VOL. 13, NO. 11, JUNE 2018 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

ZONE BASED ROUTING PROTOCOL WITH IMPROVED LOCATION ESTIMATION FOR MANET

G. T. Chavan and Vemuru Srikanth
Department of Computer Science Engineering, K. L. University, Vijayawada, India
E-Mail: gt.chavan@gmail.com

ABSTRACT

Due to inherent dynamicity of nodes in Ad-hoc networks, it requires continuous re-broadcasting from one node to another to calculate best route from source to destination. In this paper, we have introduced a novel approach that performs zone based smart re-broadcasting and thereby reduces the flooding of data and energy consumption. Further, this method was combined with location estimation algorithm. Although, Zone-Based Optimal Selective Forwarding (ZBOSF) gives superior results compare to conventional routing protocols but estimated location is not precise. Therefore, to achieve efficient localization and at the same time to keep the energy consumption low we have coalesced DV-distance algorithm for location estimation with ZBOSF. As distance estimations become more correct DV-Distance method provides more accurate position information. Hence, we used Received Signal Strength based DV-distance because of its more accurate distance estimations. Localization with received signal strength (RSS)-based DV-distance not only provides more accurate position information but also eliminates the need for additional hardware.

Keywords: zone-based optimal selective forwarding (ZBOSF), received signal strength (RSS), ZBOSF with improved location estimation (ZBOSFWL), global positioning system (GPS), localization.

1. INTRODUCTION

A mobile ad-hoc network (MANET) is a kind of structure-less wireless network that is organized by mobile nodes communicating with one other spontaneously and dynamically. Owing to limited resources at each node in MANET, routing has become core issue of research. Most routing protocols utilize absolute broadcasting to determine new routes. With growth in number of wireless network applications, MANET will become dense and large because more and more mobile devices are required to be interconnected. In such situation, with no intelligent broadcasting may cause message collision and useless recalculation which in turn can cause latency and energy loss. There is a need to fix these redundant broadcasts. This paper proposes a novel solution of zone based selective forwarding and at the same time to ensure the coverage of whole network area.

ZBOSF initially identifies location of each node followed by disintegrating the whole network into six different zones. Location information obtained from localization algorithm that is used in initial step in ZBOSF does not give accurate locations. Therefore, to achieve a highly efficient localization for each node, we amalgamated the novel zone based approach with better a better localization algorithm.

In a self-structured wireless network such as a mobile ad-hoc network, nodes can establish the reliable affiliation with only their immediate neighbors through data connections. The nodes with already known positions act as anchor node for other mobile nodes. Therefore, localizations processes are required to propagate location data throughout the network to establish the position information for all nodes in the network. Starting with each anchor, a node propagates information to its immediate first-hop neighbors only. Based on the propagated information the amount of flooding and power consumption varies.

Localization in mobile ad hoc network is one of the very keen research areas. There are many existing highly efficient localization techniques available. DV-hop is most common and much simpler in implementation and computation [25]. DV-hop propagates hop count information across the network. One of the key disadvantages of DV-hop algorithm is that it is most suitable only for networks where hop length is consistent across all sections of the network. Another variation Ad-hoc positioning system is DV-distance algorithm which propagates cumulative distance information through the network instead of hop counts. In our research work we utilized Received Signal Strength (RSS) based DV-distance algorithm. RSS based provides better distance estimates. DV-distance with RSS based distance estimates not only overcomes limitations introduced due to anisotropic network conditions but also eliminates the need for other external hardware.

To overcome this location estimation and accuracy trade-off introduced in our novel approach, we propose a modified Zone-based selective forwarding with improved location estimations (ZBOSFWL).

Whatever remains of the paper is organized as follows: the successive section summarizes similar efforts performed in current analysis, Section 3 explains proposed Zone based framework of routing protocol and furthermore portrays the working procedure. Section 4 exhibits simulated outcomes by required graphs. And next section 5 contains concluding remarks. Last section incorporates reference papers.

2. LITERATURE SURVEY

Many protocols use location information in routing and utilize GPS technology for location estimation of mobile nodes. Reliability and better scalability are the primary benefits of this generation [2 and 7]. Location Aided Routing (LAR) is a routing protocol that diminishes

the region of flooding based on the location information of source and destination [7, 10 and 20]. Different authors proposed various different routing protocols such as DREAM [9], Cluster Based Location Routing (CBLR) [1], and LABAR [3] that are likewise in view of GPS innovation and consolidate location information in routing process. Flooding based routing conventions such as AODV, Dynamic Source Routing reasons overhead issue [22 and 23]. To lessen the network overhead, a confined flooding based routing protocol is acquainted by Plestys that minimizes the area of requestor by way of using the strength of signal [8].

However GPS technology is expensive and calls for excessive power computations. Therefore, localization does keep a superior answer for MANET [19, 6, 16 and 17]. Numerous localization algorithms are suggested and overview of a few is given right here. Among all sort of localization, distributed localization is extensively used. All nodes inside the network exchange its own statistics with others and keep away from the problem of flooding. By using this manner it reduces the energy consumption and enhances effectiveness [18].

A distributed hybrid approach of distance vector and GPS triangulation for location estimation is proposed by Niculescu. It provides global coordinates through region estimation and reduces the computation fee with the aid of recomputing the coordinates of moving nodes only [21]. DV-hop is very low cost and most commonly used algorithm of distributed localization. It is analyzed and a new improved algorithm based on multilateral technique is suggested by Qingling. To reckon the distance, it incorporates the overall average per hop distance and improves the efficiency of location estimation [11].

To increase the precision result of location estimation, DV- distance is recommended by many authors [17, 18, and 21]. This approach makes use of distance measure in meters over hop count to calculate the distance among nodes. The other variation of DV-hop is DV-position based localization algorithm that desires excessive precision of perspective dimension or angle measurement to confirm the area of nodes [24]. Performance of Various multilateration techniques is evaluated by savvides and a new fine-grained localization method is proposed that estimates distance based on maximum likelihood estimator yet it is reasonable for small region network [14].

Another Zone Based Effective Location Aided Routing Protocol is suggested by G.T. Chavan that increases the scalability and diminishes the overhead of routing [4]. However there is a scope of improvement and author suggested a new zone based approach (ZBOSFWL) to increase the efficiency of location estimation.

3. PROPOSED METHODOLOGY

To reduce routing overhead and energy consumption of conventional routing protocols for MANET, a novel approach that integrates location of mobile nodes is proposed.

3.1 Zone-Based Optimal Selective Forwarding (ZBOSF)

It is executed in two different phase as-

Phase 1: In the initial phase, the location estimation algorithm finds the location of all the nodes which are available in the network. Accumulator (A) collects information of neighbors along with distance (d) between mobile nodes. Relying upon Angle of arrival (AOA), Mobile Host Node (MHN) creates zones and inform zone ID to all nodes present in network. It also prepares position table.

Phase 2: In this phase, actual data transmission is performed. If Src_Zone_ID and Dest_Zone_ID are same then data transmission is directly performed using LAR2 protocol. However in different case MHN comes in picture along with LAR2 protocol.

ZBOSF lessens the area of discovering a new route to smaller zones thereby brings down the energy consumption of mobile nodes and conjointly reduces flooding of data packets. But the estimated distance is not accurate and the presence of measurement errors demands a new location estimation technique [25].

LAR2 Algorithm

Data transmissions are performed using Location Aided Routing Protocol and working process is explained by following steps and using Figure-1.

Step1: Src_N knows the location (X_d, Y_d) of Dest_N.
Step2: Src_N determines its distance from location (X_d, Y_d) called it as $DIST_s$.
Step3: Node I receives the route request, determines its distance from location (X_d, Y_d) known as $DIST_i$.
Step4: If $DIST_s \geq DIST_i$, node I replace $DISK_s$ by $DISK_i$ and forward the request to its neighbors; else discards the route request.

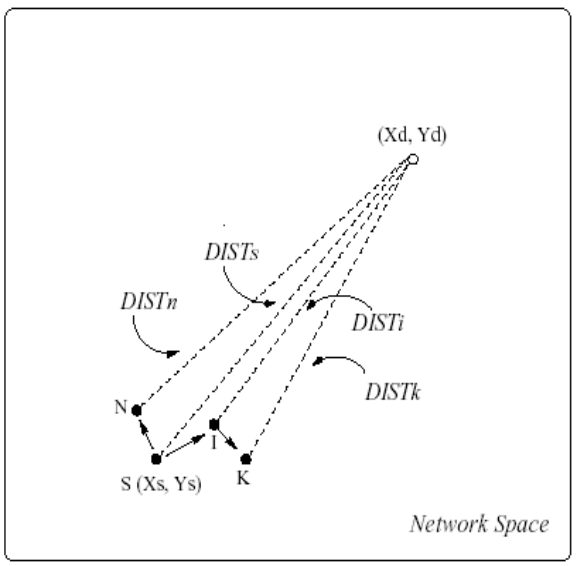

Figure-1. Distance used in LAR2 protocol.

3.2 ZBOSF with Improved Location Estimation (ZBOSFWL)

One of the major aims of ZBOSFWL system is to enhance location accuracy and to lessen GPS nodes in MANET. In this protocol DV –distance Propagation Method is used for location estimation. The conventional method makes use of GPS trilateration for distance measurement but presence of errors needs higher fractions of landmarks. In proposed protocol, received signal strength (RSS) value is used for distance measurement.

Working of this Protocol is same as ZBOSF protocol however the only difference is with Location Estimation. In this strategy each node maintains a list of reference nodes (GPS nodes). The Reference node broadcasts their position information to their neighbors and neighbor estimates distances using RSS value. Each neighbor broadcasts distances to reference nodes to their neighbors and using distance Propagation, every Node in the n/w gets their respective locations i.e. Exact Global Location. Figure-1 demonstrates actual working process.

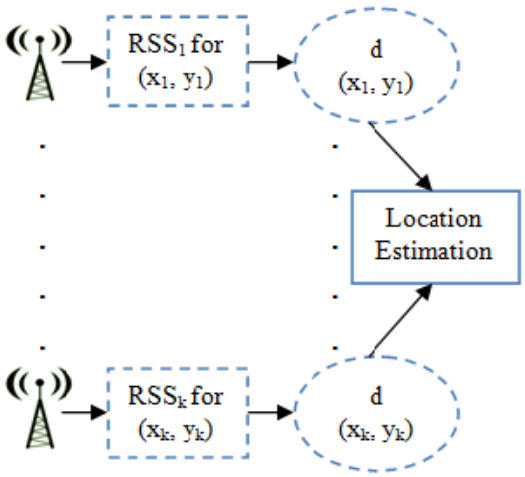

Figure-2. RSS based location estimation.

The basic concept used in localization estimation can be illustrated by following equation

$$RSS = PS_t - PL(d_0) - 10\beta \log_{10} d/d_0 + X_{\sigma RSS} \quad (1)$$

Where RSS is used to represent the received signal strength and its measuring unit is dBm. Here d is the distance between sender and receiver, β indicates path-loss exponent, the symbol PS_t shows sender's power and $PL(d_0)$ is the loss of power at reference distance d_0.

XσRSS is a variable indicates the noise present and is also treated as Gaussian random variable having variance σRSS. The measuring unit of PSt, PL(d0) and XσRSS is decibels with respect to mill watts (dBm). To compute distance đ, RSS is mapped to đ by following equation 2,

$$đ = n10^{(PS_t - RSS + X_{\sigma RSS})/(10\beta)} \quad (2)$$

Here n is a constant that integrates both $PL(d_0)$ and $\beta \log_{10}(d_0)$. After calculating the value of distance đ, data transmission is performed as same as in ZBOSF.

4. RESULT SIMULATION

For analysis purpose, NS-2, network simulator is used with 200 number of nodes and at constant bit rate traffic.

We have compared the performance of ZBOSF and ZBOSFWL with conventional ZBELAR and AODV routing protocol. Performance results obtained as throughput, Delay, Energy consumption, Routing overhead and Jitter against speed of nodes, number of nodes and Interval are shown by following figures (Figure-2 to Figure-10).

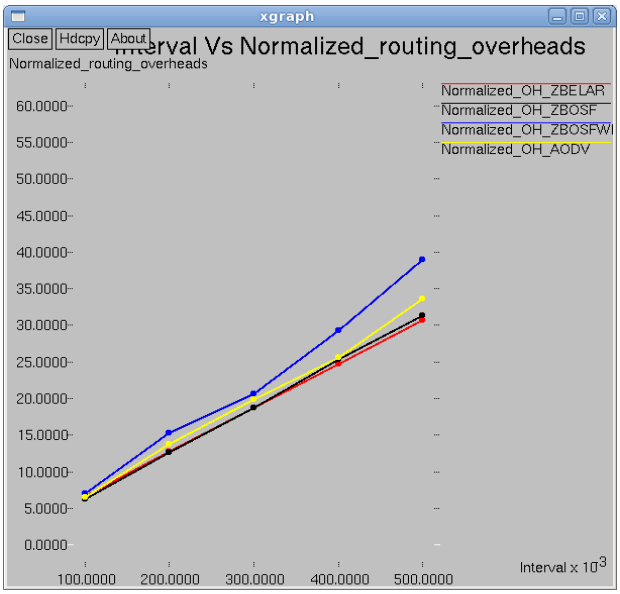

Figure-3. Simulation results of interval vs routing overhead.

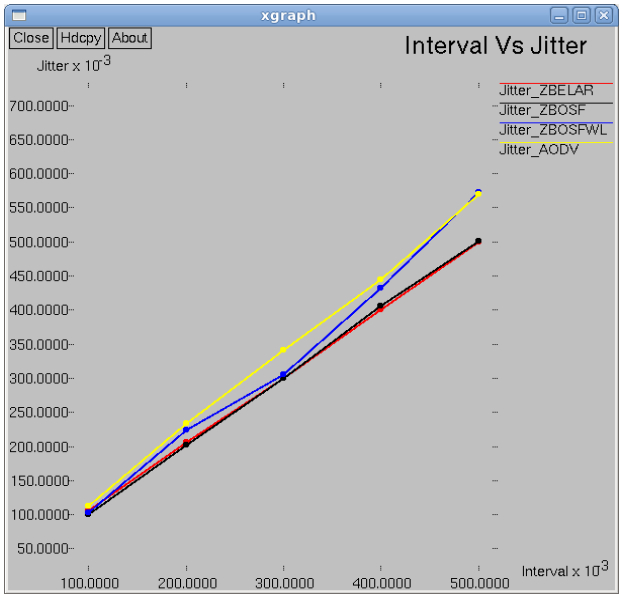

Figure-4. Simulation results of interval vs Jitter.

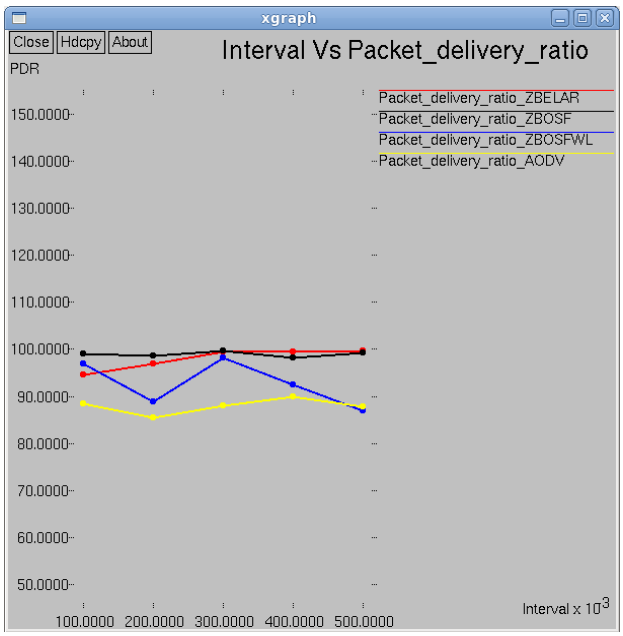

Figure-5. Simulation results of interval vs PDR.

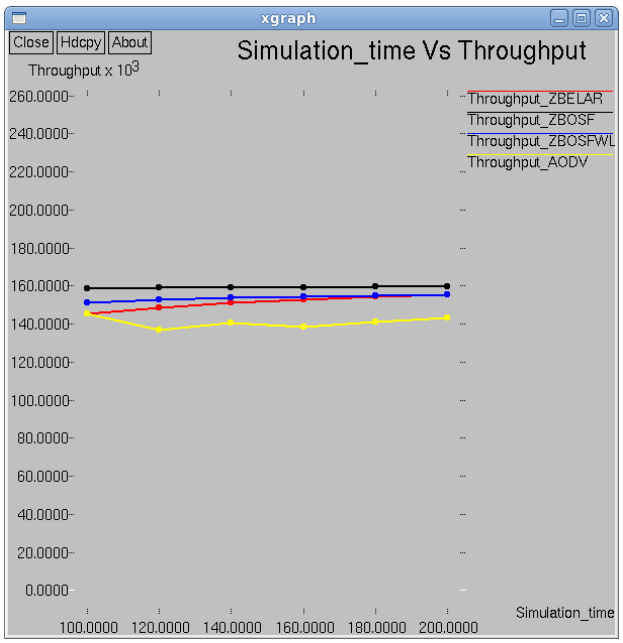

Figure-7. Simulation results of time vs throughput.

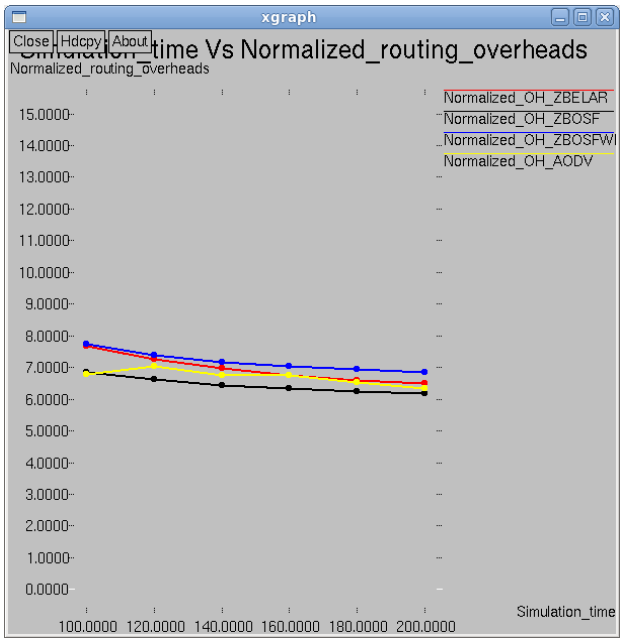

Figure-6. Simulation results of time vs routing overhead.

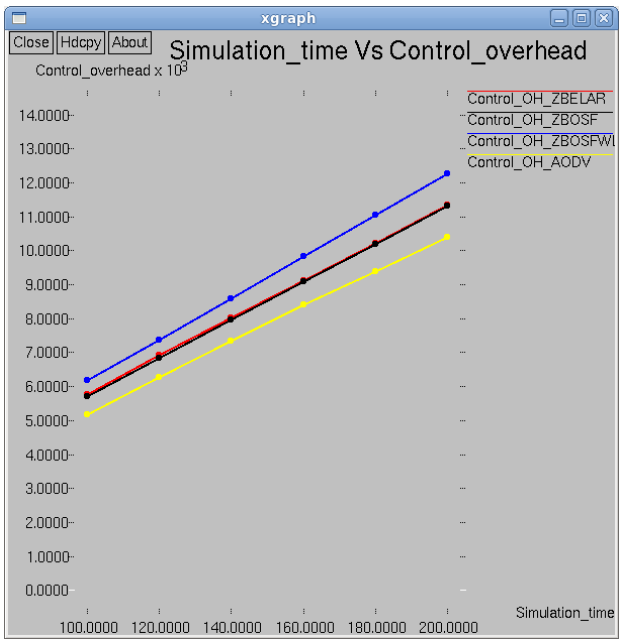

Figure-8. Simulation results of time vs control overhead.

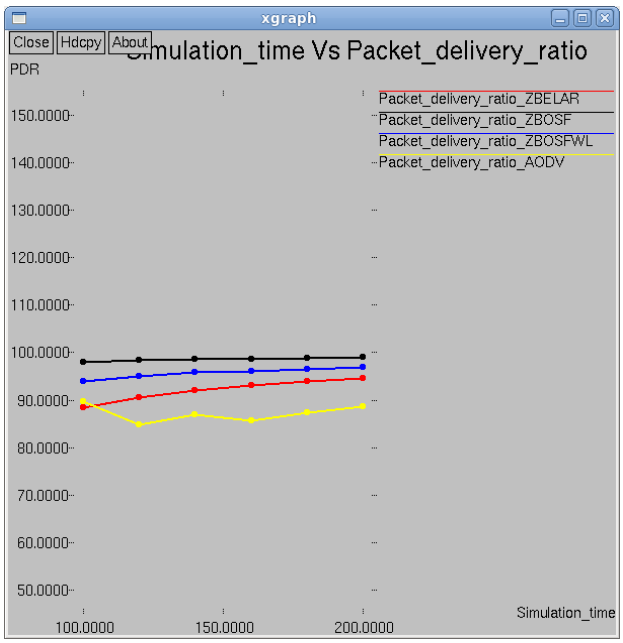

Figure-9. Simulation results of time vs PDR.

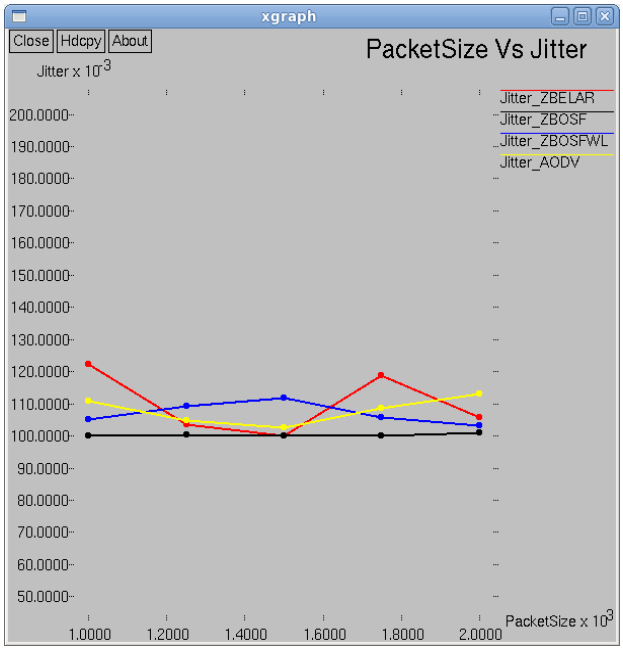

Figure-10. Simulation results of packet size vs Jitter.

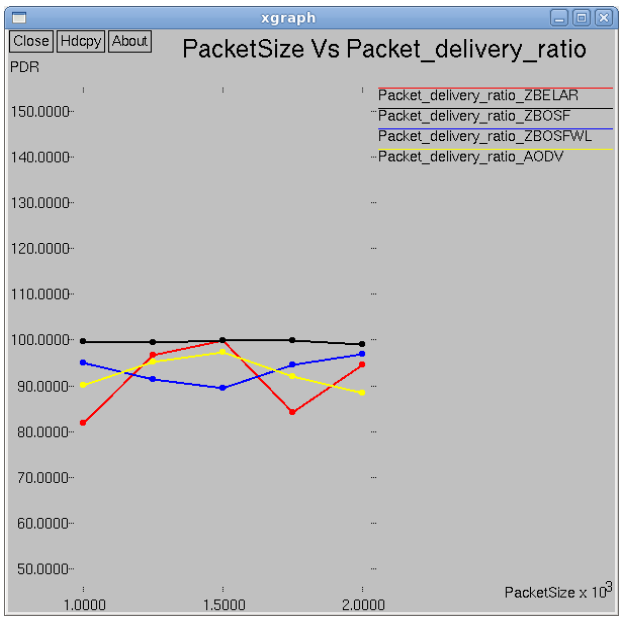

Figure-11. Simulation results of packet size vs PDR.

The variation in results exhibit that Compared with ZBOSF protocol the throughput and PDR of ZBOSFWL is low but higher than AODV protocol. And Overhead in ZBOSFWL is more contrast to ZBOSF protocol.

For further clarity a comparison Table-1 is drawn to elucidate the results obtained from various routing protocols.

5. CONCLUSION AND FUTURE WORK

This paper presented a zone based Routing Protocol to reduce the energy consumption and routing overhead. The comparative results demonstrate that ZBOSF outperform compare to AODV and ZBELAR but estimated location is not accurate.

To precise the accuracy result of location estimation and to reduce the trade-off between energy consumption and efficient location estimation, a ZBOSFWL incorporates RSS based DV distance propagation method for location detection. Compared to ZBOSF protocol, the performance of ZBOSFWL is low but higher than AODV protocol. Though the performance is not superior then ZBOSF protocol and actual data transmission process is same as of ZBOSF, main advantage of ZBOSFWL is, it estimates proper location of nodes and improve the efficiency of localization.

We have only considered the position of source node and destination node. Future work includes the dynamic behavior of mobile nodes and improves the efficiency of routing protocol.

Table-1. Comparative results of different simulated routing protocols.

No.	Parameter	ZBELAR	ZBOSF	ZBOSFWL	AODV
		Interval Vs			
1	PDR	Highest	Highest	High	Low
2	Routing Overhead	Low	Lowest	Highest	High
3	Jitter	Lowest	Lowest	Low	Highest
		Simulation Time Vs			
4	Routing Overhead	Medium	Lowest	High	Med
5	Throughput	High	Highest	High	Low
6	PDR	Medium	High	High	Low
7	Control Overhead	Medium	Medium	High	Low
		Packet Size Vs			
8	PDR	Low	High	Low	Low
9	Jitter	Low	Lowest	High	Medium

REFERENCES

[1] R. A. Santos, R. M. Edwards and A. Edwards. 2004. Cluster-based location routing algorithm for vehicle to vehicle communication. IEEE Radio and Wireless Conference. pp. 39-42.

[2] Chen Junyan, Liu Cheng, Xiong Huagang and Chen Youzi. 2010. An Efficient Location-Aided Link State Routing Protocol for MANETs. IEEE. pp. 1827-1830.

[3] Gergely V. Záruba, Vamsi K. Chaluvadi and Azeem M. Suleman. LABAR: Location Area Based Ad Hoc Routing for GPS-Scarce Wide-Area Ad Hoc Networks. Proceedings of the First IEEE International Conference on Pervasive Computing and Communications (PerCom'03), pp. 509-513.

[4] G.T. Chavan and Vemuru Srikanth. 2013. Zone Based Effective Location Aided Routing Protocol for MANET. AIM/CCPE, Springer-Verlag Berlin Heidelberg. pp. 404-407.

[5] Manoon Kummakasikit, Sakchai Thipchaksurat and Ruttikorn Varakulsiripunth. 2005. Performance Improvement of Associativity-Based Routing Protocol for Mobile Ad Hoc Networks. IEEE. pp. 16-20.

[6] Mohammad A. Mikki. 2009. Energy Efficient Location Aided Routing Protocol for Wireless MANETs. (IJCSIS) International Journal of Computer Science and Information Security. 4(1 & 2).

[7] Nabendu Chaki. 2010. LAR ^{2} P: A Location Aided Reactive Routing Protocol for Near-Optimal Route Discovery in MANET. IEEE International Conference on Computer Information Systems and Industrial Management Applications (CISIM). pp. 259-264.

[8] R. Plestys and R. Zakarevicius. 2010. Request and Response Zone Control for Routing in MANET. IEEE, 12th Biennial Baltic Electronics Conference (BEC2010). pp. 219-222.

[9] Stefano Basagni, Irnrich Chlamtac and Violet R. Syrotiuk. 1998. A Distance Routing Effect Algorithm for Mobility (DREAM). ACM, MOBICOM 198, USA. pp. 76-84.

[10] Young-Bae Ko, Nitin H. Vaidya. 2000. Location-Aided Routing (LAR) in mobile ad hoc networks. ACM, Wireless Networks. pp. 307-321.

[11] Lu Qingling, Bai Mengliang, Zhang Wei and Lian Enjie. 2011. A kind of Improved DV-hop Algorithm. IEEE, 2nd international conference on intelligent control and information processing. pp. 867-869.

[12] Pallavi Khatri. 2014. Using Identity and Trust with Key Management for achieving security in Ad hoc Networks. IEEE, International Advance Computing Conference (IACC). pp. 271-275.

[13] Z. Li, W. Trappe, Y. Zhang and B. Nath. 2005. Robust statistical methods for securing wireless localization in sensor networks. In: Proc. 4th

International Symposium on Information Processing in Sensor Networks (IPSN'05). pp. 91-98.

[14] A. Savvides, C.-C. Han and M. B. Srivastava. 2001. Dynamic fine-grained localization in ad-hoc networks of sensors. In: Proc. 7th Annual International Conference on Mobile Computing and Networking (MobiCom'01). pp. 166-179.

[15] K. Yedavalli, B. Krishnamachari, S. Ravula and B. Srinivasan. 2005. Ecolocation: A sequence based technique for RF localization in wireless sensor networks. In: Proc. 4th International Symposium on Information Processing in Sensor Networks (IPSN'05). pp. 285-292.

[16] N. Patwari, A. O. Hero III, M. Perkins, N. S. Correal and R. J. O'Dea. 2003. Relative location estimation in wireless sensor networks. IEEE, Transactions on Signal Processing. pp. 2137-2148.

[17] Dmitri D, Perkins, Ramesh Tumati, Hongyi Wu and Ikhlas Ajbar. 2001. Localization in Wireless Ad Hoc Networks. Springer, Resource Management in Wireless Networking Network Theory and Applications. 16: 507-542.

[18] Pei Y. 2012. A Survey on Localization Algorithms for Wireless Ad Hoc Networks. Springer, In: Communications and Information Processing, Communications in Computer and Information Science. 289: 512-519.

[19] Hossein Ashtiani, Shahpour Alirezaee, Seyed Mohsen Mir Hosseini and Hamid Khosravi. 2009. PNR – New Position based Routing Algorithm for Mobile Ad Hoc Networks. Proceedings of the World Congress on Engineering. I: 978-988.

[20] Ljubica Blazevic, Jean-Yves Le Boudec and Silvia Giordano. 2005. A Location-Based Routing Method for Mobile Ad Hoc Networks. IEEE, Transactions on Mobile Computing. 4(2): 97-110.

[21] D. Niculescu and B. Nath. 2001. Ad hoc positioning system (APS). IEEE, Global Telecommunications Conference. 5: 2926-2931.

[22] C. E. Perkins and E. M. Royer. 1999. Ad-Hoc On-Demand Distance Vector Routing. Second IEEE Workshop, Proc. WMCSA, Mobile Computing Systems and Applications. pp. 90-100.

[23] D. B. Johnson and D. B. Maltz. 1996. Dynamic Source Routing in Ad Hoc Wireless Networks. Mobile Computing. ch. 5, pp. 153-181.

[24] Shang, Y., Shi, H. and Ahmed. 2004. Performance study of localization methods for ad-hoc sensor networks. In: Proc. IEEE, International Conference on Mobile Ad-hoc and Sensor Systems. pp. 184-193.

[25] G.T. Chavan, Dr. SrikanthVemuru. 2017. Zone Based Optimal Selective Forwarding (Zbosf) Routing Protocol For Manet. International Journal of Sciences and Research, PONTE. 73(12/1).