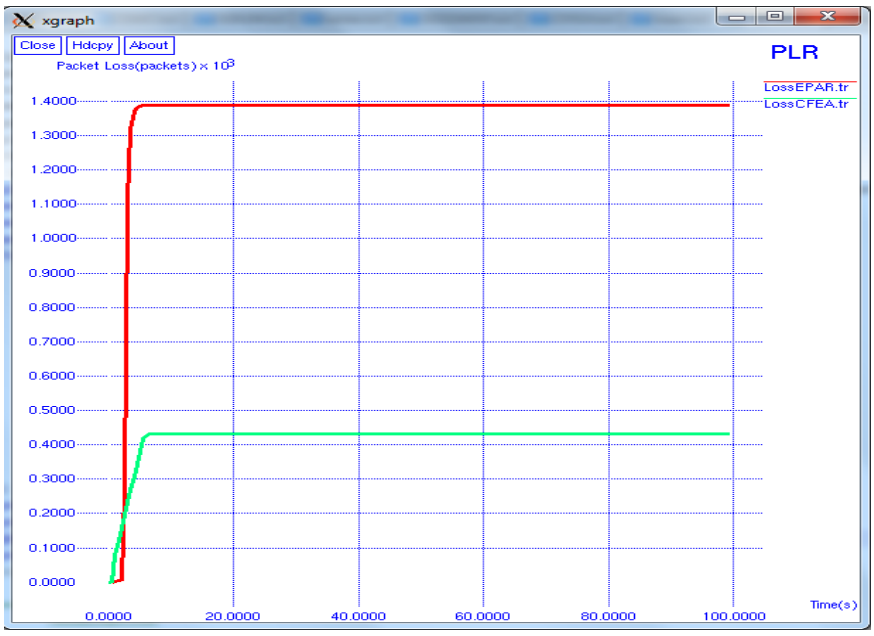

Figure 4. LR of EPAR and CFEA

3.3. Average Delay

The average delay (AD) represents the time elapsed among the instant while the source has data to send and the instant while the destination obtains the data. The AD happening by link broken and node failure due to energy dead this makes retransmission. The AD is measured by 6.

$$Delay = \frac{\sum_{0}^{n} Pkt\ Send\ Time - Pkt\ \mathrm{Re}cvd\ Time}{Time} \quad (6)$$

Figure 5 shows that the delay value is low for the proposed scheme CFEA than the existing scheme EPAR.The CFEA scheme is reduce the link broken and node failure thus diminishes the delay. But, EPAR increases the network ddelay due to retransmission of data.

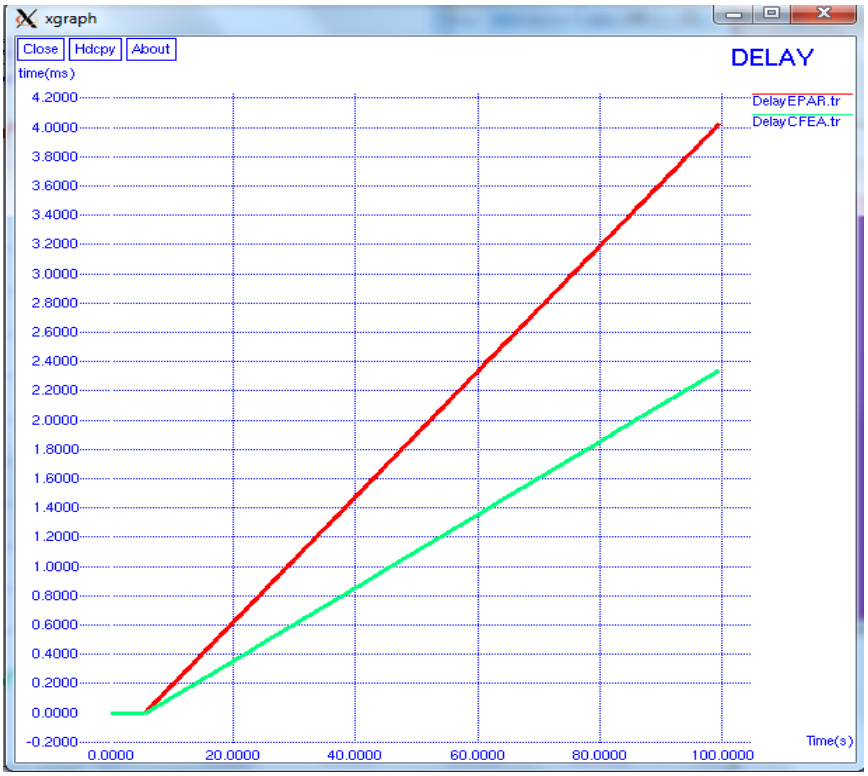

Figure 5. AD of EPAR and CFEA

3.4. Throughput

Throughput is the average of winning data received to the destination. The average throughput is estimated using 7. Figure 6 shows that proposed scheme CFEA has greater average throughput when compared to the existing scheme EPAR.

$$Throughput = \frac{\sum_{0}^{n} Pkts\ Received\ (n) * Pkt\ Size}{1000} \quad (7)$$

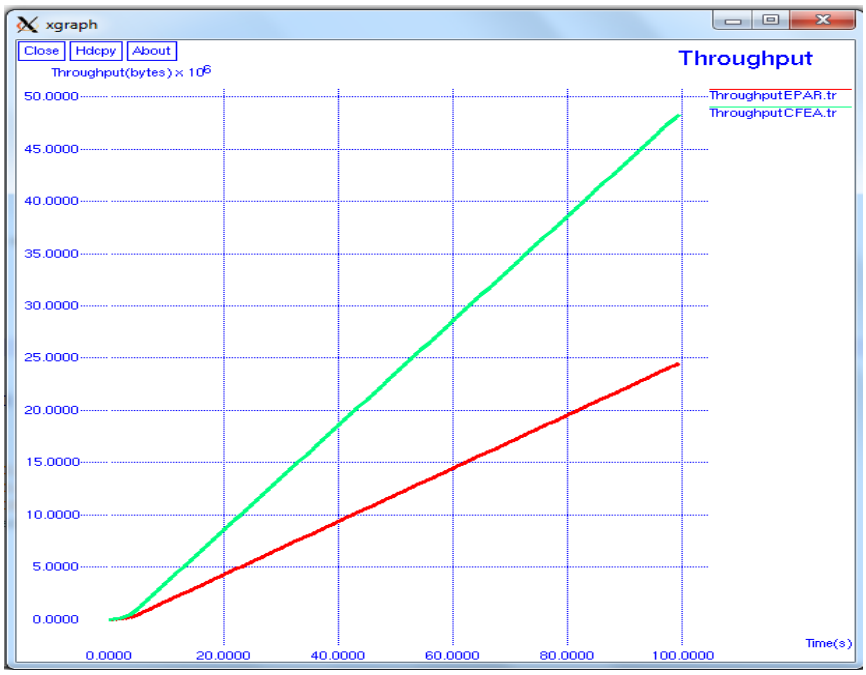

Figure 6. Throughput of EPAR and CFEA

3.5. Residual Energy

The quantity of residual energy in a node at the present case of time is called as residual energy. In the network operations the rate of drained energy is measured by the residual energy.

Figure 7 indicates that in the network the residual energy is enhanced for the CFEA when compared with the EPAR. In CFEA, minimizes the node will be dead also it reduce the link breakage probability. Thus, CFEA extend the lifespan of MANET.

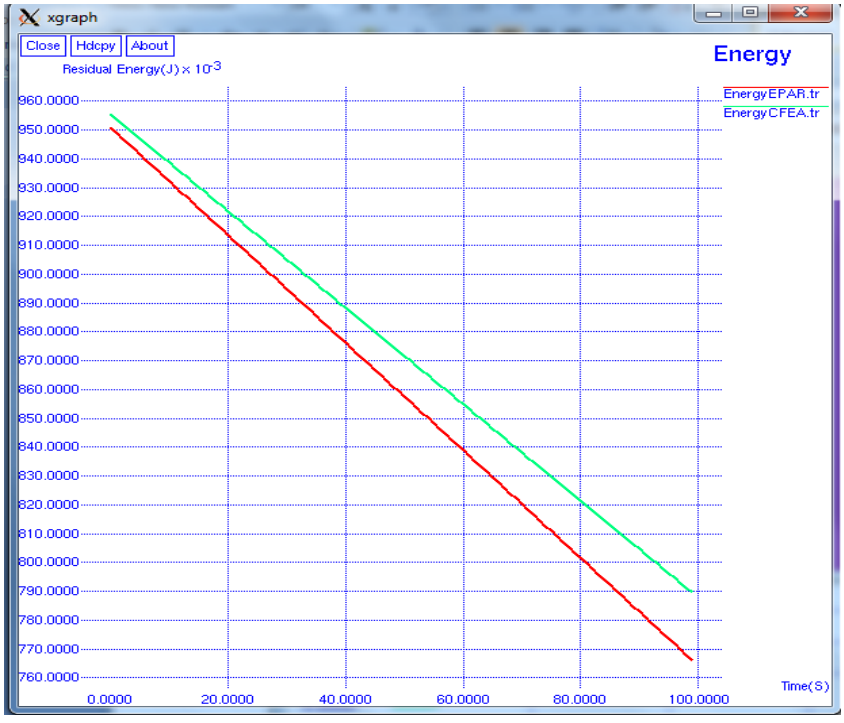

Figure 7. Residual Energy of EPAR and CFEA

4. CONCLUSION

The ultimate aim of the process is to find the discovery path at very cheap cost. It can be achieved by FResher Encounter SearcH (FRESH) algorithm. For reaching the destination, the nodes are searching the intermediate node instead of finding the destination node. The main reason for the finding the intermediate is that it has the knowledge of previously encountered the nodes. It helps to achieve the destination node. This technique is more efficiency when compared to the existing methods.

REFERENCES

[1] R. Mule and B. Patil,"Proactive source routing protocol for opportunistic data forwarding in MANETs," in *Automatic Control and Dynamic Optimization Techniques, 2016. ICACDOT 2016. International Conference on IEEE*, 2016, pp. 227-232.

[2] S. Lingeshwari, R. Natchadalingam, "Provisioning of Efficient Authentication Technique for Implementing in Large Scale Networks", *International Journal of MC Square Scientific Research* vol.6.,no.1, 2014.

[3] Y. Bai, Y. Mai and N. Wang, "Performance comparison and evaluation of the proactive and reactive routing protocols for MANETs," in *Wireless Telecommunications Symposium, 2017. WTS 2017.* pp. 1-5.

[4] B. Karaoglu, and W. Heinzelman, "Cooperative load balancing and dynamic channel allocation for cluster-based mobile ad hoc networks," *IEEE transactions on mobile computing*, Vol. 14,pp. 951-963, 2015.

[5] Z. Guo, S. Malakooti, S. Sheikh, C. Al-Najjar and B. Malakooti, "Multi-objective OLSR for proactive routing in MANET with delay, energy, and link lifetime predictions," Applied Mathematical Modelling, vol. 35, pp. 1413-1426, 2011.

[6] S. M. Adam and R. Hassan, "Delay aware reactive routing protocols for QoS in MANETs: A review," *Journal of applied research and technology*, vol. 11, pp. 844-850, 2013.

[7] Z. Sara, and M. Rachida,"Energy-Efficient Inter-Domain Routing Protocol for MANETs," in *Applied Procedia Computer Science, 2015*, pp. 1059-1064.

[8] N. Fareena, A.S. Mala, K. Ramar, "Mobility based energy efficient multicast protocol for MANET," in *Procedia engineering*, 2012, pp. 2473-2483.

[9] P. F. A. Selvi and M. S. K. Manikandan, "Ant based multipath backbone routing for load balancing in MANET," *IET Communications*, vol. 11, pp. 136-141, 2017.

[10] G. Jayanthi, V.Golla, H.N. Suresh and S. Shivashankar "Designing energy routing protocol with power consumption optimization in MANET," *IEEE Transactions on Emerging topics in Computing*, vol. 1, 2013.

[11] G Nair and N.J.R Muniraj, "Prediction based Link Stability Scheme for Mobile Ad Hoc Networks", *International Journal of Computer Science Issues*, vol.9, no.6,pp. 401, 2012.

[12] H.Xia, S. Xia, J. Yu, Z. Jia and E.H.M. Sha, "Applying link stability estimation mechanism to multicast routing in MANETs", *Journal of Systems Architecture*, vol. 60, no. 5, pp.467-480, 2014.

[13] A.Moussaoui, F.Semchedine and Boukerram, "A link-state QoS routing protocol based on link stability for Mobile Ad hoc Networks", *Journal of Network and Computer Applications*, vol.*39*, pp.117-125, 2014.

[14] J. Loganathan, "Enhanced load balancing scheme in MANET by using Co-Operative Game Theory approach", *IEEE International Conference on Innovations in Information, Embedded and Communication Systems*, pp. 1-5, 2015.

[15] P.Yang and B.Huang, "QoS routing protocol based on link stability with dynamic delay prediction in MANET", *Pacific-Asia Workshop on IEEE Computational Intelligence and Industrial Application*, Vol. 1, pp. 515-518, 2008.

[16] G.S. Devasena and S. Kanmani, "Robust Security for Health Information by ECC with signature Hash Function in WBAN", *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 11, no.1, pp. 256-262, 2018.