

Comparative Study of Routing Techniques to Trace Efficient Transfer Links in WSN

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Abstract— A wireless sensor network typically consists of a large number of multifunctional wireless sensor nodes with sensing, wireless communications and computation capabilities. Routing in WSN is very challenging due to large number of sensor nodes are deployed in an ad hoc manner. With these nodes it is not possible to make a global addressing scheme as the overhead of ID maintenance is high. As the topology changes, link failure between the nodes takes place due to several reasons like channel interference and dynamic obstacles etc that give rise to severe performance degradation. In AODV, the link failure is overcome by re-routing from the source node. The discovery and maintenance of route should consume minimum overhead and bandwidth. In this paper, we introduce a Enhanced Local Rerouting algorithm (ELRR) that will adapt quickly alternate shortest path at the point of link failure. In this paper we presents comparative analysis of routing techniques to trace fast and reliable alternate shortest path from source to destination in case of link failure problem without losing the packet. The proposed work is an efficient and improved technique for WSN that utilizes local rerouting algorithms. All the simulations of the proposed idea will be simulated on Berkeley's ns2 network simulator and the performance of the proposed scheme has been evaluated.

Keyword – wireless sensor networks, network topology, AODV, ELRR, NS2

I. INTRODUCTION

1.1 WSN OVERVIEW

A Wireless Sensor Network (WSN) is comprised of a group of wireless sensor nodes which have the capability of self organization in a decentralized fashion and without fixed infrastructure. These sensor nodes have the sensing, wireless communication and computation capabilities. The nodes which are in radio range of each other can communicate directly, and others communicate through intermediate nodes to route their packets. Each node communicate through its wireless interface. Routing in WSN is very challenging due to large number of sensor nodes are deployed in an ad hoc manner. With these nodes it is not possible to make a global addressing scheme for the deployment of a large number of sensor nodes as the overhead of ID maintenance is high. Routing is also difficult due to mobility of nodes. Several routing protocol have been designed for routing in WSN. WSNs can be widely used to perform military tracking and surveillance, natural disaster relief, hazardous environment exploration and health monitoring etc. The Fig-1. shows the WSN.

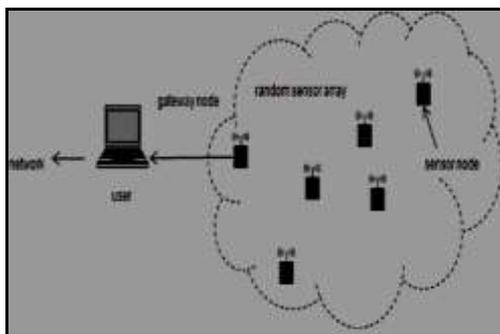


Fig -1 Typical structure of wireless sensor network

1.2 Routing Protocol in WSN

Routing protocols applied to wired networks are not suitable for ad hoc wireless networks. For example, distance vector and link state routing schemes[1] suffer from slow convergence to topology changes and bandwidth waste in periodical routing table exchanges. Especially, in distance vector routing, the forwarding loop is another serious problem. Therefore, various routing protocols are proposed

for wireless networks to solve the problems of transient routing loop and provide fast convergence to topology change. The routing protocols in WSN are categorized into three types, namely pro-active, reactive and hybrid routing protocols.

a) Pro-active or Table-driven routing protocols:

Proactive routing protocols like DSDV demand that each sensor node should have whole routing information of all nodes in the network. To achieve this goal, every node in the network maintains the routing table that is updated regularly. This type of protocol can find a path immediately between any pair of nodes whenever there is a need. Advantage is low route latency and state information although it has some disadvantages like the following.

- High overhead of updating routing table periodically.
- Bandwidth consumption due to maintenance of links.
- Maintain links that may never be used.

b) Reactive or On-demand Routing Protocols:

Reactive protocols like AODV and DSR do not maintain route information in advance, this will creates a route only when there is a need. They are best suited for low band width consumption as it does not require exchange of periodic routing table update messages required. Main disadvantage is very high route latency. Having data for transmission, a source node starts a route discovery procedure to find the destination node. Route maintenance procedure is triggered whenever a route has been discovered and is in progress until the route is no longer required.

c) Hybrid Routing Protocols :

Proactive and reactive protocols each work best in oppositely different scenarios. Hybrid routing protocol like ZRP uses the combination of both the routing techniques. It is used to find a

balance between both protocols. Proactive operations are used in small domain, whereas, reactive protocols are able to locating nodes outside those domains.

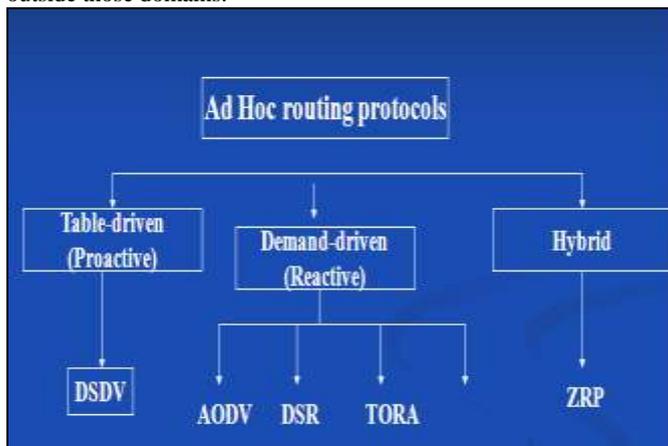


Fig 2: classification of routing protocol

1.3 Problem Definition

Wireless Sensor Network is one promising application on wireless ad hoc networks. The use of real-time applications over wireless networks force on service providers to operate disrupt-free networks. Breaches in service availability are generally due to side effects of network topological changes such as link failure. As the topology changes, link failure between the nodes takes place due to several reasons like channel interference and dynamic obstacles etc that give rise to severe performance degradation. One possible solution on link failure is that rerouting the packets through alternate path and at the same time recover the previous path from failure. After recovery from failure again update the previous path which is shortest.

In AODV, nodes are communicating with each other through relay nodes using shortest path. In between if any intermediate link fail then AODV will send RERR message back to the source node through upstream node of link break. Then source node is responsible for rerouting the packets through different path So that it increases the overhead of nodes which belongs to the path also increases.

Based on the study of various routing protocol in wireless sensor network, in this paper we introduce reactive type like AODV routing protocol for data transfer. In AODV, the link failure is overcome by re-routing from the source node but it has some drawbacks that it is a

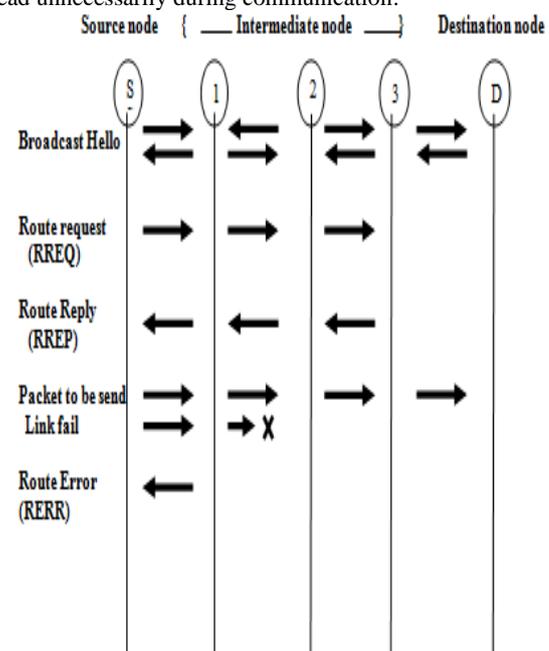
2.1 Route Discovery Phase

The AODV protocol uses *route request* (RREQ) messages flooded through the network in order to discover the paths required by a source node. An intermediate node that receives a RREQ replies to it using a *route reply* message only if it has a route to the destination whose corresponding destination sequence number is greater or equal to the one contained in the RREQ. The RREQ also contains the most recent sequence number for the destination of which the source node is aware. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence number greater than or equal to that contained in the RREQ. If this is the case, it unicasts a RREP back to the source. Otherwise, it rebroadcasts the RREQ. Nodes keep track of the RREQ's source IP address and broadcast ID. If they receive a RREQ which they have already processed, they discard the RREQ and do not forward it. As the RREP propagates back to the source nodes set up forward pointers to the destination. Once the source node receives the RREP, it may begin to forward data packets to the destination. If the source later receives a RREP containing a greater sequence number or contains the same sequence number with a smaller hop

time consuming process that increases the overhead of the nodes. In order to overcome such performance related issues, we developed the Enhanced Local Rerouting algorithm (ELRR) for Ad hoc networks that establishes alternate path at the point of link breakage. In such cases, discover reliable new and also recover the broken path is the main criteria that will determine the performance of the network in terms of Quality of Service (QoS). That's why we use local rerouting techniques which is enhanced over AODV rerouting techniques.

II. AODV PROTOCOL OVERVIEW

Ad hoc On-demand Distance Vector, (AODV) is a reactive routing protocol used in wireless networks that finds a route to destination on demand. AODV requires each node to maintain a routing table containing the discovered path information. It maintains these routes as long as they are needed by the sources. AODV is capable of creating new routes whenever a route error occurs. The advantages of AODV is that, it uses sequence numbers to determine the freshness of the route thereby preventing formation of loop and doesn't create overhead unnecessarily during communication.



count, it may update its routing information for that destination and begin using the better route.

For example, fig 2-1 shows the process of the route discovery

Fig. 2.1 AODV Route Discovery and Route Maintenance Phase

2.2 Route Maintenance Phase

Route Maintenance is used to manage (cache, expire, switch among) previously discovered routes. As long as the route remains active, it will continue to be maintained. A route is considered active as long as there are data packets periodically traveling from the source to the destination along that path. Once the source stops sending data packets, the links will time out and eventually be deleted from the intermediate node routing tables. If a link break occurs while the route is active, the node upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destination(s). When the source node receives the error packet, it deletes all the routes that use the invalid link from the buffer, and starts a new route discovery process if necessary.

III. \PROPOSED TECHNIQUES

Based on the study of various routing protocols in wireless sensor network, in this paper we introduce reactive type like AODV routing protocol for data transfer. In AODV, the link failure is overcome by re-routing from the source node but it has some drawbacks that it is a time consuming process that increases the overhead of the nodes. In order to overcome such performance related issues, we proposed the new technique with standard AODV that is **Enhanced Local Rerouting (ELRR)** technique for wireless sensor networks. In this technique, whenever link failure occurs it will not send the RERR message back to source node instead it will establish new route at the point of link breakage. That means the node at which link failed is responsible for searching the alternate shortest path. This technique will reduce the overhead of upstream nodes of the failed link also reduce the time delay for sending the data packets from source to destination

3.1 Design of ELRR

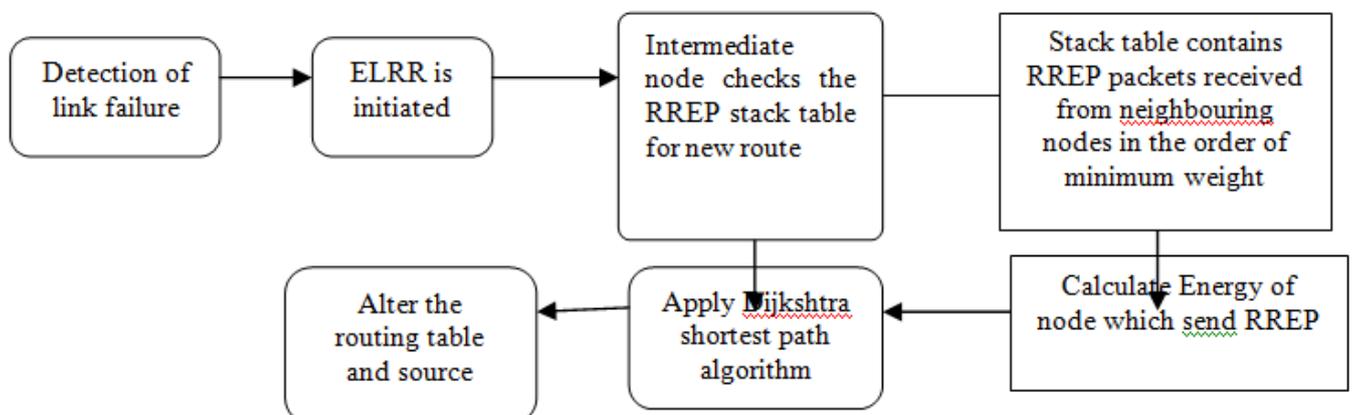


Fig.3.1. ELRR model

3.1 ALGORITHM of ELRR

The ELRR algorithm implemented with AODV routing protocol is described below:

- Step 1: If Link failure occurred during transmission then go to step 3
- Step 2: Else data packets are transferred as previous path
- Step 3: ELRR is initiated at the point of link failure

The ELRR activated in every node updates the RREP Buffer Table. It will calculate energy of each node in the buffer table and update the table with RREP packet in ascending sequence of highest energy from relevant downstream nodes. So when a link failure is detected, the topmost RREP stored in the RBT will be chosen as the next hope node and this process continues until reaching the destination. The alternate path is updated with the source node and the routing table of all relevant nodes. The Enhanced Local ReRouting (ELRR) Algorithm with AODV routing protocol is implemented and evaluated using the Network Simulator (NS 2, version 2.32). The NS2 provides substantial support for simulation of wireless networks and is more user friendly. NS2 is a cost effective solution that is alternate to real world network used to evaluate and analyze the behavior of various network design. The parameters used in our simulation are shown in **Table 1**. The simulation of WSN in ns2 using ELRR technique is as shown in fig. 3.1

In case of link failure, Enhanced Local Reouting (ELRR) techniques apply only at the point of link breakage. This rerouting technique will not only reroute the packets through alternate shortest path but also convergence link from failure. . In this it will use Dijkstra's shortest path algorithm for choosing alternate shortest path. By using this technique it will reduce the overhead of source node due to non transmission of RERR packet to source node in case of link failure. In this technique, if link is broken down then only the node where packets drop will get RERR and at that time ELRR algorithm will apply only on this node to choose alternate route and also link failure recovery mechanism will recover the broken link. The ELRR algorithm implemented with AODV routing protocol. In this algorithm when link is broken the ELRR is initiated at the point of link failure. In this it will calculate energy of each node. Dijkstra algorithm will choose next hop which have the highest energy that means its signal strength is high. Accordingly it will choose alternate shortest path. The schematic representation of ELRR is given in fig 3.1

- Step 4: the intermediate node receives RERR act as the source node
- Step 5: calculate energy of nodes in the RREP buffer table
- Step 6: choose highest energy node as its next hope And accordingly it will choose new route
- Step 7: Transmit data packets via new route
- Step 8: Update the new route to the source node.

Table 1. Simulation parameters

Channel Type	Wireless channel
Radio propagation model	Two Ray ground
Network Interface Type	Phy/Wireless Phy
InterfaceQueue Type	Queue/DropTail/PriQueue
MAC Type	MAC802.11n
Link Layer Type	LL
Max packet in ifq	100
Antenna model	Omni Antenna
Number of nodes	16
Routing protocol	AODV
Topography	1500m×500m
Simulation time	10 ms

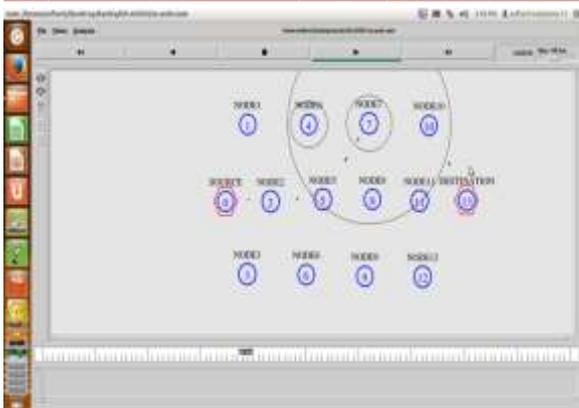


Fig: 3.1 simulation design

IV. RESULTS AND PERFORMANCE EVALUATION

The simulation results of Enhanced Local Rerouting (ELRR) incorporated in AODV routing protocol is given below.

4.1. Packet Delivery Ratio

PDR is the ratio between the numbers of packets received by the application layer of destination node to the number of packets sent by the application layer of source node.

4.2 Throughput

Throughput is the number of bits transmitted per unit second over a communication channel. Below is results of LLFR compared to the traditional AODV routing protocol.

4.3 Average End-to-End Delay

End-to-end delay is defined as the time taken for a data packet to be transmitted across a wireless network from the source to destination.

4.4. Routing Overhead

Routing overhead refers to the number of routing messages requested when a data packet is successfully delivered to the destination.

The performance of the ELRR with AODV is compared with traditional AODV routing protocol for its packet delivery ratio, throughput, routing overhead and end to end delay. The simulation results of packet delivery ratio of AODV with ELRR routing protocol as referred in Fig. 4.1 has increased when compared to standard AODV routing protocol during link failures. It is also observed that the PDR with ELRR is relatively consistent or even better during link failures, as compared to AODV in such situations. When there are more failure nodes, the routing protocol with ELRR tends to have a better PDR compared to the AODV. The average delay of transmitted data packet is calculated by dividing the total delay by the number of packets arrived at the destination. The simulation graph in Fig. 4.2 show that the throughput of AODV with ELRR is significantly better compared to AODV in the event of link failure. The ELRR achieves better throughput when compared to the other case, as the alternate path chosen by the ELRR is reliable leading to better throughput. There is negligible chance of data packet loss in case of stream of data such as voice or video

as the intermediate node in no time triggers ELRR algorithm and starts routing the data via a reliable alternate path. The average end to end delay is reduced considerably in the ELRR as referred in Fig. 4.3 when compared to standard AODV routing protocol in conditions of node failure. This has been achieved by allowing the intermediate node to quickly choose the alternate route during the link failure. Here, the data transmission time after failure is reduced, as the RBT readily has the RREP with highest signal strength of the next forwarder ready in the stack. The ELRR has reasonably lesser overhead when compared to AODV. In standard AODV, mobile nodes respond to link failures with numerous messages that are flooded across the network to maintain an active route in AODV, resulting in high overheads. The routing Protocol with ELRR has the best overhead performance because of its uniqueness in spontaneously responding to link failures. Even though the overhead of ELRR is reasonably significant, the overhead of the ELRR incorporated Adhoc network with multiple link failures is far better.

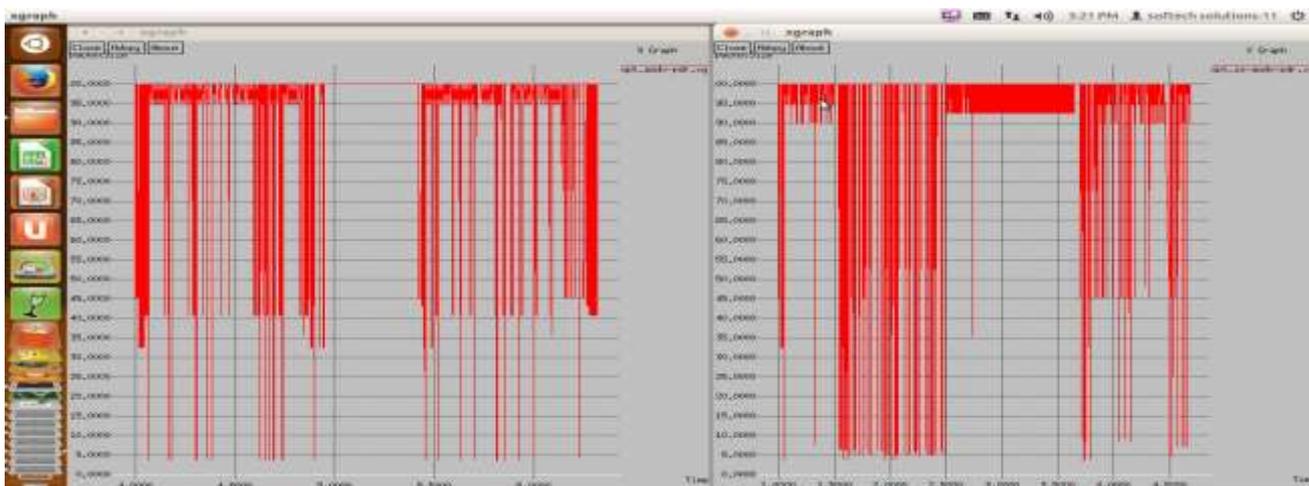


Fig 4.1: comparison of Packet Delivery Ratio of Standard AODV and AODV with ELRR

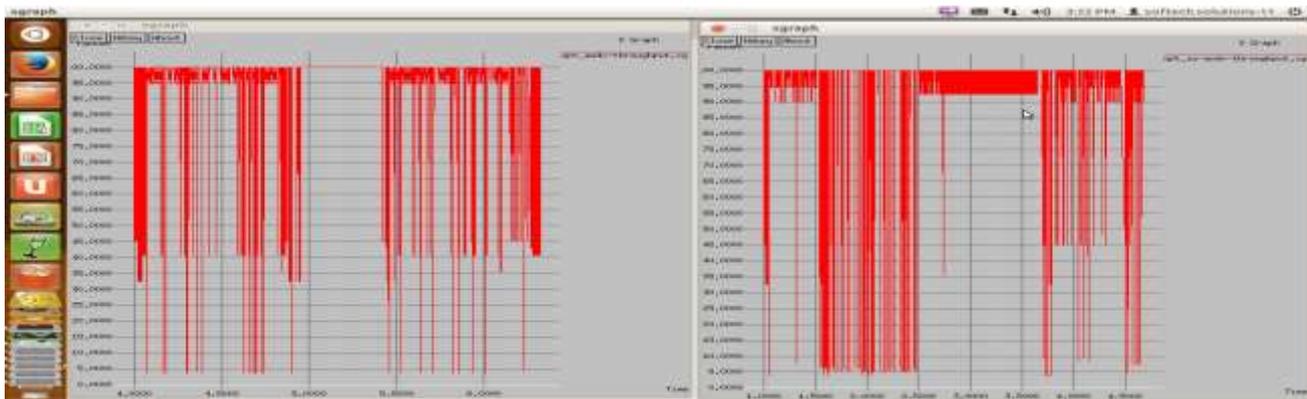


Fig 4.2 : comparison of Throughput of Standard AODV and AODV with ELRR

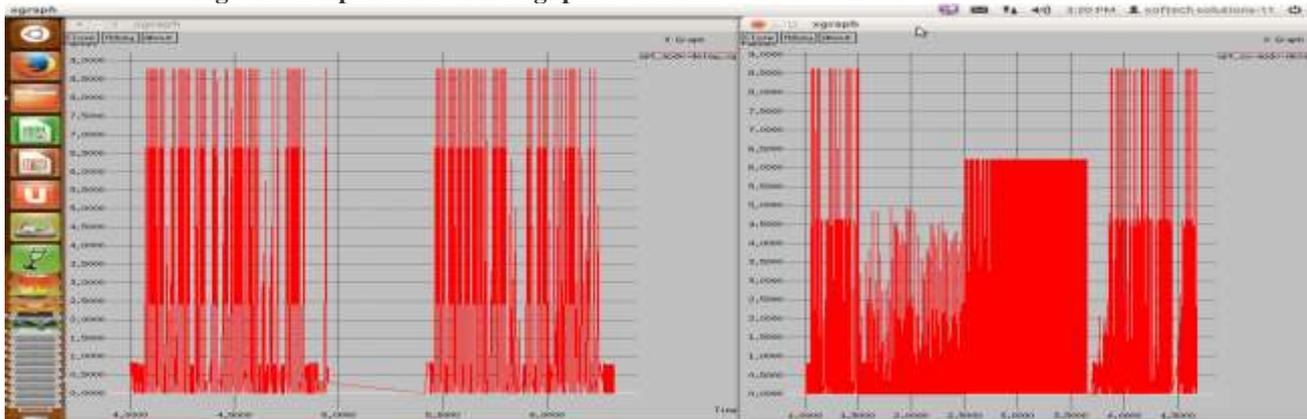


Fig.4.3: comparison of end to end delay of Standard AODV and AODV with ELRR

V. CONCLUSION

A proposed scheme for Ad hoc networks to rerouting datapackets in case of link failure called the Enhanced Local Rerouting algorithm (ELRR) with AODV routing protocol is implemented in this study. The simulation results obtained indicate the improved efficiency of the ELRR with AODV routing protocol by showing significant improvement in the QoS parameter. Here the performance of ELRR algorithm with AODV routing protocol is enhanced as compared with standard AODV in terms of packet delivery ratio, routing overhead, throughput and average end to end delay. This is achieved because the ELRR is activated quickly during link failure thereby minimising the possibility of data packet loss.

VI. REFERENCES

- [1] Olivier Bonaventure, "Graceful Convergence in Link-State IP Networks: A Lightweight Algorithm Ensuring Minimal Operational Impact" IEEE/ACM transactions on networking, vol. 22, no. 1, february 2014.
- [2] Francois Clad, Pascal Mérendol, Jean-Jacques Pansiot, "Graceful Router Updates in Link-State Protocols" Université de Strasbourg {fclad, merindol, pansiot}@unistra.fr IEEE 2013.
- [3] M. Goyal, M. Soperi, E. Baccelli, G. Choudhury, A. Shaikh, H. Hosseini, and K. Trivedi, "Improving Convergence Speed and Scalability in OSPF: A Survey", IEEE communications surveys & tutorials, accepted for publication, 1553-877X/10/\$25.00 _c 2010 IEEE.
- [4] A. Mostefaoui, M. Melkemi and A. Boukerche "Localized Routing Approach to Bypass Holes in Wireless Sensor Networks" IEEE transaction on computers 2013.
- [5] Shio Kumar Singh 1, M P Singh 2, and D K Singh "Routing Protocols in Wireless Sensor Networks – A Survey" International Journal of Computer Science &

Engineering Survey (IJCSSES) Vol.1, No.2, November 2011.

- [6] Hariom Soni, Asst. Prof. Preeti Verma "A Survey of Performance based Secure Routing Protocols in MANET" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 1, January 2013.
- [7] B.Manimekala1, M.Kayalvizhi2 "A Data Transfer in Wireless Sensor Networks Using AODV Protocol" IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No 1, January 2012.
- [8] P.R. Jasmine Jeni, A. Vimala Julie and A. Messiah Bose "An Enhanced Route Failure Recovery Model for Mobile Ad hoc Networks", Journal of Computer Science 10 (8): 1561-1568, 2014.