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Analysis of Power complexity in existing algorithms against Ad-Hoc On demand Distance Vector Routing Protocol

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Abstract- The rapid evolution in the mobile communication field, the new alternatives is derived in which mobile devices form a self-creating, self-administering and self-organizing wireless networks. Mobile Ad Hoc Network (MANET) is one such arbitrary network in which all the nodes are mobile and consists of limited radio transmission range, battery power and channel bandwidth. These Mobile Ad Hoc networks are often used in emergency situations. The frequent change in topology leads to more consumption of energy, therefore saving power in such situations is of prime importance. In this paper compares some existing power consumption reducing algorithm.

Keywords: AODV, Mobile Ad hoc Networks, Energy Efficiency and Routing.

Introduction

Mobile Ad-Hoc Networks (MANETs) are characterized with dynamic topology. This dynamism leads to mobility of nodes, interference, multipath propagation and path loss. A more challenging goal in MANET is to provide energy efficient routes as it is one of the major limiting factors in mobile nodes. MANETs are typically powered by batteries which have limited energy reservoir and it may not be easily replaced or recharged on the way. Hence, power consumption becomes an important issue and this lack of power with nodes leads to selfish behavior among nodes in case of commercial MANET.

MANET is a self-configuring and infrastructure less network. The devices and nodes are free to move independently and thus can change their links with other devices in any direction frequently. The primary challenge in the creation of MANET environment is to continuously maintain the required information to route the traffic properly. Routing is one of the main issues in the MANETs due to their highly dynamic and distributed nature. Such networks can operate by themselves or by connecting themselves to the larger internet and may contain more than one transceiver. This results in a highly dynamic and autonomous topology. Figure 1 shows the mobile ad hoc network consisting of various mobile nodes each having a particular route to another node.In particular, the most important design criteria for MANETs is energy efficient routing, since mobile nodes will be powered by batteries with limited capacity.

The main objectives of MANET routing protocols are to maximize network throughput, maximize energy efficiency, and maximize network lifeline and minimum delay. The current routing protocols in MANET for an ad hoc mobile wireless networks are classified into three categories based on routing strategy which are as follows:

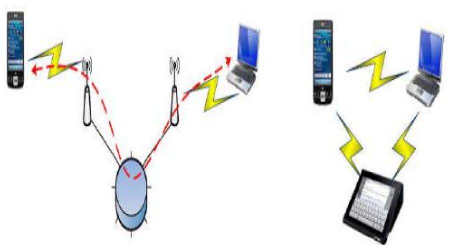

Figure. 1. Mobile Ad-Hoc Network

***Reactive Routing Protocol*:** It is an on demand routing protocol. Reactive protocol maintains no predetermined paths for communication instead find a path between source destination pair only when it is required. This protocol searches for the route in an on demand manner and establishes the connection in order to transmit and receive the packet. AODV and DSR are on demand routing protocols.

***Proactive Routing Protocol*:** It is a table-driven protocol. Proactive routing protocol each node sends a broadcast message to the entire network if there is a change in the network topology. It maintains the routing information even before it is needed. Routes information is generally kept in the routing table and updated in a periodic manner.

***Hybrid Routing Protocol*:** This Protocol is a combination of Reactive and Proactive routing protocol. It is hybrid routing protocol that combines the best features from the reactive and proactive protocol.

Based On Power Awareness:

Energy Efficiency: Energy efficient protocols are introduced to enhance energy level of nodes. Some nodes may have limited battery power. With decrease in power they become incapable to forward packets. These protocols are made to enhance this energy level among nodes. e.g. Minimum Weight Incremental Arborescence(MWIA) [13] is an example of this category. Detail of protocols focusing on this aspect is provided in the next section.

Above discussed protocols are being proposed over a span of ten years. Table 2 given below summarizes these protocols w.r.t. time so as to highlight the concerns behind these proposals

Energy Consumption in MANET

Whenever packets are transmitted via intermediate node, its energy is consumed every time. Asymmetric power configuration of adjacent nodes is affected. There are many ways to efficiently utilize energy in MANETs. By utilizing techniques for energy preservation selfish behavior may be detained to some extent.

- Firstly, by adopting optimum path, power consumed to transmit a packet may be minimized. There are algorithms used to find out the optimum path between the source and destination, node.
- Secondly, the routing protocols must be energy efficient to maximize network throughput, network lifetime, and to minimize delay.
- Lastly energy is consumed when a packet is transmitted. Nodes tend to become selfish if their energy level starts diminishing which is an important issue in MANET. It incurs routing overhead [6].

Energy Is Consumed In Three Different Ways

While sending a packet/ Active State
While receiving a packet/ Active State
While in idle mode/ Sleep Sate

The energy consumed while sending a packet is the largest source of energy consumption in all the modes. This is followed by the energy consumption during receiving a packet. The energy is also consumed when the node is idle state i.e not participating in any communication but in that case there is wastage of energy because it is not actually consumed and any other node could have used that energy which is the part of communication channel at that particular instance.

Transmission power control and load distribution approaches are used to minimize the energy consumption in the active communication energy, and sleep/power-down mode is used to minimize energy consumed during Sleep State. Given below is the description of these approaches.

Transmission Power approach

It is very necessary to find optimal path and routing algorithm for efficient routing and it can be achieved by plotting a graph and by considering vertex as mobile node and edge representing a wireless link between the two nodes. These transmission nodes are within each other's transmission range. Number of immediate nodes neighbor to a particular node can be adjusted if node's transmission power is controllable. Transmission power plays a very important role if it is weaker it can cause a problem of network partitioning that may arise due to topological sparse, on the other hand if transmission power is strong transmission range is increased and it can also reduce hop count to the destination [20]. e.g, FAR, OMN, PLR, MER.

Load Distribution Approach

Goal of this approach is to detect those nodes over the route that underutilizes the energy and to find the optimum path not on the basis of shortest route but selecting a route where energy consumption by nodes is less. A route with least load among possible routes from source to destination is chosen. In this, packets are only routed through energy rich intermediate nodes. The routes may be longer but the nodes chosen are rich in energy. Such protocols considers the energy efficiency of nodes and overloading of nodes is prevented to make them efficient thus ensures longer network lifetime e.g. MPR, LEAR.

Sleep / Power-Down Mode Approach

The sleep/power-down mode approach focuses on inactive time of communication. There are many radio hardware that support low power states. This approach also considers the fact that system must not turn off when it goes to sleep state to save the resources, most importantly energy. This approach is based on Master selection in MANET. Whenever nodes are in sleeping state in MANET, they are actually not listening or forwarding packets at that time. One of the ways to save the energy is by selecting a node as Master node and rest of the nodes are slave nodes. Master node should coordinate and manage the neighbouring slave nodes. Slave nodes can save the battery by periodical sleeps. They can wake up periodically and ask for any data transmission from the Master node. If any data is to be transmitted it is communicated by the Master node to the slave nodes. But node sleeps again if it is not addressed to it. e.g. GAF, PEN.

Effect of Energy Consumption On Nodes

Cooperation is the Core of MANETs. A Mobile Ad-hoc network is only successful if there is cooperation between nodes. High cooperation is expected between the nodes while packet transmission. But as far the commercial MANET is concerned it is difficult to encourage the cooperative behaviour between the nodes. In Commercial MANET Power consumption and power saving is a concern with every individual node. In order to save power for its own usage some nodes stops forwarding packets. Intermediate nodes want to conserve their limited resources like energy and bandwidth. This leads to selfish behaviour of nodes in MANETs. These non -cooperative nodes don't cooperate or participate in forwarding packets for other nodes or finding routing path for them. This is a serious concern & devising ways to detain or minimize selfish behaviour is an open research challenge in this domain.

Energy Centric Routing Protocols

With fast increase in popularity and applicability of MANETs, retaining energy of mobile nodes became an utmost concern for the researchers. Literature highlights that many energy centric protocols have already been proposed which try to minimize energy usage while data transmission.

- Energy Constraint Node Cache-AODV: [14] describes ECNC_AODV routing algorithm which is based on energy status of each node and cached node. This protocol is better with respect to energy consumption due to rou ting packets, routing overhead and delivery ratio.
- Flow Augmentation Routing: FAR protocol aims at minimizing the sum of link cost along the path and chooses the path with minimum cost. It basically assumes that network is static.
- Online Max-Min Routing: OMM power-aware routing protocol for wireless ad-hoc is applicable over geographic area and support application where sequence of message is not known. It is very helpful in prevention of occurrence of overloaded nodes. The performance of individual node and whole network is affected by these overloaded nodes. This protocol optimizes the lifetime of the network as well as the lifetime of individual nodes.
- Power-aware Localized Routing: (PLR) protocol is a localized, fully distributed energy-aware routing algorithm. It works with the assumption that a source node has the location information of its neighbors and the destination. PLR is equivalent to knowing the link costs from the source node to its neighbors, all the way to the destination. Based on this information, the source cannot find the optimal path but selects the next hop through which the overall transmission power to the destination is minimized.
- Minimum Energy Routing: MER protocol adjust the transmission power of individual node so that it's enough to reach the next neighbouring hop node. So aim of this protocol is to adjust the nodes power and not to make paths energy efficient.
- Multi-Path Routing: This protocol is suitable when the number of paths in use is more and data usually flow over these distinct paths simultaneously from the source to the destination. During single path load balance technique it is decided that whether a specific path is efficient for sending packets for message sending or not and when that path is found, it is considered as the optimum path. This path remains optimum till a new path is found. The problem with this technique is to decide when a good path turns into not good.
- Geographic Adaptive Fidelity: GAF protocol works on master slave architecture. It aims at saving the battery power of the network by keeping the slave nodes with low energy.
- Prototype embedded Network: PEN protocol practices the sleep period operation in an asynchronous way without involving master nodes.
- Progressive Energy Efficiency Routing Protocol: This protocol performs better during path discovery and in other mobility scenarios. It can achieve its goal in following steps:

  a) Route discovery process: It starts with searching all shortest paths, then path having minimum energy level is chosen and to perform this task route request is generated that consist of two piece of information hop count and energy consumption. Hop count is updated at every intermediate node level. For route discovery a problem regarding choice of best energy efficient route may arise if there are several routes having same energy efficiency.

  b) Route maintenance: In this protocol nodes can passively watch data exchange within its neighborhood nodes and looks for more efficient path. Control messages are sent by monitoring nodes to update paths in Replace and insert operations. Maintenance overhead is low because these messages are only send when better path is detected.
- SPAN and BECA/AFECA combination: BECA/AFECA is the two power-save approaches: the Basic Energy-Conserving Algorithm (BECA) and an extended version called the Adaptive Fidelity Energy Conserving Algorithm (AFECA). In this approaches after fixed intervals nodes can dynamically switch between different states. These states are sleeping, listening and active state. These states have important relevance because active nodes by transmitting or retransmitting message between nodes ensure active or listening states. Communicating nodes stay awake. This paper presents a comparison of a combination of Span with AFECA running on top of AODV compared with the same combination modified for nomadic networks. It consists of span coordinator selection mechanism requires BECA/AFECA chain to be modified to take super nodes into consideration. By forcing super nodes to become coordinators, regardless of how well they fare in the coordinator selection algorithms, these nodes will do as much of the routing as possible. Coordinators are in Span chosen based on a number of criteria, such as the remaining energy. It could therefore be expected that Span automatically would favour super nodes as coordinators.
- Energy Efficient Routing using OLSR. In this protocol EEOLSR Residual energy level of nodes and inaccuracy of state information is focused and residual energy collected by control messages in OLSR is also considered. Inaccurate information effect the efficiency of OLSR protocol. In this all those parameters are studied that contains inaccuracies in energy level information of neighbouring nodes. Future work

regarding proposal of some techniques to reduce inaccuracies with improves residual energy information of nodes is also suggested.

- Cluster Based routing protocol: CBRP is robust and scalable. In this paper energy efficient Cluster based routing protocol is presented and evaluated. Nodes are divided into cluster in CBRP and clusters are connected via cluster heads .In tis paper idea is to place all the member nodes expect gateway node should go to sleep mode when they are in idle mode.. In this method only Cluster Heads (CHs) and gateway nodes are active for any communication in other words the backbone of the network every time is active to any communication.

- Energy Efficient, Secure and Stable Routing Protocol: EESSRP was introduced with combining factors like security, power and stable routing. MANET is still a very critical task due to highly dynamic environment. An effort has been made to perform analysis using random way point mobility model. The results have been derived using self created network scenarios for varying number of mobile nodes.

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Ad Hoc On-Demand Distance Vector (Aodv) Routing Protocol:

Ad hoc On-demand Distance Vector Routing (AODV) is an improvement on the DSDV algorithm. Ad hoc on-demand distance vector (AODV) routing protocol is also well known in terms of better delivery ratio and less link failures while maintaining a reasonable routing control overhead[8]. It typically minimizes the number of broadcasts by creating routes on-demand as opposed to DSDV that maintains the list of all the routes. To find a path to the destination, the source broadcasts a route request packet. The neighbors in turn broadcast the packet to their neighbors till it reaches an intermediate node that has recent route information about the destination or till it reaches the destination. A node discards a route request packet that it has already seen. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only. When a node forwards a route request packet to its neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source, the nodes along the path enter the forward route into their tables. If the source moves then it can reinitiate route discovery to the destination. If one of the intermediate nodes move then the moved nodes neighbor realizes the link failure and sends a link failure notification to its upstream neighbors and so on till it reaches the source upon which the source can reinitiate route discovery if needed. Ad hoc On-demand Distance Vector Routing protocol is a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchange [9]. When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node. It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to their neighbors, and so on, until either the destination or an intermediate node with a "fresh enough" route to the destination is located. Fig.2 illustrates the propagation of the broadcast RREQs across the network. AODV utilizes destination sequence number to ensure all routes are loop-free and contain the most recent route information. Each node maintains its own sequence number, as well as a broadcast ID. The broadcast ID is incremented for every RREQ the node initiates, and together with the node's IP address, uniquely identifies a RREQ. Along with its own sequence number and the broadcast ID, the source node includes in the RREQ the most recent sequence number it has for the destination. Intermediate nodes can reply to the RREQ only if they have a route to the destination whose corresponding destination sequence number is greater than or equal to that contained in the RREQ.

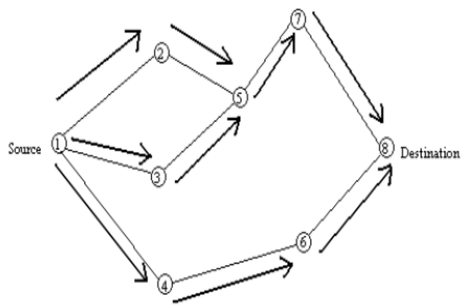

Figure. 2 : Propagation of route request (RREQ) packet[10].

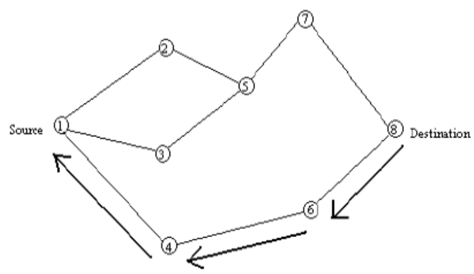

Figure. 3: Path taken by the Route Reply (RREP) packet[10].

Once the RREQ reaches the destination or an intermediate node with a fresh enough route, the destination intermediate node responds by unicasting a route reply (RREP) packet back to the neighbor from which it first received the RREQ as shown in Fig.3. As the RREP is routed back along the reverse path, nodes along this path set up forward route entries in their route table which point to the node from which the RREP came. These forward route entries indicate the active forward route. Associated with each route entry is route timer which will cause the deletion of the entry if it is not used within the specified lifetime. Because the RREP is forward along the path established by the RREQ, AODV only supports the use of symmetric links. Based on the AODV protocol we improve the flooding algorithm to make it more efficient and use efficient one way Hash functions to protect routing information. Before describing the scheme, we first introduce the management of the local node groups, for it is the base of the scheme. In this mechanism, firstly, the packet is encrypted in the sender side and then transmits the packet over the network. The packet contains information such as routing protocol, destination address etc. which is useful for correct recipient of packet at correct location. When the receiver receives the packet, it is in encrypted form which can be decrypted by only the other key which is present at receiver node previously. After decrypting the packet, the original message can be read from that packet. Thus, this will increase security of network during data transmission [11].

Literature Survey

Tripti Nema*et al* [1]. In this proposed work, one set the minimum energy threshold limit of a mobile node, when a node reach the minimum threshold limit the node goes to sleep mode, save energy and participate in the event as long as possible. The research papers are published to improve the network lifetime on the network layer. The construct of network scenarios and performance analysis is done on NS-2.34 to simulate both the AODV and AODV-Sleep under the similar scenario. This paper also compares and analyzes the simulation results with a popular on-demand routing protocol AODV to show the usefulness of this algorithm. From this simulation one finds that the overall MANET's efficiency is enhanced.

Reetika Chib *et al* **[4].** The network is deployed with the nodes and the path is established between the source node and the destination node. The path establishment is done according to the AODV and also by AOMDV routing protocol. In the scenario there may presence of nodes which are having mobility greater than the other nodes. So due to difference in the mobility there may probability of link failure. Due the failure in the link there is degradation in the routing performance which leads to the degradation in the network performance. To overcome this problem of link failure a novel technique is proposed known as the Efficient Optimization Module (EOM).The proposed EOM module enhance the routing performance in the network.

Karmel*et al* [13]. The energy wasted by the neighboring nodes by receiving the packets from source that are not meant for it results complete energy drain out and poor network performance. Overhearing means a node receives a packet not addressed to it and these overhearing transmission produces unnecessary energy consumption. Overhearing avoidance approaches are designed only for unicast messages. New approaches for avoiding overhearing for broadcast /multicast messages in a dense network environment are still an open challenge. This article presents the impact of overhearing thatresult in poor energy conservation in high mobility and dense networks.

Warwadekar*et al* [14]. In this paper we proposed energy efficient routing protocol which reduces energy consumption and thus improves network lifetime of network. Simulation is performed using network simulator NS2 and results shows that our proposed protocol reduces delay and increases throughput, packet delivery ratio by consuming less energy compared to existing AODV routing protocol.

Shiva Prakash*et al* [15]. The proposed routing model refers to the mechanism that takes available remaining energy and energy draining rate of a node into account to decide on relaying traffic. It consist of four units namely Routing, Path choosing, Mode selector and Energy units. Experiments have been conducted using NS3 simulator by considering various situations such as keeping nodes in static position and moving nodes dynamically in a simulation area. The result shows that our proposed model significantly improves network performance and increase in network lifetime.

Kanika*et al* [7]. In this paper we mainly focus in the implementation of a new strategy i.e. Intelligent Power Saver AODV (IPS-AODV) for routing in which the main criteria for routing will not be limited to only shortest path. There will be two parameters for selection of proper routing path i.e. shortest path (followed by conventional protocols) and evaluation of energy utilization of each node. It means before propagating data to the network, battery power of eachnode will be evaluated and then path will be considered. The major criterion of proposed protocol is implemented by considering the transmission of emergency packets although the node energy is below threshold point. In this paper we will also investigate that if battery power of a node is falling down below threshold value then that node should not take part in data communication while it still transmit the control packets so that energy can be conserved.

Manjinder Kaur *et al* [16].***I***n the processof MANET power consumed in sensing, transmission of datafrom one source to another. In this procedure variousproactive & reactive protocol are used that provide reliablecommunication. The major Concern in MANET is energyoptimization & reliable communication. We will reduce theenergy consumption by using dynamic clustering or residualenergy concept & implement routing protocol for reliablecommunication.

Randitha*et al* [17].The proposed algorithm maximizes the network lifetime & minimizes the power consumption during the source to destination route establishment. This algorithm takes special care to transfer both real time and non real traffic by providing energy efficient and less congested path between a source and destination pair. Algorithm focuses on 3 parameters: 1. Accumulated Energy of a path , 2. Status of Battery Lifetime (*B_S) and* 3. Type of Data to be transfer.

Jinesh Kumar singh et al [18]. A new energy Adaptive routing mechanism based on AODV is proposed in this paper which selects the path based on node energy. It calculates the remaining energy levels of the nodes before they are selected for routing path. A threshold value is defined and nodes are considered for routing only if its energy level is above this threshold value. This enforces a fair energy consumption rule on all the nodes of the network between source and destination. Another threshold value is defined which decides when to search for alternate path. If during traffic forwarding a node energy level falls below this threshold value, then the node search for its neighbour with high energy and bypass the traffic to the selected neighbour. This will keep the node from complete battery drain condition and increase the network lifetime. The proposed algorithm also drops some of the unnecessary RREQ randomly based on neighbour count of a node, which further reduce energy consumption of nodes and also reduce congestion during Route Discovery process without affecting the Performance of the routing protocol. The proposed IE-AODV (Improved Energy) is implemented in NS2 simulator. The simulation results have shown an increase in PDR, decrease in delay and throughput is maintained without inducing any significant overhead. The proposed IE-AODV provides more consistent and reliable data transfer compared to general AODV with less average energy consummation.

Varalakshmi *et al* [19]. In this paper, we propose an energy-efficient multipath routing protocol, called AOMR-LM (Ad hoc On-demand Multipath Routing with Lifetime Maximization), which preserves the residual energy of nodes and balances the consumed energy to increase the network lifetime. To achieve this goal, we used the residual energy of nodes for calculating the node energy level. The multipath selection mechanism uses this energy level to classify the paths. Two parameters are analyzed: the energy threshold and the coefficient. These parameters are required to classify the nodes and to ensure the preservation of node energy. Our protocol improves the performance of mobile ad hoc networks by prolonging the lifetime of the network. This novel protocol has been compared with other protocols: AOMDV and ZD-AOMDV. The protocol performance has been evaluated in terms of network lifetime, energy consumption, and end-to-end delay.

Manju Gaur*et al*[20]. The modified protocol is called secured efficient routing protocol (SEAODV). The SEAODV protocol based on two functions one is leader based function and one is message based function. The leader based function measure the distance of normal node and failure node. Our proposed algorithm is very efficient in compression in ADOV routing protocol. For the evaluation of performance our modified protocol tested in different network scenario tested through simulations for different distributions of nodes and failure and different connectivity models. Under all the evaluated scenarios, the technique demonstrates excellent detection probabilities.

Proposed Work

Intelligent power saver aware AODV protocol which overcomes the disadvantage of basic AODV and also serves an efficient routing protocol for adhoc networks which may take care of battery power needs. The prime focus of this strategy is to distribute the power consumption of the individual nodes and make the nodes reachable for high priority packets. During the development and design of InPSA-AODV protocol we have investigated several mechanisms.

Algorithm of InPSA-AODV

```
if packet type== AODV data packet

        if source address==current node address
                Drop the RTR route loop packet

        Else if !emergency packet && node energy <
threshold energy value Drop RTR no route.

        Else

                Forward the packet to next hop
        according to routing table

        End if
End if
```

The proposed work aims at discovering an efficient power aware routing scheme in MANETs and analyzing the derived algorithm with the help of Omnetpp. The proposed scheme SPSAR (Secure Power Save Aware) AODV is delivering more packets in different network scenarios as well as network life time of the SPSAR, SPSAR is better even in high mobility scenarios. Also protocol works especially well in terms of packet delivery and network lifetime. The process of checking the proposed scheme is on for more sparse mediums and real life scenarios and also for other metrics like Path optimality, Link layer overhead, total energy consumed etc. Although this scheme can somewhat enhance the latency of the data transfer but it results in a significant power saving and long lasting routes. This scheme is one of its types in ad hoc networks which can provide different routes for different type of data transfer and ultimately increases the network lifetime. In this protocol by using two-Fish Encryption algorithm packets are secure while transmission from source to destination.

Algorithm: SPSAR

If (TL = = NT)
    Let L Value received in M combination
    Lε1

    If (M = = 0)
        Send RERR_ACK to the source that path cannot be established.
    Elseif (m = = 1)
        Acknowledge the source with this path.

    Elseif (m> 1)

        Select the path with min {T_T_L} and acknowledge the source with the selected path.

    Else if (TL = = LT)
        Let L Value received in M combination

        L ε 2
        If (M = = 0)
            Send RERR no such path is possible.
            Elseif (M = = 1)
                Acknowledge the source with this path.
            Elseif (m> 1)
                Select the path with Min {TLT} and acknowledge the source with the selected path.
            End if
        End if
    End if
End If

Methodology

The four different algorithm is tested by the use of following factors

Consumed Energy

The number of nodes in the network versus the total consumed energy is considered as a metric.

Remaining Energy

The remaining energy available in each node after the transmission.

Packet Delivery Ratio [PDR]

This is the ratio of the data packets delivered to the destination to those generated by the traffic source.

Routing Overhead

Routing overhead is the number of routing packets transmitted per data packet delivered to the destination.

Normalized Routing Load [NRL]

This will be the ratio between the number of routing packets and the number of received packets. The Normalized Routing load must be low.

Throughput

It is the average rate of successful message delivery over the communication channel.

Simulation Model

A discrete event Omnetpp 4.3 was used for the simulation purpose [6].

Table 1. Simulation Parameters

Channel type	WirelessChannel
Radio-propagation Model	TwoRayGround
Antenna type	OmniAntenna
Interface queue type	Drop Tail /PriQueue
Maximum packet in Queue	50
Network interface type	Phy/WirelessPhy
MAC type	802_11
Topographical Area	600 x 600 m
TxPower	4.00W
RxPower	3.00W
IdlePower	1.0W
Transition Power	0.01W
Transition Time	0.003s
Sleep Power	0.004W
Total simulation Time	600 ms
Initial energy of a Node	300.0 Joules
Routing protocols	AODV
Traffic Model	FTP
Packet Size	1024 Bytes
Mobility Speed	10 m/s

Result and Discussion

In the Proposed comparison used around four different existing algorithm for energy saving. The table 2,3 and 4 shows the Packet Delivery Ratio, Normalized Route Load and Throughput. These three tables says normal comparison. It didn't show any changes

Table 2. PDR Comparisons

No of Node	Throughput (kBps)			
	AODV	InPSA-AODV	PSAR-AODV	SPSAR-AODV
10	46	65	64	66
20	42	64	60	61
30	41	63.5	64	63
40	40	63	61	61
50	40	62	61	60

Table 3. NRL Comparisons

No of Node	NRL (%)			
	AODV	InPSA-AODV	PSAR-AODV	SPSAR-AODV
10	0.32	0.15	0.16	0.165
20	0.5	0.28	0.29	0.3
30	0.68	0.39	0.39	0.45
40	0.7	0.38	0.395	0.42
50	0.72	0.37	0.375	0.4

Table 4. Throughput Comparisons

No of Node	Throughput (kBps)			
	AODV	InPSA-AODV	PSAR-AODV	SPSAR-AODV
10	46	65	64	66
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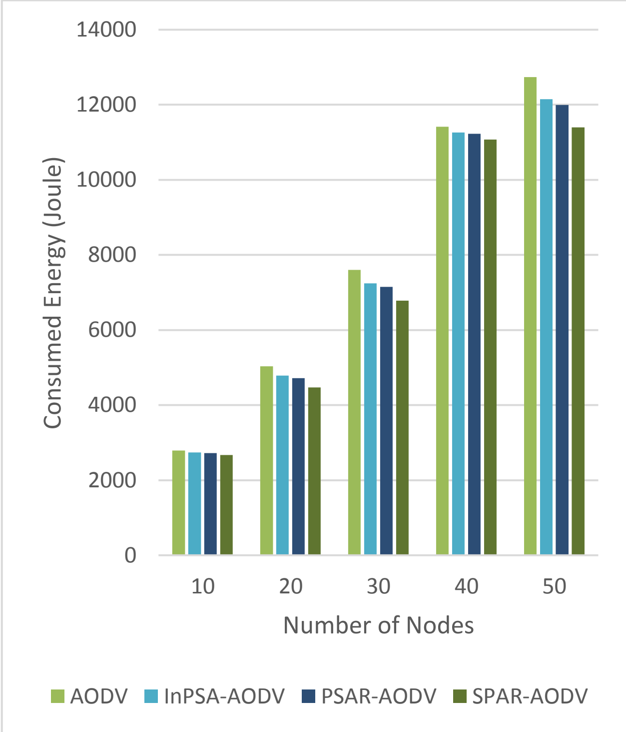

Figure 4. Consumed Energy Comparisons

The figure 4 and 5 shows the important graph that is the energy comparison. The existing algorithms gives moderate energy savings compare to the normal AODV

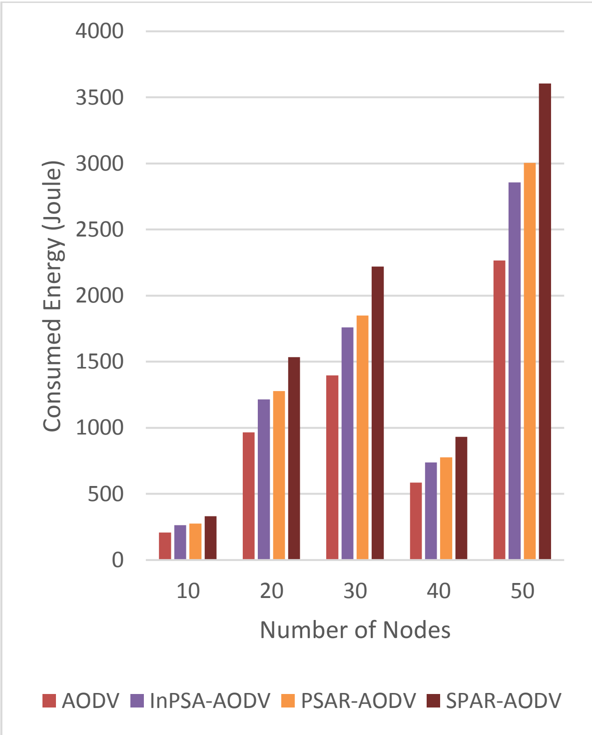

Figure 5. Remaining Energy Comparisons

Table 5. Energy Comparisons

No. of Nodes	AODV		InPSA-AODV		PSAR-AODV		SPAR-AODV	
	Remaining Energy	**Consumed Energy**	**Remaining Energy**	**Consumed Energy**	**Remaining Energy**	**Consumed Energy**	***Remaining Energy***	***Consumed Energy***
10	208.1324	2791.8676	262.2468	2737.7531	275.7753	2724.2246	330.9303	2669.0696
20	964.7701	5035.2298	1215.6103	4784.3896	1278.3203	4721.6796	1533.9843	4466.0156
30	1396.2204	7603.7795	1759.2377	7240.7622	1849.992	7150.008	2219.9904	6780.0096
40	584.8544	11415.1456	736.9165	11263.0834	774.932	11225.068	929.9184	11070.0816
50	2266.4013	12733.5986	2855.6656	12144.3343	3002.9816	11997.0183	3603.5779	11396.422

Conclusion

The existing algorithms for energy saving in the AODV gives moderate energy saving compare to normal AODV. But this evaluation is done in the normal scenarios without malicious nodes when the network has malicious in that the power consumption will be more. So the future MANET needs improved power aware technique for AODV.

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