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Analyzing the Behavior of Reactive Protocols in Wireless Sensor Networks Using TCP Mode of Connection

N. Thirupathi Rao, Debnath Bhattacharyya, V. Madhusudhan Rao, Tai-hoon Kim

***Abstract:** Wireless sensor networks are getting famous day by day in the current days of research and applications. These networks are becoming important in day to day communications. In these networks, all the nodes in the network will act as a router and sends the data collecting from other nodes to further other nodes inthe networks. These networks may be the same or the other network.In general several types of nodes and the other protocols are available in the networks.Someprotocols are hugely used while some other protocols are used very less in real time applications. These protocols are used based onvarious scenarios.The performance of the networks and the protocols used in the networks might be changed from time to time based on various parameters. Some of the important performance metrics of these networks and protocols are like network topology, a number of nodes in the network, seed time, speed time and pause time. Some of the protocols that were discussed in the current are DSR, DSDV and AODV. The different connection types that were considered here are Constant bit rate and TCP. The performance of the currently considered protocols are analyzed by using various performance metrics like end to end delay, losses in packet ratio and packet delivery ratio. The simulator NS2.35 was used in the current work to analyze the performance of these protocols.*

***Keywords:** Wireless Sensor Networks, proactive protocols, reactive protocols, DSR protocol, AODV protocol, seed time, end to end delay, speed time, the packet delivery loss ratio.*

I. INTRODUCTION

Wireless sensor networks are becoming more popular day to day in the current days. The utilization of these networks also increasing in highly related ways. The topology of these networks is becoming more popular day to day. The establishment of network topology exists autonomously and this topology existing will happen without the intervention of any human being [1]. The devices that were connected with wirelesssensor networks are generally used to calculate or conduct the calculation or the observation of the various tropical conditions or environmental conditions or the physical characteristics [2].

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* Correspondence Author (s)
N. Thirupathi Rao, Department of Computer Science and Engineering,Vignan's Institute of Information Technology,Visakhapatnam-530049, India
Debnath Bhattacharyya, Department of Computer Science and Engineering,Vignan's Institute of Information Technology,Visakhapatnam-530049, India
V. Madhusudhan Rao, Department of Chemical Engineering, Vignan's Foundation for Science, Technology and Research (Deemed to be University), Vadlamudi, Guntur-522213, India
Tai-hoon Kim, Department of Computing and IT,University of Tasmania,Churchill Ave, Hobart TAS 7005, Australia

In general the sensor networks or wireless sensor networks are used to create or to establish a link between the starting node to end node such that to transfer the data from starting node in the network tothe end node inthe network.In wireless sensor networks, it is very difficult to establish a path that is fixed between the nodes due tothe reason that the nodes may be in movable situations.

Also, it is not possible to establish fixednetwork architecture or the network infrastructure such that the nodes are movable direction and the architecture of the network might change from time to time[3].The routing protocols in these networks will play a key role in the functioning of these networks. The important thing in routing protocols used in these network models are that these networks will maintain routing table such that all the routes and other details about that particular routes available are stored in the routing table. The routing table of these networks might change from time to time. The values inthe network routing table might change or update from time totime.

Based on the data available in the routing table, the routing algorithm uses the data and tries to calculate the good pathor the best pathavailable inthe set of routes available and identifies the best path and the short path from source to the destination [4]. These protocols are designed on the basic concept that these networks mode or the nature is dynamic in nature. In the routing table and every routing node inthe network tries to make itself available and make itself identifiable to other set of nodes in the network[5, 6].The routing node in the network always tries to identify the next nodeinthe network and the current process in repeated until the current considered node reaches to its destination. Based onthe routing table data, the algorithm identifies itself the best path and the short path in the set of routes available inthe network to reach from source to the destination in the network [7,8]. The synchronizing of a routing table is of two types and the two types are the static type and the second one is the dynamic type.

In the static synchronizing mode, the router in the network is configured manually and the destination was fixed manually. The current condition can be implemented only when the network was in the static mode or the static network. The topology and theroutingtable data of the network changes and data updates time to time in dynamic networks. Hence, in dynamic model the establishment ofroutes or the paths between the source and destination is always very difficult to manage.The various set of protocols are selected inthe current article and the performance of those protocols are discussed and explained in detail.

The performance can be analyzed inthe means of some tables and graphical representations and the detailed explanation about the working and performance of these protocols were discussed in detail. The protocols considered here are the AODV, DSR, and DSDV etc.

II. ROUTING PROTOCOL

In general when we are discussing about the protocols in wireless sensor networks, two type's protocols are available. They are reactive and proactive protocols in routing. In reactive type of protocols, the route for transfer of packets from source to destination is observed only when there is a requirement for the data to be transmitted between the sources to the destination [9,10]. Whereas proactive routing protocols, each node maintains the routing table and based onthe requirement whenever it is required the nodes will share the data based on the requirement and other available data.In the current article both type of protocols are selected and the performance of these two types of protocols are analyzed and discussed here.Some of the protocols considered hereinthe current article are asfollows.

A. AODV

The AODV [11] convention manufactures courses between hubs just on the off chance that they are asked for by source hubs. AODV is in this manner considered an on-request calculation and does not make any additional traffic for correspondence along connections. They likewise structure trees to associate multicast bunch individuals. AODV makes utilization of arrangement numbers to guarantee course freshness. They are self-beginning and circle free other than scaling to various versatile hubs. In AODV, systems are quiet until associations are set up. System hubs that need associations communicate a demand for association. The remaining AODV hubs forward the message and record the hub that asked for an association. Therefore, they make a progression of impermanent courses back to the asking for hub. A hub that gets such messages and holds a course to an ideal hub sends a regressive message through transitory courses to the asking for hub. The hub that started the demand utilizes the course containing minimal number of jumps through different hubs. The sections that are not utilized in steering tables are reused after some time. On the off chance that a connection falls flat, the directing mistake is passed back to the transmitting hub and the procedure is rehashed [12].

B. DYNAMIC SOURCE ROUTING (DSR)

DSR is a reactive routing protocol [13,14]. Connection state calculation is utilized into DSR convention. That implies best course from source to goal are spared into each hub. For any sort of progress into system topology, the entire system will get the data by flooding. Hub produces a blunder message when any disappointment happened into link.DSR put away all moderate hubs ID in the parcel header and stores all steering data of various ways, if there has numerous ways to go to the goal [15].Dynamic Source Routing (DSR) is a self-keeping up steering convention for remote systems. The convention can likewise work with cell phone frameworks and versatile systems with up to around 200 hubs. A Dynamic Source Routing system can arrange and sort out itself autonomously of oversight by human directors.

It is a responsive convention and all parts of the convention work totally on-request premise. It chips away at the idea of source directing. Source directing is a steering method in whichthe sender of a parcel decides the total arrangement of hubs through which, the bundles are sent.The upside of source directing is : middle of the road hubs don't have to keep up modern steering data so as to course the bundles they forward.The convention is made out of the two fundamental components of "Course Discovery" and "Course Maintenance". DSR requires every hub to keep up a course – store of all known self – to – goal sets. In the event that a hub has a parcel to send, it endeavours to utilize this reserve to convey the bundle. This ask for incorporates the goal address, source address and a novel distinguishing proof number. On the off chance that a course is accessible from the course – reserve, however isn't legitimate any more, a course support system might be started. A hub forms the course ask for bundle just in the event that it has not already forms the parcel and its location is absent in the course store.

C. DESTINATION-SEQUENCED DISTANCE-VECTOR ROUTING (DSDV)

DSDV [14,15] is a Proactive routing protocol. This is a table driven calculation dependent on adjustments made to the Bellman-Ford steering component. Every hub in the system keeps up a directing table that has passages for every one of the goals in the system and the quantity of jumps required achieving every one of them. Every section has a succession number related with it that helps in recognizing stale passages. This system enables the convention to maintain a strategic distance from the arrangement of directing circles. Every hub occasionally sends refreshes labelled all through the system with a monotonically expanding even grouping number to promote its area. New course communicates contain the location of the goal, the quantity of jumps to achieve the goal, the grouping number of the data got in regards to the goal, just as another arrangement number one of a kind to the communicate.

The course named with the latest grouping number is constantly utilized. At the point when the neighbours of the transmitting hub get this refresh, they perceive that they are one bounce far from the source hub and incorporate this data in their separation vectors. Each hub stores the "following steering bounce" for each reachable goal in their directing table. The course utilized is the one with the most elevated succession number for example the latest one. At the point when a neighbour B of A discovers that An is never again reachable, it promotes the course to A with a vast measurement and a succession number one more prominent than the most recent arrangement number for the course constraining any hubs with B on the way to A, to reset their steering tables.

III. CONNECTION TYPE

In the current considered work, the connection type considered was the Transmission Control Protocol method.

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IV. PERFORMANCE METRICS&NETWORK PARAMETERS SIMULATIONS

Several performance analysis metrics are available inthe literature and other experiments are also available inthe literature.Some of them are packet delivery ratio, qualityof service tothe end users, end to end delay and the lossof packet ratio etc. But in the current work, only three metrics are considered and they are end to end delay, packet loss ratio and the packet delivery ratio.

A. IMPLEMENTATION & SIMULATION RESULTS

In the current work, Network Simulator NS2.35 was selected under Linux platform for the full work so far considered to implement.It'san open source simulator and the performance was implemented the results were analyzed. By using OTCL and C++ the implementation part was completed and the results were displayed in the form of tabular and graphical representations given [11, 12, 13]. The protocols considered here are AODV, DSR and DSDV.

B. PARAMETERS OF SIMULATIONS

For the current experiment, the bed size utilized was at 1400x1400 size environment. The number of nodes considered are 120 with a constant seed time of 1.5 and the variable speed times are 5s, 15s, 25s, 35s, 45s etc, pause times are 5s, 10s, 15s etc. The simulation time considered was for 180s. The network parameters considered for the current simulation mechanism was as follows in table 1,

Table I.Parameters considered in the current model

Parameters	Values
Simulation Area	1400x1400
Packet size	512
Simulation Time	180s
Speed Time	5s,15s,25s,35s,45s
Seed Time	1.5s
Number of Nodes	120
Traffic	TCP
Protocols	AODV,DSR,DSDV
Network Simulator	NS2.35

C. SIMULATION RESULTS

In the current work, the connection type selected was the TCP mode and the routing protocols used to analyze the performance of the wireless sensor network are DSR, AODV and DSDV etc. The pause times selected here are 5s, 10s, 15s, 25s, 35s and 45s. The other requirements considered and implemented were given in detail in table 2.

Table II. Performance of DSR protocol for the current model

DSR						
Number of Nodes	Speed Time	Pause Time	Packet Type	LPR	PDR	End –to-End
120	5s	5s	TCP	5.35	95.4	96.2
		10s	TCP	4.98	95.7	98.5
		15s	TCP	4.65	96.1	92.3
	15s	5s	TCP	5.62	95.6	89.2
		10s	TCP	5.21	96.2	92.4
		15s	TCP	4.91	96.8	86.1
	25s	5s	TCP	6.13	96.2	92.5
		10s	TCP	5.98	96.8	95.1
		15s	TCP	5.45	97.1	93.2
	35s	5s	TCP	6.23	97.2	97.1
		10s	TCP	6.12	97.4	98.5
		15s	TCP	5.98	97.8	96.3
	45s	5s	TCP	6.38	96.5	97.2
		10s	TCP	6.24	97.6	92.1
		15s	TCP	6.05	97.9	94.3

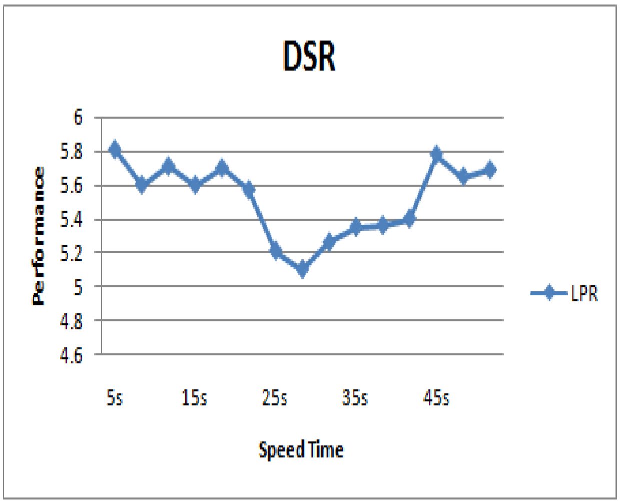

Fig 1.Performance of DSR protocol for Loss of Packet Ratio

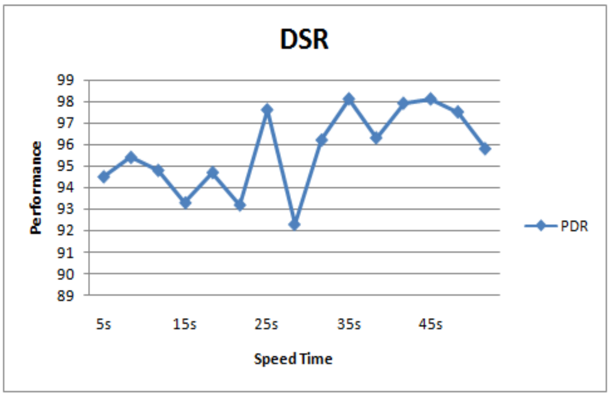

Fig 2.Performance of DSR protocol for Packet to Delivery Ratio

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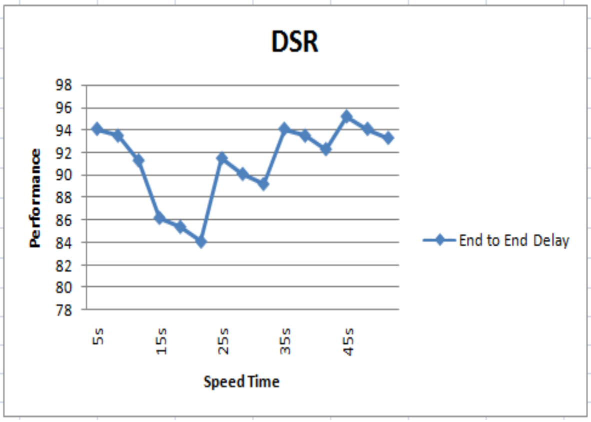

Fig 3.Performance of DSR protocol for End to End Delay time

Table III. Performance of AODV protocol for the current model

AODV						
Number of Nodes	Speed Time	Pause Time	Packet Type	LPR	PDR	End –to-End
120	5s	5s	TCP	6.23	96.1	96.2
		10s	TCP	5.95	96.4	94.5
		15s	TCP	5.82	96.8	92.3
	15s	5s	TCP	5.95	95.3	89.2
		10s	TCP	5.65	95.7	88.4
		15s	TCP	5.23	96.2	86.1
	25s	5s	TCP	6.98	95.6	92.5
		10s	TCP	6.23	96.3	91.1
		15s	TCP	5.26	97.2	90.2
	35s	5s	TCP	6.12	97.1	97.1
		10s	TCP	5.95	97.3	96.5
		15s	TCP	5.85	97.9	96.3
	45s	5s	TCP	6.23	96.1	97.2
		10s	TCP	6.12	96.5	95.1
		15s	TCP	5.92	96.8	94.3

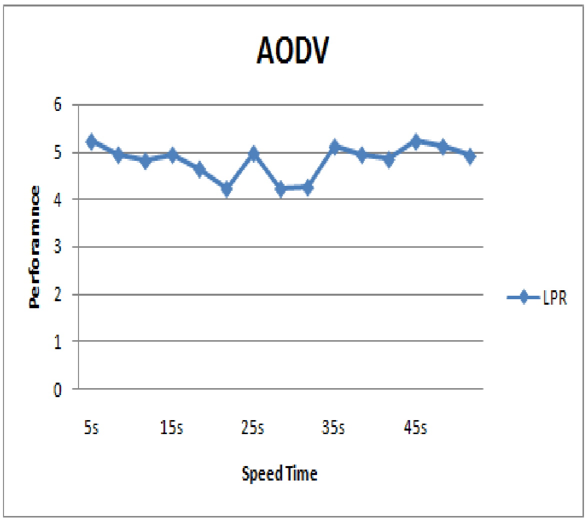

Fig 4.Performance of AODV protocol for Loss of Packet Ratio

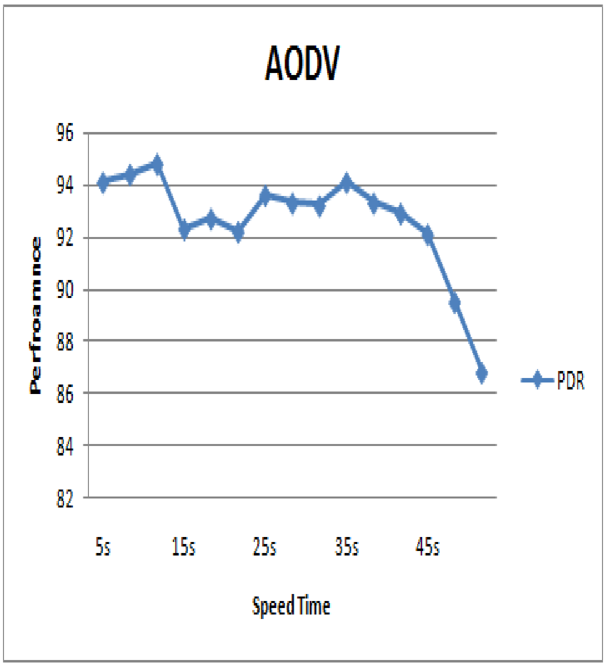

Fig 5.Performance of AODV protocol for Packet to Delivery Ratio

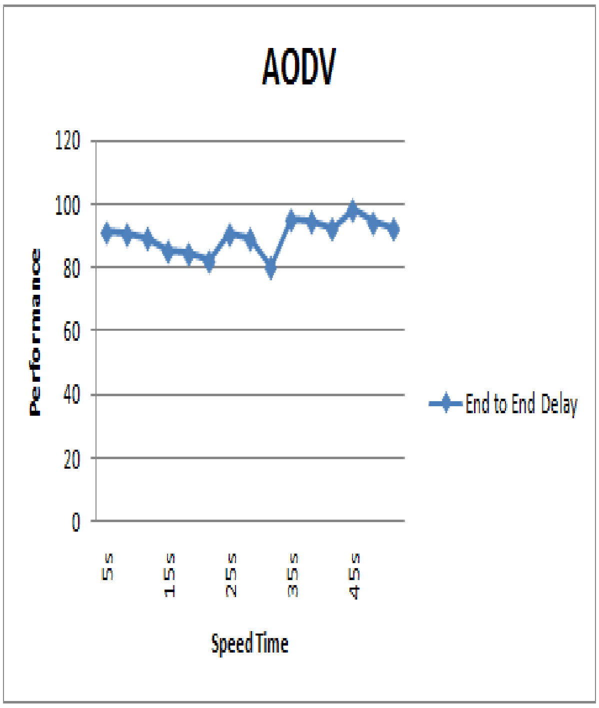

Fig 6.Performance of AODV protocol for End to End Delay time

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Table IV. Performance of DSDV protocol for the current model

DSDV						
Number of Nodes	Speed Time	Pause Time	Packet Type	LPR	PDR	End –to-End
120	5s	5s	TCP	5.89	94.5	94.1
		10s	TCP	5.64	95.4	93.5
		15s	TCP	5.78	94.8	91.3
	15s	5s	TCP	5.68	93.3	86.2
		10s	TCP	5.71	94.7	85.4
		15s	TCP	5.59	93.2	84.1
	25s	5s	TCP	5.25	97.6	91.5
		10s	TCP	5.12	92.3	90.1
		15s	TCP	5.29	96.2	89.2
	35s	5s	TCP	5.45	98.1	94.1
		10s	TCP	5.32	96.3	93.5
		15s	TCP	5.41	97.9	92.3
	45s	5s	TCP	5.78	98.1	95.2
		10s	TCP	5.65	97.5	94.1
		15s	TCP	5.69	95.8	93.3

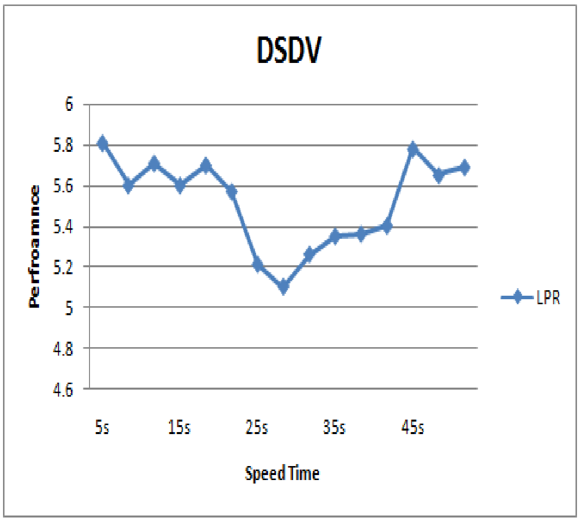

Fig 7.Performance of DSDV protocol for Loss of Packet Ratio

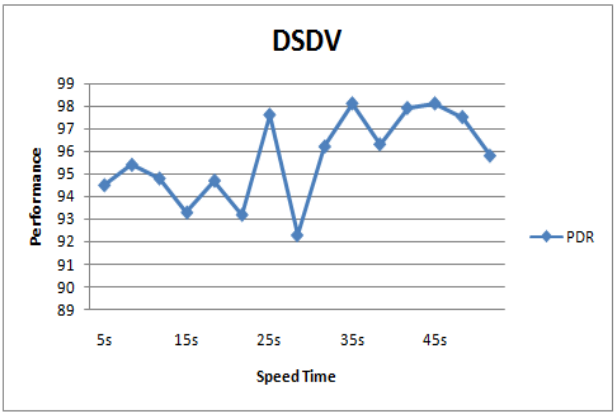

Fig 8.Performance of DSDV protocol for Packet to Delivery Ratio

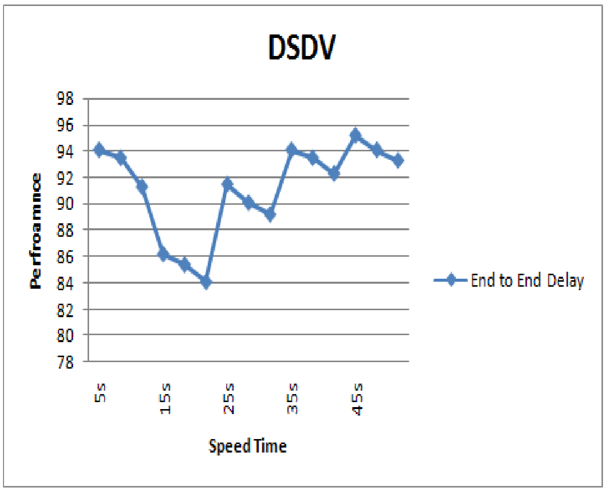

Fig 9.Performance of DSDV protocol for End to End Delay time

The graphical representation of the performance of the currently considered algorithms with the current model is presented above in detail. The performance of the current model wireless sensor networks with the usage of various protocols like both reactive and proactive protocols are used and their performance was shown on the graphical representations in the above sections and the numerical illustrations are also shown in the form of tabular results and other results are shown as graphical representations. Almost all the protocols are performing well in various scenarios. The performance of each protocol was good in a particular scenario. The protocol utilization was the choice of the user to implement when it is required based on the results achieved in the above sections in the current article.

V. CONCLUSION

In the current article, four protocols are discussed in detail and also an attempt has been made to analyze the performance of these four selected protocols performance on the basis of various performance metrics under various protocols.The protocols considered here inthe current work are DSR, AODV and DSDV. The performance metrics were considered and calculated for all the above protocols and the results were tabulated in the results and discussion section. The performance was given in the form of graphical representation also inthe results section. The total simulation mechanism was doneonthe open source simulator NS2.35 by using boththe OOTCl and C++ script. The results say that the all protocols are working better in various scenarios and each protocol is performing a particular scenario better than the other set of protocols. The current results will help the engineers working onthe networks and especially in the wireless sensor networks to have a clear picture and idea on what to do when an analysis was being done and also which particular protocol can be selected for several applications at various scenarios.

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The packet transmission arte considered in the current article was the TCP model. The other model was the CBR that is constant bit rate was implemented i n the next phase of our work and will be given the clear idea about the both typesof the data transmissions.

REFERENCES

1. Kaysar Ahmed Bhuiyan et. Al., “Efficiency and Performance analysis of routing protocols in WSN”, International Journal of Advanced Engineering Research and Science (IJAERS), Vol.4, No.4, Pp: 109-118, 2017.
2. Amandeep Kaur et. Al., “Comparison of AOMDV, DSR and MDART Multipath Routing Protocols”, Advances in Wireless and Mobile Communications, Vol.10, no.5, Pp: 961-967, 2017.
3. J. A. Hamilton et al. “E Network, Web & Security”, Global Journal of Computer Science and Technology, Vol.14, Issue No.6, Version 1.0, 2014.
4. http://www.ni.com/white-paper/7142/en/[Last accessed on 12-02-2019]
5. Adel.S.Elashheb. “Performance Evaluation of AODV and DSDV Routing Protocol in wireless sensor network Environment”, International Conference on Computer Networks and Communication Systems vol.35, 2012, Singapore.
6. https://folk.uio.no/kenneho/studies/essay/node12.html[Last accessed on 12-02-2019]
7. Charles E. Perkins, “Ad hoc Networking”, Pearson, ISBN 978-81-317-2096-7, First Impression, 2008.
8. Perkins, C., Belding-Royer, E., Das, S. “Ad hoc On-Demand Distance Vector (AODV) Routing”, 2nd Workshop on Mobile Computing Systems and Applications (WMCSA '99), February 25-26, 1999, New Orleans, LA, USA .
9. M.K.Marina and S.R.Das, “On-Demand multipath distance vector routing in ad hoc networks” in Proceedings Ninth International Conference on Network Protocols. ICNP 2001, USA.
10. Suresh Kumar, Jogendra Kumar, “Comparative Performance Study of Zone Routing Protocol over AODV and DSR Routing Protocols on Constant Bit Rate (CBR)” International Journal of Computer Applications, 2012, Volume 45, No.4, Pp.21-25.
11. http://www.isi.edu/nsnam/ns[Last accessed on 12-02-2019]
12. http://www.isi.edu/nsnam/ns/tutorial/[Last accessed on 12-02-2019]
13. http://itantenna.blogspot.com/2012/01/install-ns234-on-ubuntu-1004.html.[Last accessed on 12-02-2019]
14. Mohini M. Ade, S. S. Asole, “Survey of Routing Protocols Performance with Mobility Models in Wireless Mobile Ad-hoc Networks”, International Journal of Recent Technology and Engineering, May 2017, Vol.6, No.2, Pp.32-35.
15. Luis Javier García Villalba, Ana Lucila Sandoval Orozco, Alicia Triviño Cabrera and Cláudia Jacy Barenco Abbas, “Routing Protocols in Wireless Sensor Networks”, Sensors, October 2009, Vol.9, Pp.8399-8421.

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