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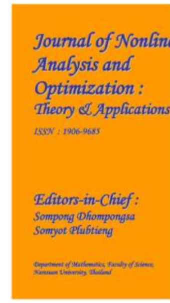

ANALYSIS OF OPPORTUNISTIC ROUTING IN MOBILE AD-HOC NETWORKS USING ENHANCED ALGORITHM FOR DISTRIBUTED ADAPTIVE OPPORTUNISTIC ROUTING WITH GREY WOLF OPTIMIZATION ALGORITHM

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Abstract: Opportunistic routing network carries in opportunistic data forwarding that permits multiple candidate nodes in the forwarding region to perform on the broadcasted data packet. Novel routing paradigm for opportunistic routing protocols has been proposed to overcome routing protocol limitations and to provide efficient delivery of data in these highly dynamic ad hoc networks. This increases the reliability of data delivery in the network with reduced delay. If the network congestion, hence delay, were to be replaced by time-invariant quantities, the heuristics in would become a special case of d-AdaptOR in a network with deterministic channels and with no receiver diversity. In this paper, the Extremely Opportunistic Routing (EXOR), d-AdaptOR (Distributed Adaptive Opportunistic Routing)and Enhanced algorithm for Distributed Adaptive Opportunistic Routing with Artificial Fish-Swarm algorithm (EDAOR-AFS) , Enhanced Algorithm for Distributed Adaptive Opportunistic Routing With Firefly Algorithm (EDAOR-FF) , Enhanced Algorithm for Distributed Adaptive Opportunistic Routing With Grey Wolf Optimization Algorithm (EDAOR-GWO) Algorithms is compared and analyzed, in this research proposed EDAOR-GWO and then it selects shortest route for transferring the packets of data from transmitter node to the receiver node for increase the transmission reliability of sensor networks, network life time, energy consumption, peak signal noise ratio of the packet delivery ratio, and reduce the routing overhead. Here, the experimental result illustrated and compared with the existing method, The result is that each hop moves the packet farther (on average) than the hops of the best possible predetermined route the EDAOR-GWO algorithms provides better result.
Keywords: Opportunistic Routing, Grey Wolf Optimization Algorithm, Firefly Algorithm, Mobile Ad hoc Network, Artificial Fish-Swarm algorithm

I.Introduction

A Mobile Ad hoc Network is considered as a wireless communication network, wherever the nodes are not communicated within range of direct transmission of each other that needs the intermediate nodes to forward data. In which a networking paradigm begin from the needs in emergence operations, disaster relief operations, search and rescue, and battle field communications. It has infrastructure less, maintains mobile users, and reduces under the group of using multi-hop wireless networking. The two most significant operations are performed at the network layer, there are routing and data forwarding, are considered as distinct concepts[1][2]. Routing decides the path way to allow a data packet must determine to follow from the source node to the target node and it grants forwarding date with control inputs. Data forwarding controls how packets are must taken and handled from one link to another link. The opportunistic routing defeats the negative aspect of unreliable wireless transmission through broadcasting one transmission that can be overheard by multiple neighbors. MANET is to make wireless links as better as wired ones, so as to developments in the field of routing. Opportunistic routing enhances network packet delivery ratio rate and the transmission reliability of networks. [3]

In Opportunistic Routing, the transmission reliability of sensor networks and network packet delivery ratio rate know how to be automatically increased by using a dynamic relay node to forward the packet. For example, Opportunistic routing includes EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF , EDAOR-GWO. This ratio utility is inversely proportional to the progress of every node such that the node closer to the destination has higher priority. Because of the unreliability performance of wireless communication, the distant node within the radio range of a transmitter may suffer from a poor connection, and that causes high packet loss and Multipath routing protocols face a major challenge in reducing energy usage. MANETS will be the most important thing when it comes to networks in the future. It is common for nodes in MANETs to be shared for a specific purpose and to have limited power. Research work in this paper focuses on developing an improved routing protocol inspired by biological techniques to reduce route failure and boost packet delivery success.compares the performance EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF , EDAOR-GWO algorithms in opportunistic routing protocols in wireless ad hoc networks[4][5].

II.Algorithms For Opportunistic Routing

In this paper, the five algorithms, discussed to optimize the route discovery in the deployment of wireless adhoc network where efficiencies of both the algorithms are utilized for enhancing the routing algorithm then compare with other opportunistic algorithms.

III. EXOR Protocol

ExOR is an opportunistic routing protocol that has been increased for multi hop wireless networks [6]. This routing protocol combines the routing and MAC protocols; however, whole packets are broadcasted at the network layer. The routing performance is developed by using the dynamic approach and opportunistic routing for selection of the links, if the links routed on the default path be converted into unstable. After that process have a batch of packets, which is an identifier 'BatchID' the source node transmits each packet to the queue and then to the list. It is forwarding nodes that exist in a priority order based on the cost metric or ETX metric [7]. The forwarding lists of the source nodes have only all nodes that are much close to the target destination while compared the distance between the destination node and source node. Each and every packet should be performed with marking packets which have been received by the nodes with higher priorities or the sending node.

III. D-AdaptOR (Distributed Adaptive Opportunistic Routing Algorithm)

The explanation of d-AdaptOR provides the following notations[8]. Let σ^i represent the set of potential reception outcomes because of a transmission from node $i \in \Theta$, i.e. $\sigma^i = \{S : S \leq N(i), i \in S\}$. Let $N(i)$ represent the set of neighbors of node i consisting node itself. Refer to σ^i as the state space for node *i*'s transmission. Moreover, let $\sigma = \cup_{i \in \Theta} \sigma^i$. Let A(S) = S U {T} represent the space of all permissible actions accessible to node i upon successful reception at nodes in *S*. Finally, for each node *i* define a reward function on states $S \in \sigma^i$ and potential decisions $a \in A(S)$ as,

$$g(S,a) = \begin{cases} -c_a & \text{if } a \in S \\ R & \text{if } a = T \text{ and } d \in S \\ 1 & \text{if } a = T \text{ but } d \notin S \end{cases}$$

Detailed description of d-AdaptOR

The function of d-AdaptOR can be defined in terms of initialization and four steps of transmission, reception and acknowledgement, relay, and adaptive computation as demonstrated in figure 2. For simplicity of presentation assume a sequential timing for each of the stages. Use n^+ to represent a few (small) time after the begin of n^{th} slot and $(n + 1)^-$ to represent a few (small) time before the end of n^{th} slot such that $n < n^+ < (n + 1)^- < n + 1$.

- **Initialization:**
  For all $i \in \Theta$, $S \in \sigma^i$, $a \in A(S)$, initialize

$$\left.\begin{aligned} &\boldsymbol{\wedge_0 (i, S, a) = \nu_{-1} (i, S, a) = N_{-1} (i, S)=0, \ \wedge^i_{max} = 0,} \\ &\textbf{\textit{while}} \ \boldsymbol{\wedge^T_{max} = -R.} \end{aligned}\right\}$$

Table 1: Notations used in the description of the algorithm

Symbol	Definition
S^i_n	Nodes receiving the transmission from node i at time n
a^i_n	Decision taken by node i at time n
A(S)	Set of variable actions when nodes in S receive a packet
N(i)	Neighbors of node I including node i
g(S,a)	Reward obtained by taking decision a when the set A of nodes receive a packet
ν_n (i, S, a)	Number of times up to time n, nodes S have received a packet from node I and decision a is taken
N_n(i, S)	Number of times up to time n, node S have received a packet from node i
Λ_n(i, S, a)	Score for node I at time n, when nodes S have received the packet and decision a is taken
Λ^i_{max}	Estimated best score for node i

- **Transmission Stage:** In this stage arises at any time *n* in which node *i* broadcast if it has a packet.
- **Reception and acknowledgement Stage:** In the acknowledgement and reception stage, successful reception of the packet transmitted by node *i* is acknowledged by each node in S^i_n. Let S^i_n represent the (random) set of nodes that have received the packet sent by node *i*. Presume that the delay for the acknowledgement stage is small enough such that node *i* infers S^i_n by time n^+ (not more than the duration of the time slot). In support of all nodes $k \in S^i_n$, the ACK packet of node *k* to node *i* consists of the EBS message $\wedge^k_{max}$. The counting random variable N_n is incremented, upon acknowledgement and reception as follows:
  $N_n(i,S) = \quad N_{n-1}(i,S) + 1 \ \text{ if } S = S^i_n$

$N_{n-1}(i,S) \quad if\ S \neq S^i_n$

- **Relay Stage:** Node i chooses a routing action $a^i_n \in A(S^i_n)$ in accordance with the following (randomized) rule parameterized by $\in_n(i,S) = \frac{1}{N_n(i,S)+1}$:
- With probability $(1-\in_n(i,S))$,
  $a^i_n \in \Lambda_n(i, S^i_n, j)$
  is selected,
- With probability $\in_n(i, S^i_n)$
  $a^i_n \in A(S^i_n)$
  is selected uniformly with probability,

$$\frac{\in_n(i,S^i_n)}{|A\ S^i_n|}.$$

Node i transmits FO, a control packet which includes data about routing decision $a^i{}_n$ at some time strictly between n^+ and $(n+1)^-$. If $a^i_n \neq T$, after that node a^i_n prepares for forwarding in next time slot, while nodes $j \in S^i_n$, $j \neq a^i_n$ expunge the packet. If termination action is selected, i.e. $a^i_n = T$, all nodes in S^i_n expunge the packet.

Upon selection of a routing action, the counting variable ν_n is updated.

$$\nu_n(i,S) = \begin{cases} \nu_{n-1}(i,S,a)+1 & if\ (S,a) = (S^i_n, a^i_n) \\ \nu_{n-1}(i,S,a) & if\ (S,a) \neq (S^i_n, a^i_n) \end{cases}$$

- **Adaptive Computation Stage:** At time $(n+1)^-$, after being done with transmission and relaying, node i updates score vector $\nu_n(i,.,.)$ as follows:
  For all $S = S^i_n$, $a = a^i_n$,

$$\Lambda_{n+1}(i,S,a) =$$
$$\Lambda_n(i,S,a) + \alpha_{\nu_n}(i,S,a)$$
$$\times(-\Lambda_n(i,S,a) + g(S,a) + \Lambda^a_{max}),$$

Otherwise, $\Lambda_{n+1}(i,S,a) = \Lambda_n(i,S,a)$.

Furthermore, node i updates its EBS message Λ^i_{max} for future acknowledgements as:

$$\Lambda^i_{max} = \Lambda_{n+1}(i, S^i_n, j).$$

IV. Enhanced Algorithm For Distributed Adaptive Opportunistic Routing With Firefly Algorithm (Edaor-Ff)

Hybrid Firefly with d-adaptOR algorithm is used to selecting the best path for data transmission, initial populations are considered as a route discovered by Firefly algorithm [9]. In this method, the best path is selected by utilizing the concept of firefly algorithm. The firefly optimization algorithm is used to identify the best transmission range over the networks. The fireflies moves one place to another place in order to estimate nodes and evaluates more transmission range within less time of the interval. After identifying the optimal path, the Unilateral(Uni) scheme is applied for the mobile adhoc networks. By using the unilateral wakeup scheme the nodes with slower moving speed to sleep more without losing the network performance. This scheme is used in both entity mobility and group mobility of nodes. The main intent of this hybrid algorithm is to enhance the energy efficiency with less computation overhead in the mobile adhoc networks [10]. The distance between the nodes is considered as r in the algorithm. The paths found in the first phase are considered as a firefly algorithm. The parameters such as energy, bandwidths are considered as parameters of the algorithm. The fitness value of the algorithm is considered as a residual energy. The light intensity is considered as a total energy cost for particular path or route from source to destination. The light intensity of the proposed system is directly proportional to the fitness of the algorithm $(x) \propto (x)$.based on the light intensity the path's are selected and given as input to the attractiveness. There are four components of the algorithm:

- Initialization: Initialize all the nodes.
- Find the shortest path using firefly functions.
- Attractiveness Function: The attractiveness of fireflies is proportional to their brightness or light intensity. The brightness or light intensity is decreased as the distance between fireflies increase. Therefore, the attractiveness of a firefly is determined by the following
  $\beta = \beta_0 x\, e^{-\gamma r^2}$
  where the distance between any two fireflies denotes by r, the attractiveness at $r = 0$ is β_0 and a light absorption coefficient is γ. The distance between any two fireflies x_i and x_j is expressed as follows :
  $$r_{ij}\, ||x_i - x_j|| = \sqrt{\sum_{k=1}^{d} (x_{i,k} - x_{j,k})^2}$$
  where $x_{i,k}$ is the k-th component of the spatial coordinate x_i of i-th firefly and d is the number of dimensions.
- Movement of Firefly: Firefly i is attracted toward the other brighter firefly j, then its movement is defined as below equation [11]
  $$x_i = x_i + \beta_0 x\, e^{-\gamma r_{ij}^2} x\, (x_j - x_i) + ax\, (rand - \frac{1}{2})$$
  In equation (3), x_i is current position,
  $$\beta_0 x\, e^{-\gamma r_{ij}^2} x\, (x_j - x_i)$$

is the brightness of the firefly and the last term represent random motion. The example results of firefly algorithm developed by Yang, and the location of fireflies [12].

- Transmission Stage: This stage occurs at time n in which node i transmit if it has packet for transmission
- Reception and acknowledgment Stage: Si denotes the random set of nodes that have received the packet transmitted by node i. In this stage, successful reception of the packet transmitted by node i is acknowledged to it by all the nodes in the Si. The delay for the acknowledgment stage is small enough (not more than the duration of the time slot) such that node i infers Si by time n. For all the nodes the ACK packet of node j to node i includes the EBS message. Upon reception and acknowledgment the counting random variable N_n is incremented.

- Relay Stage: In this stage node i select a routing action according to the randomized rule parameterized by forwarding probability. The node i transmit control packet that contains information about routing decision at some time strictly between two intervals. Upon selection of routing action, the counting variable is updated.
- Adaptive Computation Stage: At time (n+1), after being done with transmission and relaying, node i updates score vector. Node i updates its EBS message for future acknowledgments.

● Fitness value: The residual energy of a node by calculating the total energy consumed by a node whenever it is in one of the following states [22]:

i)IDLE: During this state the node is idle

ii)CCA_BUSY: During this state the node is busy

ii) TX: During this state the node only transmits packets

iii) RX: During this state the node only receives packets

iv) SWITCHING: During this state the nodes switches from one channel to another.

For each node n_i the residual energy (n_i) is computed as:

$(n_i) = E_{\text{curent}}(n_i) - E_{\text{con}}(n_i)$ where, $E_{\text{curent}}(n_i)$ and $E_{\text{con}}(n_i)$ denote the current energy of the node n_i and the energy consumed by the node n_i, respectively. On the averge, the current energy is set to the initial energy of the node. (n_i) is considered as a attractiveness of the path. Since the consumed energy of each node n_i is influenced by the node is (i.e., IDLE, TX, RX, CCA BUSY, SWITCHING), the following equation is used to determine its consumed energy as:

Light intensity calculation: For each node n_i an energy cost function (n_i) is assigned that is given by:

$$C\,(n_i) = \frac{E_{init}(n_i)}{R(n_i)}$$

Therefore, the total energy cost for a route p commencing source node n_S to destination node n_D, is given by:

$$E_p = \sum_{n_i \in p, n_i \neq n_D} C(n_i)$$

The selected route l will be the one that satisfies the following property:

$$E_l = \{E_p : P \in V\}$$

Where, V is the set of all the possible routes.

V. Enhanced Algorithm For Distributed Adaptive Opportunistic Routing With Artificial Fish-Swarm Algorithm (Edaor-AFS)

D-adaptOR with Artificial Fish-Swarm algorithm is used to selecting the best path for data transmission, Initialize the random numbers and the optimizing variable. The Fish-Swarm algorithm is used to find the best transmission range over the network limits. This is a basic biological behavior of AFS tends to the food in adopted with best node route; generally the fish perceives the concentration of food in water to determine the movement by vision or sense and then chooses the tendency [13].

- **Random Area Find stage:** In the reception and acknowledgement stage, successful reception of the packet transmitted by node *i* is acknowledged by all the nodes in S^i_n. Let S^i_n denote the (random) set of nodes that have received the packet transmitted by node *i*. Assume that the delay for the acknowledgement stage is small enough (not more than the duration of the time slot) such that node *i* infers S^i_n by time n^+.

  AFS behavior that tends to the food; generally the fish perceives the concentration of food in water to determine the movement by vision or sense and then chooses the tendency. Behavior description: Let *Xi* be the AF current state and select a state *X j* randomly in its visual distance, *Y* is the food concentration (objective function value), the greater *Visual* is, the more easily the AF finds the global extreme value and converges.

$$X_n(i,S) = \begin{cases} X_{n-1}(i,S) + 1 & \text{if } S = S^i_n \\ X_{n\,1}(i,S) & \text{if } S \neq S^i_n \end{cases}$$

$$Xi = Xi + Visual.rand\,() \qquad (1)$$

If *Yi* < *Yj* in the maximum problem, it goes forward a step in this direction;

$$X_i^{(t+1)} = X_i^{(t)} + (X_j - X_i^{(t)}) / |(X_j - X_i^{(t)}|.Step.rand() \qquad (2)$$

Otherwise, select a state *X j* randomly again and judge whether it satisfies the forward condition. If it cannot satisfy after *try_number* times, it moves a step randomly. When the *try_number* is small in AF_Prey, the AF can swim randomly, which makes it flee from the local extreme value field.

$$X_i^{(t+1)} = X_i^{(t)} + Visual.rand\,() \qquad (3)$$

- **Transmission Relay Stage:** In the moving process of the fish swarm consider data transmission of best area when a single fish or several ones find food, the neighborhood partners will trail and reach the food quickly. Behavior description: Let *Xi* be the AF current state, and it explores the companion *X j* in the neighborhood (*d ij* <Visual), which has the greatest *Y j*. If *Y j* > *Yi* and *n fn* < *δ*, which means that the companion *X j* state has higher food concentration (higher fitness function value) and the surrounding is not very crowded, it goes forward a step to the companion *X j*,

$$X^{(t+1)}{}_i = X_i^{(t)} + (X_j - X_i^{(t)}) / |(X_j - X_i^{(t)}|.Step.rand() \qquad (4)$$

Otherwise, executes the preying behavior consider for Node *i* chooses a routing action $a^i_n \in A(S^i_n)$ corresponding to the following (randomized) rule parameterized by $\in_n (i\,,S) = \frac{1}{N_n(i,S)+1}$:

$S^i_n = X^{(t+1)}{}_I$ With probability $(1- \in_n (i\,,S))$,

$$a^i_n \in \wedge_n\ (i, S^i_n, j)$$

is selected, With probability $\in_n (i\,,\, S^i_n\,)$ $a^i_n \in A\,(S^i_n)$is selected uniformly with probability,

$$\frac{\in_n(i,S^i_n)}{|A\ S^i_n|}.$$

Node *i* broadcasts FO, a control packet that contains information about routing decision $a^i{}_n$ at some time strictly between n^+ and $(n + 1)^-$. If $a^i_n \neq T$, then node a^i_n prepares for forwarding in next time slot, while nodes $j \in S^i_n$, $j \neq a^i_n$ remove the packet. When termination action is selected, i.e. $a^i_n = T$, all nodes in S^i_n expunge the packet.

VI. Enhanced Algorithm For Distributed Adaptive Opportunistic Routing With Grey Wolf Optimization Algorithm (Edaor-Gwo)

Grey wolf optimization with D-adaptOR algorithm is used to selecting the best path for data transmission, initial populations are considered as a route discovered by grey wolf algorithm [15]. In this method, the best path is selected by utilizing the concept of grey wolf algorithm. The grey wolf optimization algorithm is used to identify the best transmission range over the networks.

In the GWO, social interaction and dominating leadership are modeled by observing the grey wolf pack's natural behaviors and dynamics. A pack of grey wolves prefers to preserve order and discipline by classifying the wolves into four distinct categories, namely [16].

- Alpha Wolf (Al_Wf): This wolf is the in-charge of making all the group's most important decisions.
- Beta Wolf (Be_Wf): It acts as a backup of Alpha wolf. This type of wolf steps in when the alpha wolf isn't there.
- Delta Wolf (De_Wf): This type of wolf are sentinels, wise wolves and watchdogs of the pack.

It is said that prey hunting is entirely dependent on the alpha, beta, and delta wolves (also known as the "leading hunters").

VII. EXPERIMENTAL RESULTS

In this simulation process, the EXOR, d-AdaptOR and **EDAOR-AFS** , **EDAOR-FF** , **EDAOR-GWO** compare with the performance of an OR policy (with the ETX metric) respect to the network parameters and design parameters using given below topologies. Figure 2, 3 and 4 show the three different network topologies for which the shortest path search is executed using EXOR d-AdaptOR and **EDAOR-AFS** , **EDAOR-FF** , **EDAOR-GWO** algorithms. The performance of the **EDAOR-GWO** algorithm is compared with the EXOR d-AdaptOR and **EDAOR-AFS** , **EDAOR-FF** approach for the configurations shown in Figure 2, 3 and 4. Projected technique simulates by using NS2 which is open source and also for adding new protocol. The random waypoint (RWP) model of NS2 is obtained for utilizing Original movements and locations of the nodes. In Figure 2, 3 and 4 illustrates the physical locations of all the topologies. In a 200 × 300 feet square region,- 10 feet of transmission range organize 5 or 10 or 15 wireless nodes based on topologies, after that source-destination pair to be diagonally and maximally divided from each other in a perfect manner. L is selected to be 5 meters distance and neighbors are divided by distance L m; Let source node denotes S to destination node denotes D within a wireless ad hoc network is selected at the maximal distance. The entire packets are transmitted with the 802.11b one megabit/second bitrates. Packets are generated a constant bit rate (CBR) source with rate 40 packets/sec. Assume that the length of 512 bytes equipped with uncomplicated CRC error detection. The pause time is 6 seconds and node speed is 6 m/s. Power level of transmission is

200m and transmission cost is assumed with one unit, at the same time as reward for effectively delivering a packet to the destination is to be 20.

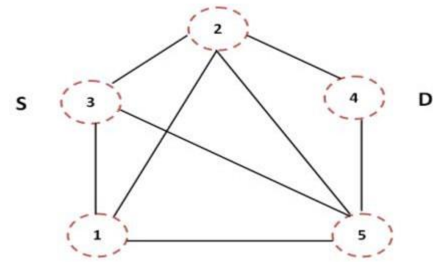

Figure 2: 5-Node Network

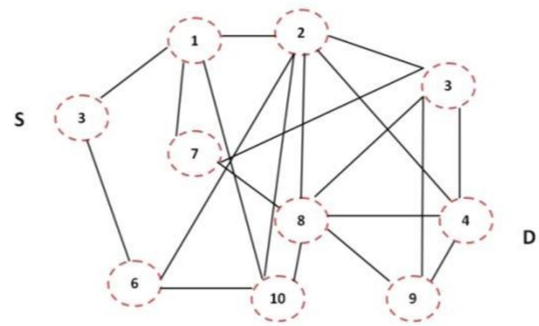

Figure 3: 10-Node Network

Packet Delivery Ratio: Proportionally, the packet delivery ratio is directly performed with the number of packets take delivery by the destination to transmit the number of packets by the source.

Packet Delivery Ratio = ∑ packets delivered by destination / ∑ packets send by source (OR)

$$PDR= S1\div S2$$

Let the each destination received the sum of data packets denote S1 and the each source generated or transmitted the sum of data packets denote S2. The clear graph structure illustrates the fraction of data packets with the aim of successfully delivered during the number of nodes versus simulations time. The performance dependency on R evaluates and with respect to R that have plotted the variation in the performance. The expected delivery ratio of **EDAOR-GWO** as *R increases* from 10 to 100: For small *R*, all the packets are nearly dropped as the cost of transmission of the packet and relaying is not worth the obtained delivery reward in figure 5 plot. But, as *R* increases away from a threshold *R*0 (example provided here, this threshold value is 10, other than in general that based on the network diameter), the delivery ratio remains fixed.

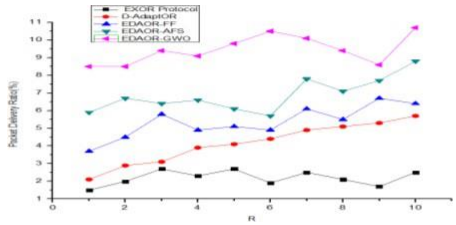

Figure 5: Packet Delivery ratio varied in *R*

Routing Overhead : The effect of the number of nodes perform on the routing overhead of the three algorithms that shows in Figure 6. As the number of nodes increases, the routing overhead of the five algorithms presents different growth trends. Among other algorithms like EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF , EDAOR-GWO performance has the fastest growth rate of routing overhead, which is thrice that of the EDAOR-GWO algorithm EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF algorithm is much better than that. In the network, When the number of nodes is performed as high as 10, the routing overhead of the EDAOR-AFS algorithm is around 5.7, that of the EDAOR-FF algorithm is around 6.4 and D-AdaptOR is around 8.8 , EXOR is around 10.7 the routing overhead of the EDAOR-GWO is the lowest around 2.5. Because the ExOR algorithm depends on the flooding strategy, it will generate a large number of copies in the network, which is likely to cause too much routing overhead.

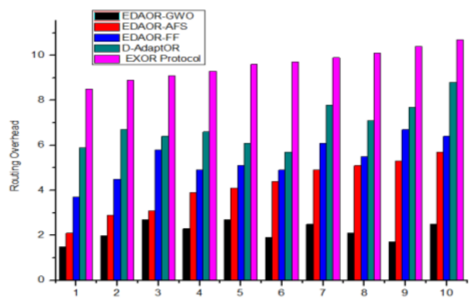

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Figure 6: Routing Overhead

Energy consumption : In Figure 7, the mobility speed ranges from 1 to 10 are plotted in the x-axis with the unit of interval 5, in which that the y-axis is plotted energy consumption ranging from 1 to 11 joules. Figure 7 compares and analyzes energy consumed by EDAOR-GWO to deliver the packet to the receiver with EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF. The EDAOR-GWO routing protocol designed and choose to find the most stable route toward the destination using the available multiple paths. The route chosen by EDAOR-GWO could be the best routing pathway and consumes less energy than other routes, with the shortest route and storage optimization and time consuming, where the other protocols simply select the shortest path without check whether its quality of results so that the issues occurs retransmission and route failure. Because of retransmission and route failure vast amount of energy is wasted by EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF. The protocol EDAOR-GWO consumes less energy for delivering data packets to the destination than EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF where illustrates clearly in Figure7.

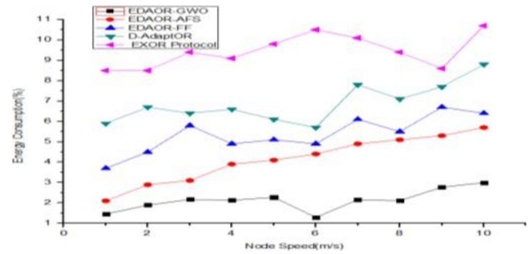

Figure 7: Energy consumption over node speed

VIII. Conclusion

In this paper, we presented EDAOR-GWO, an opportunistic routing protocol which dynamically chooses paths on a per transmission basis in a wireless network. In addition,. We ound that EDAOR-GWO takes advantage of longer transmission distances to forward the packet further on each hop than predetermined routes, which validates our intuition that transmissions are frequently received beyond intermediate nodes specified by even the best predetermined routes. Simulation results illustrated that the EDAOR-GWO algorithm has performed much better than EXOR, d-AdaptOR and EDAOR-AFS , EDAOR-FF .Network life time, energy consumption, peak signal noise ratio of the packet delivery ratio, and reduce the routing overhead those parameters are analyzed in an efficient way.

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