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Optimization of Energy Efficiency using Directional Flooding Protocol in MANET

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Abstract*: The development in the field of wireless technology leads to the increase in application over wireless networks. This increased utilisation of wireless network promoted the research overthe energy efficient networks to generate maximum efficiency with limited battery resource. The mobile ad hoc network (MANET) is a type of wireless network in which the nodes are of mobile type. The nodes in MANET can move freely without any bound of limitations. The MANETS generate communication paths individually without the help of centralized infrastructure or centralised nodes like routers or switches. The communication is established using routing protocols which generates the path between sender and destination nodes, transfers data and control packets through the path and maintain the path information to renew the path in case of path failure. Some applications like military surveillance of the nodes in the MANET move randomly and update its location and information to the receiver node frequently. This leads to maximum consumption of energy in the nodes. The load balancing and energy efficient routing play a vital role in the MANET. A directional flooding approach is introduced to reduce the power consumption and extend the network life time. The performance of the directional flooding protocol was compared with on demand routing protocols like AODV and DSR routing protocol to measure the efficiency of the system in hardware environment.

Index Terms*: MANET, directional flooding, AODV, DSR, Energy efficiency.

I. INTRODUCTION

In last ten years, the use of mobile devices was increasing humongous. In a country, the significant proportion of human population and mobile devices are increased. Laptops, personal digital assistance (PDA) and mobile phones are frequently referred as “nodes” in mobile ad hoc networks (MANET). Any other personal devices with wireless interface card can also participate in the wireless network. A mobile device supports in different wireless communication technologies like wireless local area network, 3G, 4G network. These are the devices may choose the suitable interface to communicate the particular assumption.A wireless ad hoc networks have uniform features and yet to make changeover to the commercial world. Most of the real world deployments are fugacious and establish to allow the short-term communication. Some area of applications have as a part of field of battle communication in armed service operation, explore and deliver operation throughout a disaster, collection of information from uncongenial environment, communication for the purpose of education in schools, campus and conferences. Wireless ad hoc networks can play significant role in providing communication among the devices and passing data traffic into the internet infrastructure. Furthermore, the wireless ad hoc networks can be blended with the existing infrastructure in order to improve the network coverage, capability and measurability.

A node in a MANET is not just send or received the data, it also participate in forwarding data destined for other nodes. The skilfulness of MANET is well suited for some scenarios such as meetings, battlefields, and disaster hit areas. Network connections are implemented without any hassle and short time period. In additionally MANET is a highly spontaneous and dynamic network. Nodes can leave and join the network at any point of time without notification.

The protocols are designed for MANET. It is specially deploying a resource hungry application for example streaming in MANET. In the mobile nodes, the streaming application and the heavy burdens are very limited. The internet engineering task force’s have a MANET working group. This MANET working group is focusing on designing and developing protocol technologies. This protocol technology can enhance the mobile routing. There are various routing protocols has been designed for MANETs. The energy optimizations of routing protocols are designed for MANET. It can be performed at any layer of OSI stack. Although, attaining the high-energy efficiency, the protocols are used in each layer in OSI stack. Energy efficiency have been considered by taking two various aspects of routing protocol, the first is performance of the protocol and the other one is energy consumption of the protocol. The effect of certain factors is for example packet size, load, varying traffic patterns, and mobility rate. Both the real world test bed as well the simulated environment calculated the streaming energy efficiency. One of the crucial applications of streaming over MANET is a disaster recovery operation. Mobile devices that could be carried by rescue personnel. The rescue personnel is applied to stream live video captured by a cam to the central server. The streaming application over a MANETs is not only in rescue operation, also used to other applications is battlefields, entertainment purposes, and location-based services. Mobile Ad-Hoc networks offers to a number of benefits and it is suitable for wide range of applications.

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One of the main challenges in MANETs is that, the nodes generally have limited memory, processing capabilities.

II. LITERATURE SURVEY

Distributed solution based on density of network consists of two mechanisms. The first one is adjustable transmission ranges and clustering. Another one is the adjustable transmission range is using to attain the energy efficient design. An efficient broadcast system where nodes in a virtual backbone is used to forward the broadcast message. The virtual backbone is applying the Wu and Li's process and the density reduction process [1].

The Mobile Ad hoc Network (MANET) is related to infra structure fewer networks. The MANET word is taking from the contention collection of mobile devices. The contenting group of mobile devices could be reconfigured through wireless network. Due to the dynamic network of MANET network, its topology is uncertain and unpredictable [2].

In the MANET different reactive routing protocol was introduced. Then check the more performance metrics for example, end to end delay, throughput. These performance matrixes are to detect the routing protocol based on enforced condition within our network. Within the network the number of nodes has been increased up to 20 nodes [3].

Constructive Relay-Based Cooperative Routing (CRCPR) is presented in mobile ad hoc networks. Using topological information maintained and stored in a Cooperative Table and Relay Table. Constructive Relay-Based Cooperative Routing improves the resilience to mitigate the mobility problem through the self-managing to construct adequate relays. Constructive Relay-Based Cooperative Routing novel method is a route selection mechanism, energy harvesting, and to calculate the energy harvesting across the network is used [4].

Require to investigate the performance of different mobile ad hoc networking protocols (MANET). The Ad-hoc on-demand distance vector (AODV) and destination-sequenced distance-vector (DSDV) is our baseline of two used protocols within the reactive and proactive routing. Compare with the performance of an ant colony implementation optimization Ant Hoc Net [5].

An Efficient Network distributed Planning and Routing system in Large-Scale mobile Ad hoc networks (MANETs) is presented. There are three protocols are composed. The first protocol is fast-distributed connected dominating set (FDDS), this will constructs the virtual backbone through the fast distributed hierarchical algorithm. Another protocol FDDS<-M is the distributed maintenance protocol. The third protocol FDDS-R.is a fuzzy logic controller, it can easily in existing link [6].

An unmanned aerial vehicle (UAVs) has enormous potential in the civil and public domains. These two domains are very useful applications, where the human lives otherwise endangered. Multi Unmanned aerial vehicles scheme is more economically and efficiently as compared with the single unmanned aerial vehicles scheme. Major problems to be resolved before using the unmanned aerial vehicles, this can be provide the reliable and stable context-specific networks [7].

Adaptive Topology Control for Mobile Ad Hoc Networks (MANET) is presented. The control protocol is permits the each node to energy efficient routing or conserve its own energy. However, it could drastically shrink the broadcasting power of the beacon messages for the mobile nodes. Need to prove that any change and reconstruction of broadcasting radius converge within five or four beacon intervals [8].

Mobile ADhoc Networks (MANET) is the collection of wireless mobile nodes, it will form a network topology. Each node is communicated by the wireless links; it requires effective dynamic routing protocols. The wireless network transmission range is limited, so if any nodes want to interchange the data with the other nodes throughout the network, it requires multiple hops. Stationary infrastructure is not available in wireless network, for example base stations. Mobile nodes require to operates as routers to preserve the data about the wireless network connectivity. Routing protocols are presented for ad hoc wireless networks. The performance of two reactive MANET routing protocols require to compare. The first one is Ad Hoc On-Demand Distance Vector Routing (AODV) and the other one is Dynamic Source Routing (DSR) [9].

The routing protocols can be providing benefits to mobile ad hoc networks (MANETs) for both the reliability and performance. Require to compare the MANET protocols between the Ad Hoc On-Demand Distance Vector Routing (AODV) and destination-sequenced distance-vector (DSDV). The performance matrix involves the throughput and Delay [10].

A Device-Energy-Load Aware Relaying (DELAR) Framework for Heterogeneous Mobile Ad Hoc Networks (MANETs) are presented. The heterogeneous MANETs are having the normal nodes (B-nodes) as well as powerful nodes (P-nodes). DELAR frameworks are to attain the energy conservation in heterogeneous mobile ad hoc networks. However the "mini-routing" is initiated to the data link layer & Asymmetric MAC system. The MAC system is supporting to the MAC-layer over the unidirectional links. This MAC-layer induced by the asymmetric transmission power levels among the normal nodes and powerful nodes [11].

Mobile ad hoc networks (MANETs) routing protocols Taxonomy is presented. There are number of MANETs routing protocols to detect the path form the source to destination. This protocol can be classified and categorized. These classifications are helps to analyzing, evaluating, understanding and comparing. This classification can help to designers and researchers to differentiate the functions of the protocols & to detect the relationships among them. This protocol cannot involve any one classification and one category [12].A new opportunistic routing protocol, called JOKER is presented. As well as the routing protocol presented for the coordination phases, and candidate selection.

The routing protocols are allows to maximum performance of the supporting network multimedia traffic as well improves the nodes energy efficiency. JOKER is compared with a various test-benches along with the BATMAN routing protocol. This protocol is supporting to the demanding service for example video streaming [13].

A mobile ad hoc network (MANETs) is the computational device that produces the random topology for communication. The MANET is not required the central controller or the base station. The MANET is using for networks, it working as a router as well host. The routing protocol used in MANET, this is classified into three category- reactive, proactive and hybrid routing protocol [14].

To Evaluate the Impact of Vector Mobility Model over Routing Protocols in (MANETs) is presented. In mobile ad hoc networks (MANETs) system, the nodes are free to move randomly. Therefore, that wireless topology maybe changes rapidly and may unpredictable. Different mobility characteristics are expected to significant impacts in the performance of the routing protocols [15].

III. METHODOLOGY

In Mobile Ad hoc wireless sensor network, the node move freely without any restriction. In MANET, network nodes mobility and distance make hard for transmitting node to deliver the packet to destination node. Since, the nodes are mobile and free moving without any restriction, it is unlikely for routing protocols to determine a definite path between the sender and receiver. In situations where transmitter and receiver nodes are in close vicinity, it may be easy to find the route however, the time taken to determine the route between sender and receiver is high due to propagation delay. Furthermore, the control signal from sender to destination increases network overhead. Hence, flooding scheme implement to increase data reliability and reduce route computation time in MANET.

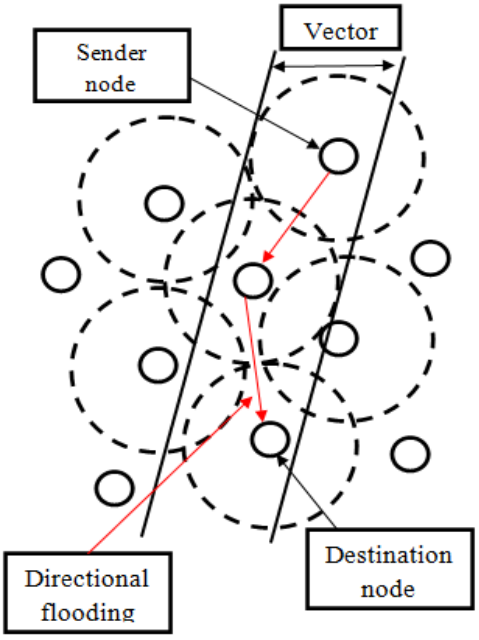

Fig.1. Directional flooding in MANET

In flooding scheme, the data from sender node sends to all the other nodes in its vicinity. The data transmission continues until the data packet reaches the destination node. The approach increases energy consumption across all nodes and increases network overhead. Conventional routing algorithms such as AODV and DSR routing protocol apply to route data packets to destination node in MANET. In AODV, the route between transmitter and receiver node establish by sending route requests to all the nodes in network. The route request increases in size until the route request reaches the destination. Up on successful route request reception, acknowledgement message is sent to base station for framing routing path. The chances of encountering destination node by route discovery messages increase by DSR routing protocol. In DSR, the transmitter node floods the entire network with Route request message to find destination node. If the Route Request message is positive, route between sender and receiver node frame with acknowledgement signals. In both AODV and DSR routing scheme, considerable energy waste and network overhead increase due to Route request message. The network overhead and energy consumption overcome by Directional flooding scheme. In directional flooding the data flow through in one direction unlike in Flooding scheme. The flooding scheme depends on node coverage region and vector of the nodes in MANET. The vector frame with knowledge of both sender node and receiver node. Once, the vector is framed, only the intermediate nodes in vector participate in data flooding as shown in figure 1. The control messages are sent to intermediate nodes to participate in data forwarding. If the data reaches any node outside of vector then the node discards the data. The process repeats itself till the data packet reaches destination node.

Fig.2. MANET node placement

The performance of the directional flooding is mapped and compared with the AODV and DSR routing algorithms. The efficiency of the routing algorithm is measured based on the total energy consumed by the network during the fixed time period. The algorithm was implemented in hardware environment to analyse the performance of the network in real time situations. The directional flooding, AODV and DSR routing protocols are developed using c language and executed in the mobile nodes (Laptops). The nodes are selected with configuration of I5 processor and 4 GB RAM. The nodes are connected through the Wi-Fi network directly to each node. Figure 2 shows the placement of nodes for testing the performance of the routing protocols.

IV. RESULT AND DISCUSSION

The directional flooding is developed in hardware platform and the performance of the routing algorithm is compared with the efficiency of the AODV and DSR routing protocols. The performance metrics like bandwidth consumption, bit error rate, energy efficiency, delay and turnaround time was measured. The figure 3 shows the throughput of the MANET. The throughput is a measure of maximum bandwidth consumed by the network during the execution time. The bandwidth consumption is measured by varying the distance between the sender and receiver node. The directional flooding algorithm generates maximum throughput of about 1.12Kbps, AODV generates 1.02Kbps and DSR generates 0.91 Kbps. The bandwidth consumed by the Directional flooding protocol is 36.72% higher than DSR ad AODV protocol.

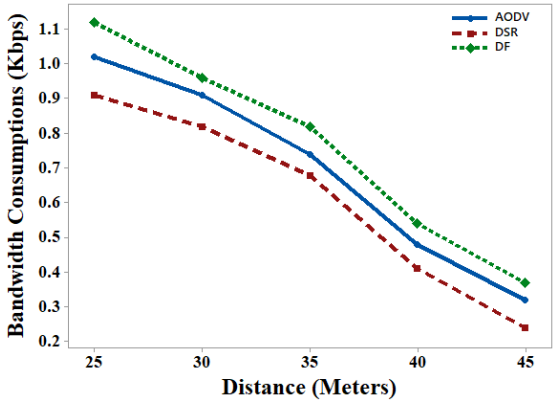

Fig.3. Bandwidth Consumption

Energy consumption is total energy consumed by the node during the communication. Battery power is one of the scares resources in MANET. Therefore, reduction in power consumption improves the efficiency and lifetime of the network. The figure 4 shows the energy consumed by the network by implementing the routing algorithms like AODV, DSR and directional flooding. The power consumption is measured by changing the transmission time between nodes in the MANET. The consumption of energy increases dynamically above 120 minutes of transmission time. The directional flooding consumes 49% of total battery power, which is 10% lower than AODV and DSR routing protocol.

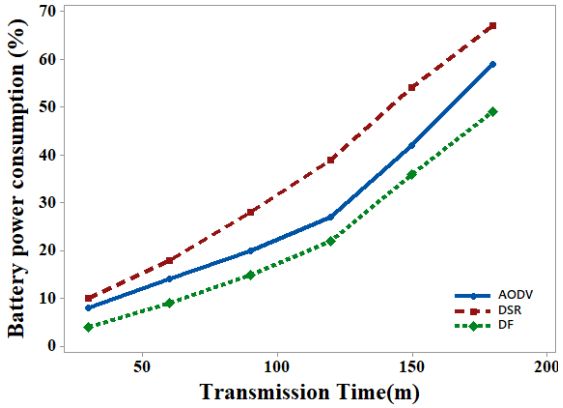

Fig.4. Energy consumption

Delay is the measure of time taken by the data packet to reach the destination node from the sender node. The delay in transmission was calculated by changing the packet size of the transmitted data packet. Delay increases when the packet loss ratio and retransmission rate increase in communication. Increase in packet size increases the probability of packet drop when the network is placed in the noisy environment. The increase in the delay is plotted for the routing protocols like AODV, DSR and Directional flooding. AODV and directional flooding protocol generates similar delay time at packet size of 25 and 30 bytes. Directional flooding generates 32% lesser delay then AODV and DSR routing protocols. Increase in delay reduces the efficiency of the network.

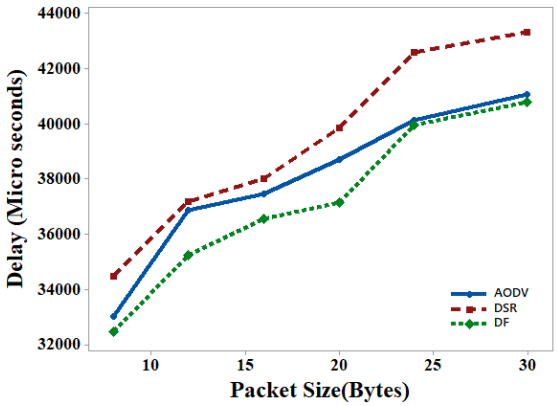

Fig.5. End to End Delay

The transmitted bits can be corrupted and generates errors at the receiver side due to the presence of noise in the network. The SNR value of the network is fixed as 6 and the bit error rate is measured for AODV, DSR and Directional flooding protocols. The Figure 6 shows the Bit error rate plot for the protocols with amount of packets transferred between the nodes in MANET. The DSR routing protocol generates higher bit error rate at 150bytes of data packet transferred in the channel.

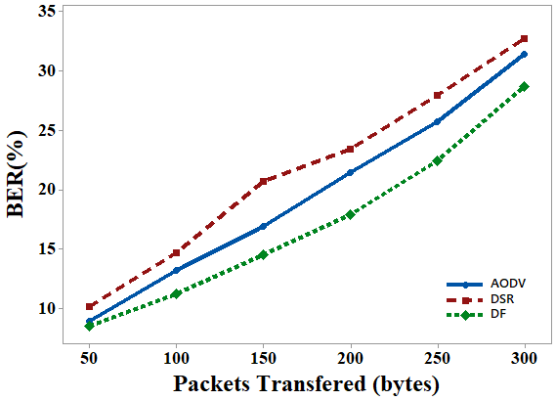

Fig.6. Bit error rate

The directional flooding generates the maximum bit error rate of 28.7 %, which is 31 percentage of total error generated by the AODV and DSR routing algorithm.

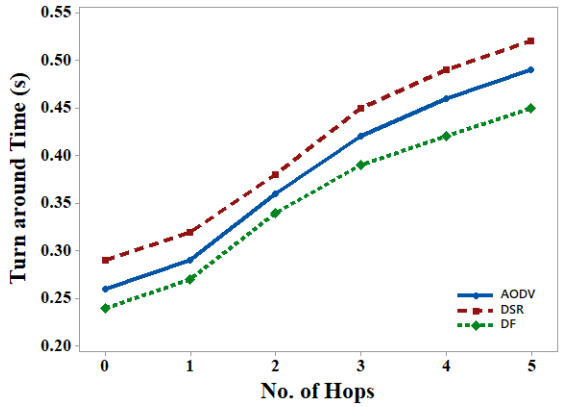

Fig.7. Turnaround time

Turnaround time is the measure of time taken by the processor to execute a complete cycle of operation. It represents the processing time, which includes identifying the path between the sender and receiver node, data packet transmission and path maintenance. Increase in turnaround time increases the processing time, parallel increases the power consumed by the node for processing. Figure 7 shows the turnaround time measured from the MANET with different routing protocols. The turnaround time is measure by varying the number of hop counts between the sender and receiver node. The reduction in the turnaround time shows the efficiency and simplicity of routing protocol. The directional flooding generates the turnaround time of about 0.45 seconds. It is 7% lower than the DSR and AODV routing protocol.

V. CONCLUSION

Energy efficiency in mobile ad hoc network is an important aim in the development of routing protocol. Due to the mobility of the nodes, energy efficiency during data packet transmission plays an important role in MANET. Direction flooding protocol is developed and the performance is compared with the on demand routing protocols like AODV and DSR routing protocol. A hardware system is designed to measure the performance metrics of the routing protocols. From the results, the directional flooding protocol provides 36.7% higher efficiency than AODV and DSR protocols and consumes energy of about 49% from total battery power.

REFERENCES

1. J. Wu, S. Member, and F. Dai, “Virtual Backbone Construction in MANETs Using Adjustable Transmission Ranges,” *1188 IEEE Trans. Mob. Comput. VOL. 5, NO. 9, Sept. 2006 Virtual*, vol. 5, no. 9, pp. 1188–1200, 2006.
2. A. K. S. Ali and U. V. Kulkarni, “Comparing and analyzing reactive routing protocols (aodv, dsr and tora) in qos of manet,” *Proc. - 7th IEEE Int. Adv. Comput. Conf. IACC 2017*, vol. 4, no. 5, pp. 345–348, 2017.
3. T. K. Araghi, M. Zamani, and A. B. T. Abdul Mnaf, “Performance analysis in reactive routing protocols in wireless mobile Ad Hoc networks using DSR, AODV and AOMDV,” *Proc. - 2013 Int. Conf. Informatics Creat. Multimedia, ICICM 2013*, vol. 4, no. 5, pp. 81–84, 2013.
4. J. Bai, Y. Sun, C. Phillips, and Y. Cao, “Toward Constructive Relay-Based Cooperative Routing in MANETs,” *IEEE Syst. J.*, vol. 12, no. 2, pp. 1743–1754, 2018.
5. C. Brill and T. Nash, “A comparative analysis of MANET routing protocols through simulation,” *2017 12th Int. Conf. Internet Technol. Secur. Trans. ICITST 2017*, vol. 5, no. 4, pp. 244–247, 2018.
6. W. El-hajj and A. Al-fuqaha, “On Efficient Network Planning and Routing in Large-Scale MANET,” *3796 IEEE Trans. Veh. Technol. VOL. 58, NO. 7, Sept. 2009*, vol. 58, no. 7, pp. 3796–3801, 2009.
7. L. Gupta, R. Jain, and G. Vaszkun, “Survey of Important Issues in UAV Communication Networks,” *IEEE Commun. Surv. Tutorials*, vol. 18, no. 2, pp. 1123–1152, 2016.
8. A. A. K. Jeng and R. H. Jan, “Adaptive topology control for mobile ad hoc networks,” *IEEE Trans. Parallel Distrib. Syst.*, vol. 22, no. 12, pp. 1953–1960, 2011.
9. K. Kanchan and S. C. Gupta, “Effects of traffic density on performance of reactive routing protocols,” *CARE 2013 - 2013 IEEE Int. Conf. Control. Autom. Robot. Embed. Syst. Proc.*, vol. 4, no. 5, pp. 1–6, 2013.
10. D. Kumar, A. Srivastava, and S. C. Gupta, “Routing Protocols for MANET,” *Perform. Comp. Pro-active React. Routing Protoc. MANET Deep.*, vol. 4, no. 6, pp. 1–4, 2011.
11. W. Liu, C. Zhang, G. Yao, and Y. Fang, “DELAR: A device-energy-load aware relaying framework for heterogeneous mobile ad hoc networks,” *IEEE J. Sel. Areas Commun.*, vol. 29, no. 8, pp. 1572–1584, 2011.
12. N. H. Saeed, M. F. Abbod, and H. S. Al-Raweshidy, “MANET routing protocols taxonomy,” *2012 Int. Conf. Futur. Commun. Networks, ICFCN 2012*, vol. 4, no. 5, pp. 123–128, 2012.
13. R. Sanchez-Iborra and M. D. Cano, “JOKER: A Novel Opportunistic Routing Protocol,” *IEEE J. Sel. Areas Commun.*, vol. 34, no. 5, pp. 1690–1703, 2016.
14. A. K. Sharma and M. C. Trivedi, “Performance comparison of AODV, ZRP and AODVDR routing protocols in MANET,” *Proc. - 2016 2nd Int. Conf. Comput. Intell. Commun. Technol. CICT 2016*, vol. 4, no. 5, pp. 231–236, 2016.
15. Suryakant and N. Kushwaha, “To evaluate the impact of vector mobility modelover routing protocols in MANET,” *Proc. 2014 Conf. IT Business, Ind. Gov. An Int. Conf. by CSI Big Data, CSIBIG 2014*, vol. 4, no. 5, pp. 1–6, 2014.
16. S.Omkumar and S.Rajalakshmi, ”Analysis of Quality of Service using Distribution Coordination Function in Aodv” European Journal of Scientific Research, Vol.58 No.1 , 2011, pp 6-10.
17. S.Omkumar and S.Rajalakshmi, “Improving QoS of Ad-hoc Networks by using SNR and T-AODV Routing Protocol”, Asian Journal of Scientific Research, pp 1-8, Oct 2013.