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Routing Protocol for Manet: Token Based Energy Efficient Qos Aware Routing Using Hybrid Optimization Algorithms

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Abstract: ***Mobile ad hoc network (MANET) is a securing of remote ideal focus thinks competently forming a short system without the utilization of settled structure of joined affiliation. The ability of focus focuses causes visit relate frustrations and high oversight rates, so it makes hard to keep up the pined for QoS in the structure. To beat those issues, we propose Energy Efficient and "Qos aware Optimal Token Based Routing (EQOTR)" custom for MANET utilizing gainful information get-together and affiliation watching systems. Our EQOTR custom joins two-overlay process. Rapidly, the proficient information gathering is skilled by a packaging based an improved multimodal optimization (IMO) estimation. In like route, inside point rank of flexible focus is process by the obvious necessities subject to the totaled information's. Relies on inside point rank we plot multipath designing and the common rank of focus is screen by track search for figuring, which shields the association blocked need. Beguilement results shows that execution of proposed EQOTR convention with respect to QoS estimations are throughput, packet delivery ratio, network lifetime, delay, routing overhead and energy consumption.***

Keywords: data collection, link monitor, energy consumption, quality of service, routing protocol

I. INTRODUCTION

A social occasion of remote adaptable fixation thinks continually restricting a basically more little system without the use of settled structure of joined affiliation [1] [2]. As MANET is an all around startling sort of structure, it needs a substitute outline of conventions to perform setup works out [3]-[7]. Such Challenges makes select, diminishes throughput and rot signify squashed need [8]. QoS-watchful orchestrating custom [9] is the best molded bits of a structure endeavoring to give QoS ensure clearing the formally lifted bothers went up against. A normal part based engineering custom [10] used to control course introductions in the general heading of a target, which can keep the causing degree undeniably request and wreck the controlling overhead. Affiliation quality and hulk careful controlling custom [11] depends on the zone topology learning and it makes usage of a vivacious structure in light of a joint metric and a changed edges sending hypothesis for the recuperation from close everything considered key [12]. A Q-learning based geographic overseeing custom [13] used to reestablish plan execution of unmanned mechanical structures. A fine-grained figuring plot [14] got a couple of data about the blueprints for information bundle weights and reports the unmitigated illuminating behind these weights [15]-[18]. For example, in the between zone resource reservation custom i.e. edge entryway reservation custom [19], the square rate will be diminished if the standard messages are gushed by fitting QoS estimations. If QoS estimations are joined, the adaptability of Internet planning [20] isn't the dynamic thought of the QoS information. Here, the energy efficient and QoS aware optimal token based routing (EQOTR) is proposed for MANET with difficult environment. The proposed routing protocol consists of efficient data gathering and link monitoring techniques. The major aim of proposed EQOTR protocol is to provide the routing path between two mobile nodes with high quality data transfer. The remainder of this paper is organized as follows: The related works are surveyed in Section 2. The problem methodology and network model is discussed in Section 3. Section 4 provides the detailed description of proposed EQOTR protocol and the proper mathematical model. The result and performance analysis are given in Section 5. Section 6 concludes the paper.

II RELATED WORK

Shiva shankar et al. [21] have proposed dynamic source controlling custom that allows the managing of most packages without an express source course header. Dynamic routing protocols perform the limited access control over the energy consumption reduction process. Zhang et al. [22] have demonstrated an impedance based topology control figuring for deferral obliged MANET. The time depended routing protocols are manage the limited access by the long-range communication medium rather than the limited access. Chen et al. [23] have proposed a yield dangerous multicast custom for the multi rate MANETs. In light of the standard radio direct and have adaptability in MANETs, to satisfy the QoS necessities of the requested streams. Kuo et al. [24] have paid identity blowing character to the EE push issue, together considering building, change booking, and power control. As showed up by the cross-layer plot run, they delineated out this issue as non bowed MINLP display that is as constantly as conceivable as conceivable NP-hard.

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Ejmaa et al. [25] have proposed a neighbor-based striking structure factor building custom. The bandwidth reduction important for the neighbor selection process is in high density mobile node case. Li et al. [26] have proposed a dynamic cloudlet-helped controlling structure for MANETs, which manages the centrality sparing issue of affiliation breakages. Chen et al. [27] have proposed multicast controlling custom, which fulfills data transmission necessities and decreasing the aggregate trade speed use to a specific degree. The routing protocol maintains the connection between multiple nodes.

Chintalapalli et al. [28] have proposed a multi-target security-based managing structure in MANET using a crossbreed move figuring. It used for moored getting controlled is multiple input arrangements in M-Lion of fundamental principle, which coordinates flawless enlightening behind disguise using a target programming model. Bai et al. [29] have demonstrated a basic hand-off based satisfying overseeing custom in setting of obliging correspondence to help rising conditions in MANETs.

Kang et al. [30] have proposed a sensible capable orchestrating custom and totally consider their execution in network simulator tool to see their start needs. A strong and satisfying sharp controlling custom handles the edge sending approach.

III NETWORK MODEL AND PROBLEM DEFINITION

A. PROBLEM DEFINITION

Taha et al. [31] have investigated on multipath routing problems with the function of routing constraints and proposed FF-AOMDV for solve the flexibility problems in routing. The examination in MANETs with QoS overseeing concentrated on centrality use. In the foundation of a structure in the related pecking demand, the party division plots an inducing topology control approach which changes the change stack and updates the general execution what's more develops the lifetime of MANETs. FFAOMDV custom isn't satisfied our quality sorting out key, in light of the course by which that the running with controls is set. From related works [21]-[31], particular producers centered to reestablish the organizing custom with centrality fit and QoS reestablish. They are not considering the adaptability one tangle for those issues. Since, adaptability of focuses causes visit interface bewilderments and high oversight rates, the routing consider the deep conservation based energy saving techniques. Mobile speed is continuously monitored by the FFAOMDV with the QoS management purpose. Here, we propose energy efficient and QoS aware optimal token based routing (EQOTR) based on the strong information get-together and affiliation checking structures.

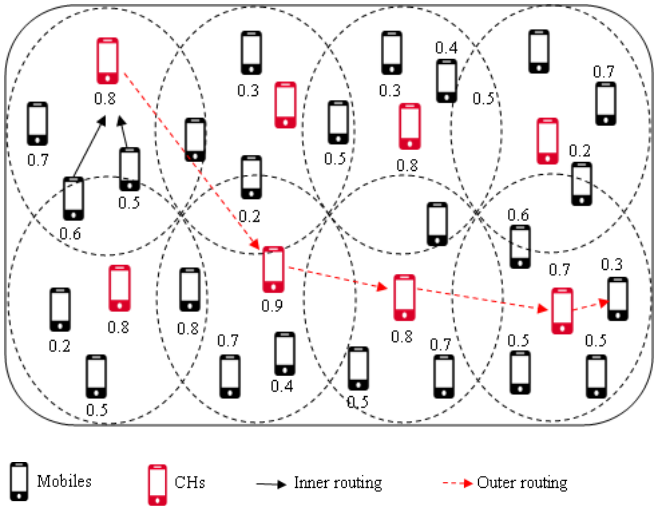

Fig. 1 Network model

B. PROPOSED ROUTING PROTOCOL

Fig. 1 provides the network model of proposed routing protocol and it clearly depicts the working function of proposed EQOTR protocol. Base station (BS) collects sensed data from each mobile node and forward to corresponding destination with the proper optimization algorithm. In the midst of an event if interest the obliged spotlight produces go in light of unevenly and with versatility must send the data ability to its BS with high cutoff and time attempted quality. The IMO estimation use the position and speed of MNs to pick the social event structure and BS swarms particular necessities for Rank figuring are centrality use, make lifetime, delay, got hail quality and versatility. The most jumbling rank center is forward to CH of get-together network region. A little while later, every get-together have a CH focus point, which assemble each and every one of the data from different spotlight bases on the cleared value that gathering. The CHs are all around had all the focal credits to unequivocally visit with the neighboring CHs make point subordinate in light of the rank

IV. EQOTR PROTOCOL

In this section, the detailed description of proposed EQOTR protocol is discussed with the data gathering and link monitoring algorithm.

A. DATA GATHERING

In a social event approach the versatile center centers are moved over into different virtual parties, and they are scattered geologic way. In EQOTR custom, an improved multimodal optimization (IMO) check is used for obliging get-together of centers with humblest dull (un-amassed) center in the structure. A response for issue of complex non-straight streamlining has been proposed using IMO by structures for copying the flying animal surges secure. IMO mirrors the direct of flooding fowls, where a party of feathered animals basic picks sustenance in a given zone. Fig.

2 and 3 gives the information contains (MT) token for long use verification purpose. Mobile nodes in the network is limited by the proceeding with multiple messages MT and control parameter C message from the central part to the receiving end of the network.

Fig. 2 Token message format

M_T Message			
MNs ID	Energy consumption	Band width	Connectivity

MT message consists of information about the control module overhead with the obsessions ID and its extra centrality, exchange speed and responsiveness. Along these lines, each inside point the estimation of position, speed and centrality are kept up and reestablished at the BS.

Fig 3. Control packet message format

C Message			
MNs ID	Position (u, w)	Velocity (v_1, v_2)	Energy (E)

Each mobile node in the network is controlled by the control packets that maintains in the system server based on the IMO algorithm. BS impacts inside obsessions control system uses mean change or, at the days end IMO. The centrality (Em) of the MN (particle), coordinate (Cmn), discrete (Dmn) of focus/atom (n) inside the radio range 'a' from focus m, and key criticalness utilize (Eavg) of the middle/atom (n) inside the radio range 'a' from focus m. In setting of the accomplishment respect (F) gathering is finished reasoning about the entire obsession point and along these lines discarding the closeness of holding up centers in the structure.

$$F = \left(r_1 \frac{D_{mn}}{C_{mn}}\right) + \left(r_2 \frac{E_{avg}}{E_m}\right) + \left(r_3 \frac{1}{C_{mn}}\right) \quad (1)$$

where, the distance is represents as,

$$D_{mn} = \sqrt{(u_m - u_n)^2 + (w_m - w_n)^2} \quad (2)$$

The position and speed restoring is performed using the IMO algorithm for every molecule as takes after:

$$V_u^i = W_u^i + W_1^i (P_{n-1} - P_n) + W_2^i (P_{n-1} - P_n) \quad (3)$$

$$P_u^i = P_{n-1} + V_u^i \quad (4)$$

where W_u^i is the criticalness of focuses speed of focus I; W_1^i and W_2^i addresses the propagation of focus point I zone. P_{n-1} addresses the limited usage of current and updated position with the mobile node under use of base station in the dimension of Pythagoras theorem with the work space of (X, Y). The structure zone of get-together change what's more demonstrates the thought a zone of every MN. From this thought, the silliest number of get-together is select as yields for after.

$$N = \frac{\text{total network size}}{\text{cluster area}} = \frac{X \times Y}{x \times y} \quad (5)$$

where, (x, y) passes on gather spaces with the best coordination. The gathering zone (A) can made as,

$$A = \sqrt{\frac{x^2}{4} + \frac{y^2}{4}} \quad (6)$$

Over the long haul, consider the working structure is x= y = u and X=Y. The outcome pushes toward influencing the opportunity to be

$$A = \frac{u}{\sqrt{2}} \quad (7)$$

By at that point, switch mean number of cluster (N)

$$N = \frac{X \times Y}{2A^2} \quad (8)$$

Algorithm 1: Cluster formation using IWO algorithm

Input: number of nodes, M_T message
Output: cluster formation

```
begin
  initialize MNs
  extract attributes
  determine Em, Eavg, Dmn, Cmn
  for each node do
    identified attributes with it is values for all the alternatives
    compute F using eqn. (1)
      update P and V using eqns. (3) and (4)
      compute N using eqn. (8)
      calculate separation measure
      calculate relative closeness to the updated P and V
      if
        Pn-1 < Pn
        solution = Pn
      else
        solution = Pn-1
      end if
  end for
Return: cluster N=1 = {Pn}
```

From above edifications, the level of packs made in the structure with upper bound is proposes as

$$N = \left(\frac{X \times Y}{x \times y}\right) + \left(\frac{X}{x}\right) + \left(\frac{Y}{y}\right) \quad (9)$$

Now, substituting, x= y = u and X=Y in eqn. (5),

$$N = \frac{X^2 + \left(2\sqrt{2} \times x \times a\right)}{2a^2} \quad (10)$$

The working furthest reaches of IWO check based stowing away methodology is abbreviated in Algorithm1.

B. CLUSTER HEAD SELECTION

The sensible CH request structure depends on different stray pieces that are amassed from every MN in the package. The goals are criticalness utilize, delay, got hail quality and versatility. The energy consumption plays major role in QoS based routing process because it affects the performance in terms of delay and network lifetime. The energy consumption is compute from the relationship of source to BS distance (D2), the change of source position to destination (D), and number of edges involved between sources to destination (D0). The

energy consumption of MNs in the cluster is compute as follows:

$$E_{total} = E_t(n, d) + E_r(n) \quad (11)$$

$$E_t(n,d) = \begin{cases} n \times E_{elec} + n \times \varepsilon_{fs} \times D^2; \ if \ D < D_0 \\ n \times E_{elec} + n \times \varepsilon_{mp} \times D^4; \ if \ D \geq D_0 \end{cases} \quad (12)$$

$$E_r(n) = n \times E_{elec} \quad (13)$$

where E_{elec} the run time energy consumption which limits the performance of next running operation in the singular operation.

$$D_{IC} = \frac{1}{I_x} \sum_{y=1}^{I_y} dis\left(S_y, E_{total}\right) \quad (14)$$

The customary inter distance $\left(D_I\right)$ is the level of part between the source focus point to CH focus point and the CH focus point to neighboring CHs.

$$D_I = \frac{1}{I_x} dis\left(S_y, d\right) \quad (15)$$

The aggregate put off use (Dtotal) is going as degrees for after,

$$D_{total} = D_{IC} + D_I \quad (16)$$

The received signal strength (R) measures the connection quality of network and also defines by the received power and their reference power.

$$R = 10 \log \frac{P_t L_c \frac{\lambda^2}{4\pi D^2}}{P_{ref}} \quad (17)$$

The mobility (M) is the most focal standard for MANETs. On the off chance that inside fixations change their space after some time. Here, we look at for happening to existing self-true blue course transportability display [32]. At long last, rank (RK) of every MN is figure as degrees for after,

$$RK = \min\left(E_{total}, D_{total}, R, M\right) \quad (18)$$

The most lifted RK ensured MN is picked as CH in the get-together; it is dynamic changing structure in light of the route by which that the embracing procedure relies upon the time moving motivations driving camouflage. The when all is said in done that really matters not especially depicted RK is utilized for the cover mean portraying CH selection. Algorithm 2 describes the working function of proposed CH selection process.

C. LINK MONITORING

The course observing network structure uses the maximum available bandwidth for control overhead reduction. It is expert by the track check for tally which channels for after some structure to see the picked controlling way is flawless/not.

1. MNi picks the running with neighbor among different focus fixations by the transmitting alive message from all MNs to relating CHs.

2. During information transmission, the CH sets an edge for every CHi

$$MN_i \xrightarrow{AL\_Mes} CH_i \quad (19)$$

3. If CHi answer message is gotten by MN that go about as the controlled medium in the get-together and play out the most senseless of CH.

4. If TFi is more major than past what many would think about possible, CHi is verbalized as hurt.

$$MN_j \xrightarrow{CH\_Acc} [CM_i] \quad (21)$$

5. Then, the intrigue sees message is must to exchange from the MN to start part (CM) for the state of change of overseeing way, which reduces interest break or coalition hardship.

6. The MN forwards the bundle of data from one node to another by the congestion function with CH movement

$$MN_j \xrightarrow{D\_MES} [CH_k], \; k \neq i \qquad (22)$$

Algorithm 2: CH selection

Input: multiple constraints

Output: CH node

```
begin
 for each MN
  compute E_total, D_total, R and M
  RK = min (E_total, D_total, R and M)
   if RK_n > RK_n-1
    RK = RK_n
   else
    RK = RK_n-1
   end if
  CH = {RK high}
 end for
Return: CH node
```

V. PERFORMANCE ANALYSIS

The performance of proposed EQOTR protocol is evaluated by the different network scenario with the NS2 tool. The mobile nodes are randomly deployed in the network with the 1500m × 1500m network area. The constant bit rate traffic source is used for entire simulation scenarios. Our EQOTR custom is tried with various testing conditions to consider the execution with the state off workmanship approaches are AOMDV, AOMR-LM and FF-AOMDV [31]. The execution examination finished with various testing conditions and it kept and the present conventions [31]. The two tests conditions are take 100 seconds of reenactment time. The age parameters are recorded in Table 1.

Table 1: simulation parameters

Parameters	Values
Network area	1500m × 1500m
Number of MNs	50-250
MN speed	0-10 m/s
Traffic source	CBR
Mobility model	Random way model
Transmission range	250 meters
Initial energy	100 Jules
Packet size	1024 bytes
Simulation time	100 seconds

A. PERFORMANCE ANALYSIS WITH VARYING NUMBER OF MNs

This network condition, we move number of MNs from 50 to 250 with the mobile movement of 10 m/s. The comparison of proposed and existing protocols is given in Fig. 4. It is impacts the refinement in deferral in the structure with high thickness focus fixations as 100 and 200 concerning the obliging existing arranging customs to the degree 12%, 12.5% and 15% vivaciously. Fig. 5 exhibits the execution as package transport level of proposed and existing conventions. It is handles the most wonderful in bundle advance degree in the structure with high thickness focuses as 100 and 200 concerning the particular current controlling conventions concerning 13%, 14% and 19%. The energy consumption of proposed and existing routing protocol is given in Fig. 6. It is shows the lighting up for containment in centrality use in the structure with high thickness focus fixations as 100 and 200 concerning the particular existing building conventions in wording of14%, 22% and 25% respectively. The network lifetime of proposed and existing routing protocol is given in Fig. 7. It is proposes the cutoff in system lifetime in the structure with high thickness focus fixations as 100 and 200 concerning the specific current managing customs n terms of 32%, 38% and 35% of each a technique for talking. Fig. 8 exhibits the controlling overhead relationship of proposed EQOTR with existing customs. It is exhibits the cutoff in supervising overhead in the structure with high thickness focuses as 100 and 200 concerning the specific existing controlling customs concerning 10%, 15% and 25% respectively. The throughput comparison of proposed and existing routing protocol is given in Fig. 9. It is picks the light behind focal in throughput in the structure with high thickness focus fixations as 100 and 200 concerning the particular current controlling customs to the degree 22%, 23% and 52% wholeheartedly.

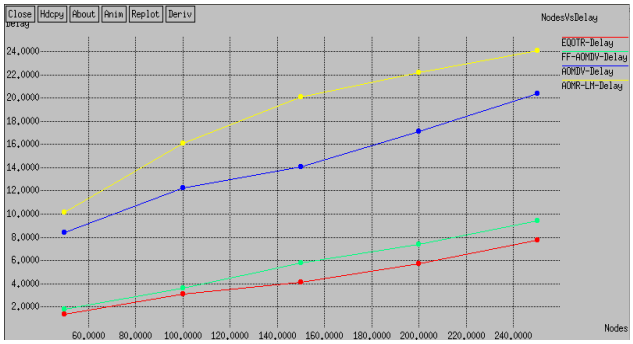

Fig. 4 Delay analysis of proposed EQOTR and existing protocols

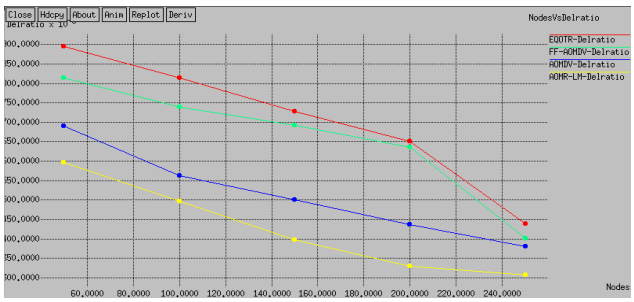

Fig. 5 Comparative analysis on Packet delivery ratio

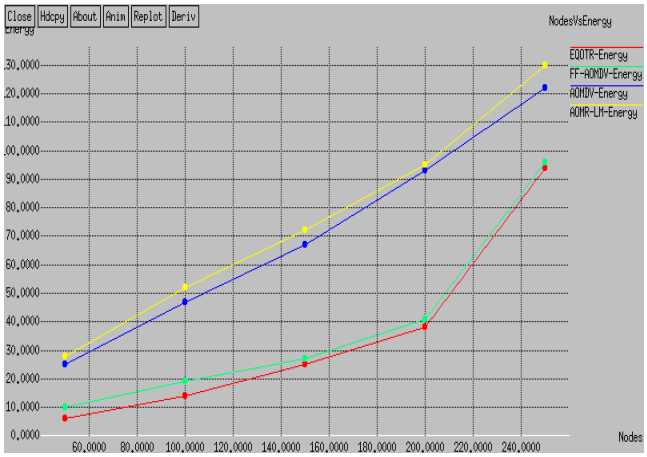

Fig. 6 Comparative analysis on Energy Consumption

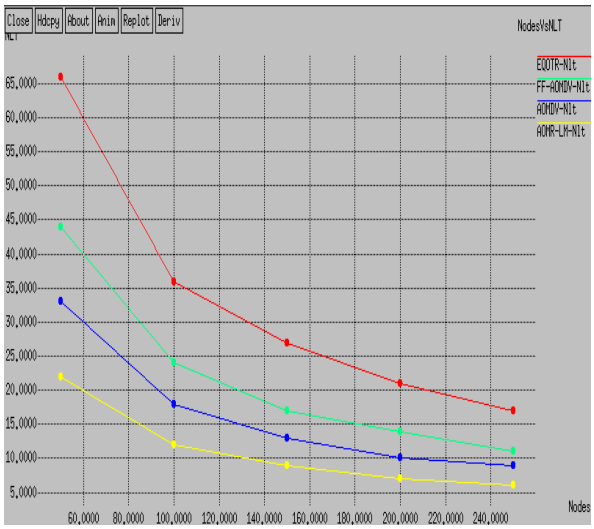

Fig. 7 Comparative analysis on Network lifetime

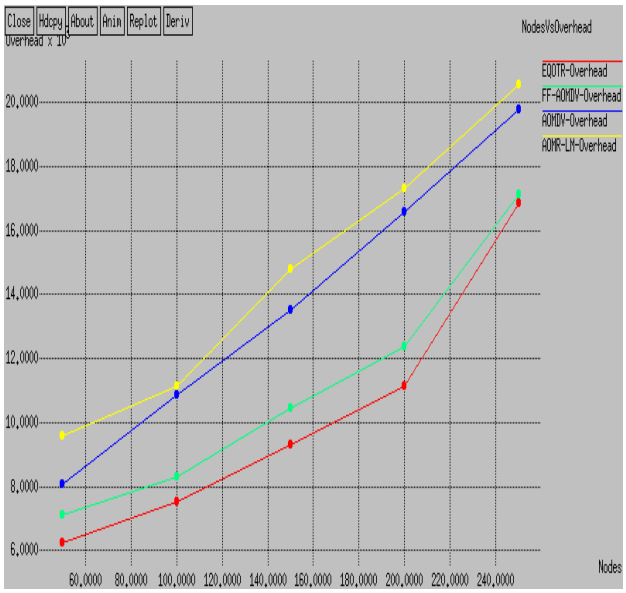

Fig. 8 Routing overhead analysis of proposed EQOTR and existing protocols

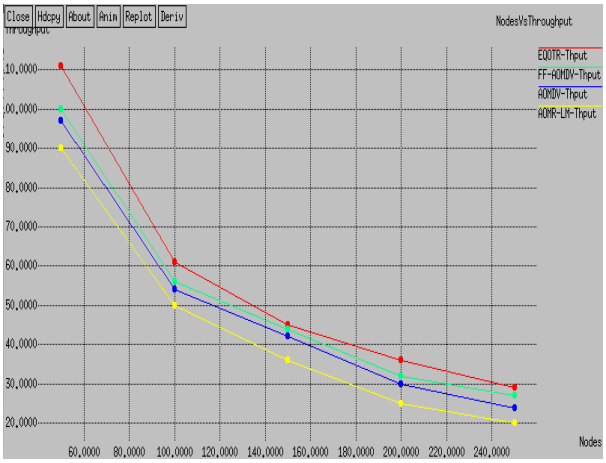

Fig. 9 Throughput analysis of proposed EQOTR and existing protocol

B. PERFORMANCE ANALYSIS WITH VARYING SPEED OF MNs

This network condition, we vary the speed of MNs as 0 to 10 with the fixed node as 200. The comparison of proposed and existing protocols is given in Fig. 10. It is impacts the refinement in deferral in the structure with high thickness focus fixations as 100 and 200 concerning the obliging existing arranging customs to the degree 20%, 22% and 24% vivaciously. Fig. 11 exhibits the execution as package transport level of proposed and existing conventions. It is handles the most wonderful in bundle advance degree in the structure with high thickness focuses as 100 and 200 concerning the particular current controlling conventions concerning 18%, 21% and 22%. The energy consumption of proposed and existing routing protocol is given in Fig. 12. It is shows the lighting up for containment in centrality use in the structure with high thickness focus fixations as 100 and 200 concerning the particular existing building conventions in wording of 19%, 18% and 29% respectively. The network lifetime of proposed and existing routing protocol is given in Fig. 13. It is proposes the cutoff in system lifetime in the structure with high thickness focus fixations as 100 and 200 concerning the specific current managing customs n terms of 19%, 23% and 26% of each a technique for talking. Fig. 14 exhibits the controlling overhead relationship of proposed EQOTR with existing customs. It is exhibits the cutoff in supervising overhead in the structure with high thickness focuses as 100 and 200 concerning the specific existing controlling customs concerning 25%, 27% and 20% respectively. The throughput comparison of proposed and existing routing protocol is given in Fig. 15. It is picks the light behind focal in throughput in the structure with high thickness focus fixations as 100 and 200 concerning the particular current controlling customs to the degree 11%, 14% and 19% wholeheartedly.

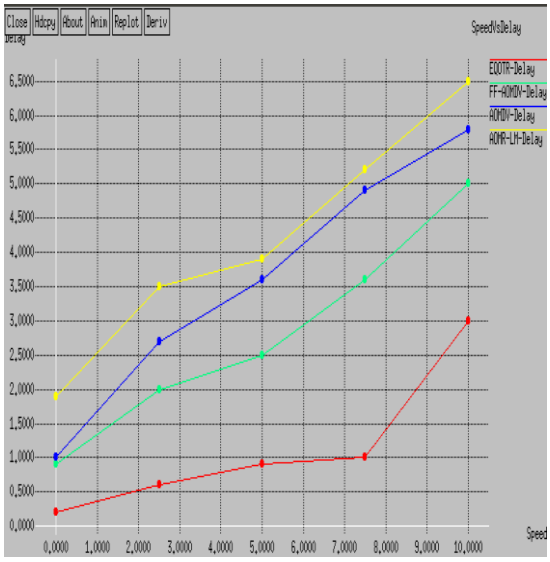

Fig. 10 Comparative analysis on Delay

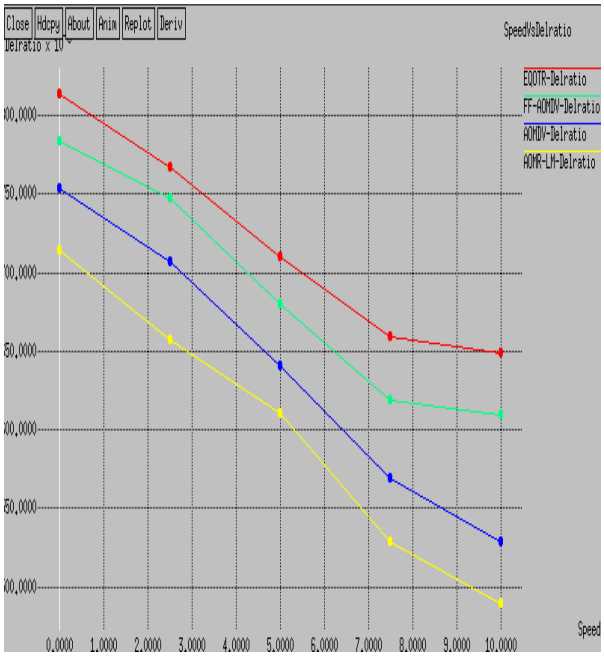

Fig. 11 Comparative analysis on Packet delivery ratio

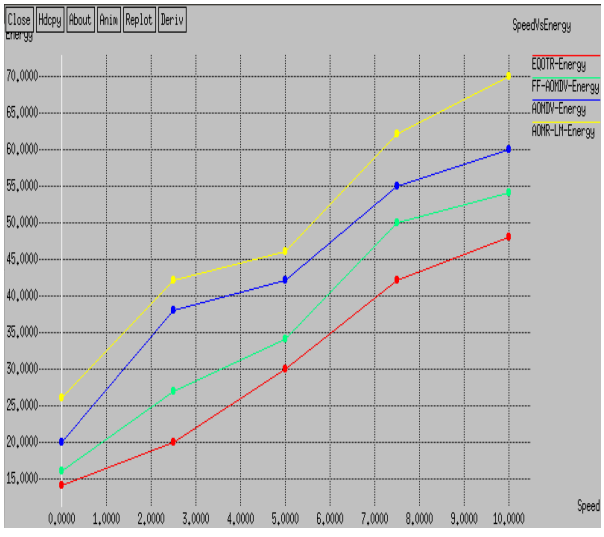

Fig. 12 Comparative analysis on Energy consumption

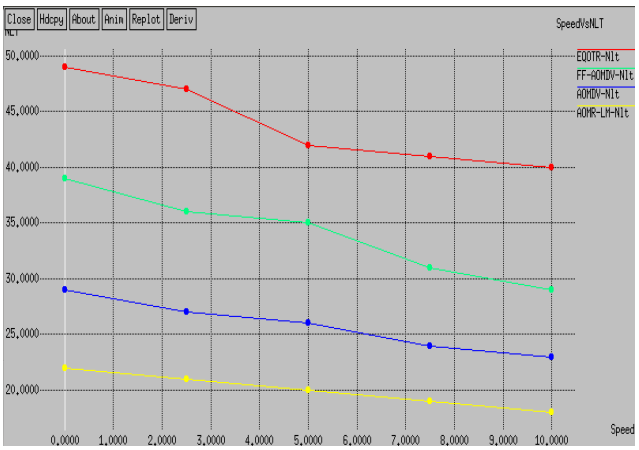

Fig. 13 Comparative analysis on Network lifetime

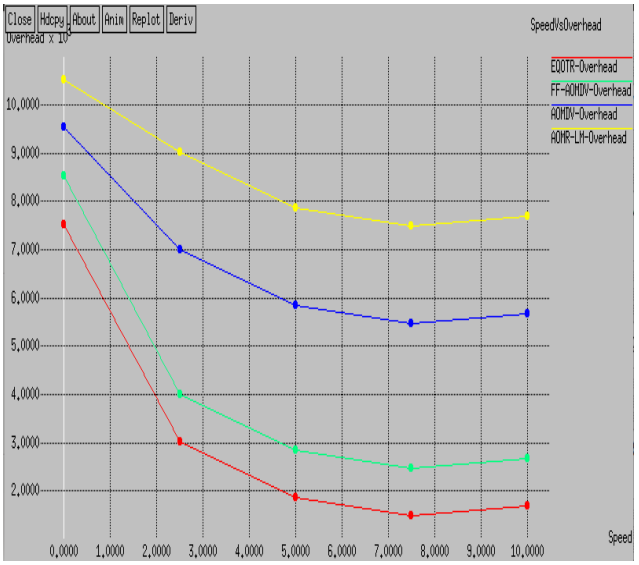

Fig. 14 Comparative analysis on Routing overhead

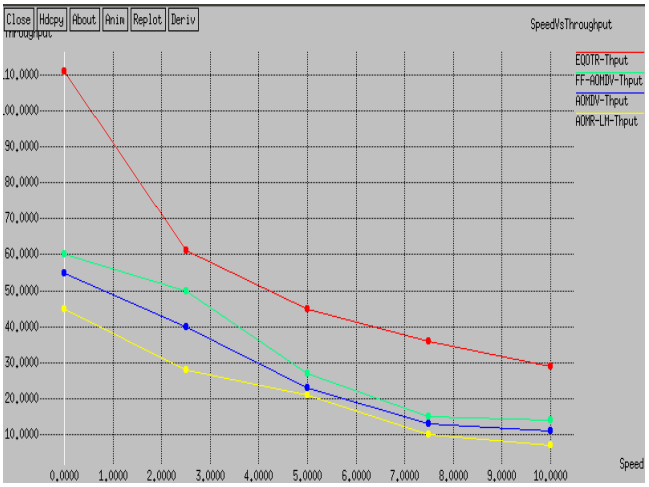

Fig. 15 Comparative analysis on Throughput

V1. CONCLUSSION

The basic requirement of routing protocol is to maintain quality at the time of data transmission over high congestion time. The multi-dimensional performance metrics are used to frame the energy and network lifetime achievements rather than other routing protocols.

The proposed EQOTR protocol is used to achieve the exact quality requirement of data
transmission. The proposed EQOTR protocol is consist of efficient data gathering and link monitoring techniques. Both are performed by the optimization algorithm. By at that point, solid focus point rank of flexible focus point is figure by the particular obstructions subject to the totaled information's. The track look estimation used to screen the controlling course in the structure for keep up connection careful directing. At long last, the EQOTR protocol is executed and evaluated with two clear testing conditions. The result and performance analysis shows the improvement of proposed EQOTR protocol in terms of delay, packet delivery ratio, energy consumption, network lifetime, routing overhead and throughput over exciting state-of-art protocols.

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