ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

Implementation of Quality of Service using Geographic Opportunistic Routing in WSN

M.Mahendran[1], Sriraman Balaji[2], G. Sivakannu[3], M. Lakshmi Prabha[4]

Assistant Professor, Dept. of ECE, Saranathan College of Engineering, Trichy, Tamilnadu, India[1,2,3,4]

ABSTRACT: Routing is an important issue in sensor network for ensuring Quality of Service (QoS). It is very challenge task for ensuring QoS in monitoring and surveillance system because these applications require delayless and reliable data delivery service. Existing work uses multipath routing approach which consumes more energy. In this work we used Geographic Opportunistic Routing for providing Quality of Service in Wireless Sensor Network and also this protocol cannot be directly applied to guarantee both reliability and delay constraints in on efficient manner. In order to provide efficient Quality of service, we used candidate selection and prioritization algorithm in Efficient QoS Aware GOR (EQGOR). This algorithm ensures energy efficiency, end to end reliability and time complexity. The implementation shows graph of improved throughput and Packet Delivery ratio using this algorithm in NS2.

KEYWORDS*:* Wireless sensor networks; Quality of Service; Geographic Opportunistic Routing, Packet Delivery Ratio (PDR)

I. INTRODUCTION

Wireless sensor networks (WSNs) are used for various applications like environment or habitat monitoring, home automation, and traffic control etc. A typical sensor network consists of spatially distributed sensor nodes, to monitor various conditions [1]. These sensor nodes usually operate on non-rechargeable battery power and hence we need to maximize the network lifetime, by improving the energy efficiency of WSNs. Providing reliable and timely communication in WSNs is challenging because, the varying channel conditions and sensor node failures cause changes in topology and connectivity. Here, to forward a packet reliably, multiple retransmissions may be required, leading to long delay as well as waste of energy. Therefore, we provide QoS (Quality of Service) provisioning, which refers to its ability to deliver a guaranteed level of service in unreliable links. The QoS requirements can be specified in the form of routing performance metrics, such as delay, throughput or jitter.

For periodic environment reporting applications, delivery delay is not critical as long as the data reaches destination. While for mission critical applications, reliable and timely delivery is crucial. In this case, QoS routing for both the end-to-end reliability and delay guarantees becomes essential. However, due to the contradictory multiple constraints like reliability, latency and energy efficiency, only soft QoS provisioning is attainable. The soft QoS is meeting the QoS requirements with probability. Compared with the single path routing with retransmission to guarantee delivery reliability, the multipath approach may probably provide shorter end-to-end delay by removing the retransmissions. However, there are major disadvantages: Significant energy cost and channel contentions and Interference causing delay and transmission failures.

This work addresses two issues of the multi constrained QoS routing in WSNs. Firstly, for Multi constrained QoS provisioning in WSNs, We propose to exploit the geographic opportunistic routing (GOR).Secondly, Existing GOR protocols cannot be directly applied to guarantee both reliability and delay QoS constraints in an efficient manner. Considering the reliability and delay constraints as well as the intrinsic energy constraint in WSNs, we need to design a GOR protocol which can achieve good balance among energy efficiency, end-to-end delay and reliability. Opportunistic routing aims to improve wireless performance by exploiting spatial diversity in dense wireless networks. In geographic opportunistic routing, location information is available at each hop. Thus, we investigate the problem of efficient GOR for multi constrained QoS provisioning (EGQP) in WSNs, which is formulated as a multi objective multi

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

constraint optimization problem. We provide insight into the properties of multiple routing metrics in GOR. Based on the theoretical analysis and observations, we propose an Efficient QoS aware GOR (EQGOR) algorithm for QoS provisioning in WSNs. Through comprehensive performance comparisons, we demonstrate the low time complexity and effectiveness of EQGOR for multi constrained QoS provisioning in WSNs.

II. RELATED WORKS

Jianwei Niu et al, proposed to enhance existing reactive routing protocols to provide reliable and energy-efficient packet delivery against the unreliable wireless links by utilizing the local path diversity. Specifically, a biased backoff scheme is introduced during the route discovery phase to find a robust guide path, which can provide more cooperative forwarding opportunities. Saeed Rasouli Heikalabad et al, proposed a new multi path routing algorithm is proposed for real time applications in wireless sensor networks namely QEMPAR[ix] which is QoS aware and can increase the network lifetime. QEMPAR which is QoS aware and can increase the network lifetime. QEMPAR protocol uses four main metrics of QoS with special relation in path discovery mechanism.

Young-Jin Kim et al, proposed a Geographic routing(Karp, B., and H. T. Kung., 2000) has been widely hailed as the most promising approach to generally scalable wireless routing. However, the correctness of all currently proposed geographic routing algorithms relies on idealized assumptions about radios and their resulting connectivity graphs.

Michele Zorzi et al, proposed a Geographic Random Forwarding (Zorzi, M., and R, Rao 2003). It is based on the assumption that sensor nodes have a means to determine their location and that the positions of the final destination and of the transmitting node are explicitly included in each message. In this scheme, a node which hears a message is able (based on its position toward the final destination) to assesses its own priority in acting as a relay for that message. All nodes who received a message may volunteer to act as relays and do so according to their own priority.

T Shiva Prakash, proposed a Link Reliability based Two-Hop Routing protocol for wireless sensor networks (WSNs). The protocol achieves to reduce packet deadline miss ratio while considering link reliability, two-hop velocity and power efficiency and utilizes memory and computational effective methods for estimating the link metrics. This system explores the idea of incorporating QoS parameters in making routing decisions i.e.,: (i)reliability (ii) latency and (iii) energy efficiency. Traffic should be delivered with reliability and within a deadline. The proposed protocol is devised using a modular design, separate modules are dedicated to each QoS requirement.

Paolo Casari, proposed a Geographic forwarding in Wireless Sensor Networks (WSN). It has long suffered from the problem of by passing "dead ends". In this paper, we approach the problem of dealing with dead ends in a novel way that allows us to guarantee the delivery of packets to the sink without requiring the overhead and the inaccuracies incurred by "planar" methods.

III. SYSTEM MODEL

We consider a multi-hop WSN in a two-dimensional planar region. We assume the network is densely deployed, i.e., each node has plenty of neighbours. Nodes know the geographical location information of their direct neighbours and where the destination is [26]. We assume that the MAC layer provides the link quality estimation service, e.g., the packet reception ratio (PRR) information on each link can be obtained by counting of the lost probe messages or data packets [27]. Each node is aware of the PRR values to its one-hop neighbours. To keep consistency, we follow the variable definitions about GOR in [20]. Assuming node i is sending a data packet to the sink node (denoted as Dest), and j is one of i's neighbours which is closer to the sink than i. Define aij in Eq. 1 as the single-hop packet progress (SPP) to the Dest when a packet is forwarded by neighbour j. Ci is defined as the available next-hop forwarder set of node i, where all nodes in Ci have positive SPPs.

$a_{ij} = Dist(i;Dest) - Dist(j;Dest);$

Where Dist(i;Dest) is the Euclidian distance between node i and the Dest. Let pij denote the PRR between node i and j. For any neighbour j, node i maintains the pair information (aij ; pij) in its neighbour table. Let Fi ($F_i \subseteq C_i$) denote the selected forwarding candidate set of node i, in which all nodes are cooperatively involved in the local forwarding task when node i sends a data packet to the sink node.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

The GOR procedure is described as following: when node i has a data packet to send to the sink node via multi-hop communication, it selects the forwarding candidate set Fi based on its local knowledge of available next-hop forwarder set Ci. Then node i broadcasts the data packet where the list of candidates and their priorities are included in packet header. These candidates follow the assigned priorities to relay the packet opportunistically. For each candidate, if having received the packet correctly, it will start a timer whose value depends on its priority. The higher the priority is, the shorter the timer will be. The forwarding candidate whose timer expires will reply an ACK, to notify the sender as well as all other candidates to cancel their timers. Subsequently, this forwarding candidate becomes the actual next-hop sender in an opportunistic manner. The forwarding process repeats until the packet reaches the sink node. If no forwarding candidate has successfully received the packet, the sender will retransmit the packet if the retransmission is enabled. Denote tk as the single-hop medium delay of the kth candidate, which is the time from the sender broadcasts a packet to the kth candidate claims it has received the packet. In GOR, the medium delay can be divided into two parts. One part is the sender delay, which includes the backoff delay and the transmission delay of the data packet (there is no RTS/CTS exchange for the broadcast transmission). The second part is the candidate coordination delay, which is the time needed for the kth candidate to acknowledge the sender and suppress other potential forwarders. The single-hop medium delay is defined as Eq. 2, where the signal propagation delay is ignored.
tk = TBack-off + TDATA + k · (TSIFS + TACK);
(2) Where TBack-off includes the Distributed Inter-frame Space (DIFS) and a random back-off time for the sender to acquire the channel, TSIFS is the value of Short Inter-frame Space (SIFS). TDATA and TACK are the transmission delays for sending a data packet and an ACK, respectively. Fig. 1 shows an example illustrating the single-hop medium delay with three prioritized forwarding candidates. We know tk is an increasing function of k, i.e., the forwarding candidate with higher priority has shorter coordination delay than the lower priority candidate. This is because the lower priority forwarding candidates always wait higher priority candidates to relay the packet first.

IV. EXISTING SYSTEM

Providing reliable and timely communication in WSNs is a challenging problem. This is because the varying wireless channel conditions and sensor node failures may cause network topology and connectivity changing over time [2]. Under such conditions, to forward a packet reliably at each hop, it may need multiple retransmissions resulting in undesirable long delay as well as waste of energy. Therefore, many existing works have been proposed to improve the routing reliability and latency in WSNs with unreliable links. Quality of Service (Quality of Service) provisioning in network level refers to its ability to deliver a guaranteed level of service to applications. The Quality of Service requirements can be specified in the form of routing performance metrics, such as delay, throughput or jitter. For periodic environment reporting applications, delivery delay is not critically significant as long as the sensory data arrives at the sink node. While for other mission-critical applications, e.g., target tracking and emergency alarm, reliable and timely delivery of sensory data is crucial in the success of the mission. In this case, Quality of Service routing for both the end-to-end reliability and delay guarantees becomes one of the important research issues in WSNs. Several existing works [3-9], MMSPEED[5], MCMP[6], EQSR[7] , ECM[8] , and DARA[9] propose to utilize multiple paths between the source and sink for multi constrained Quality of Service provisioning in WSNs. Data transmission along multiple paths can achieve certain desired reliability, and the delay Quality of Service requirement is met as long as any one packet copy arrives at the destination before the deadline. Compared with the single path routing with retransmission to guarantee delivery reliability, the multipath approach may probably provide shorter end-to-end delay by removing the retransmissions. However, it has following two major disadvantages: 1) Sending a packet over multiple paths inevitably induces significant energy cost, which is one of the primary design concerns in WSNs; 2) Exploiting multiple paths also introduces more channel contentions and interference which may increase the delivery delay as well as cause transmission failures.

V. PROPOSED SYSTEM

The work addresses of the multi constrained Quality of Service routing in WSNs: 1) The multipath routing is not suitable for multi constrained Quality of Service provisioning in Wireless senor networks. We propose to exploit the geographic opportunistic routing (GOR) for Quality of Service provisioning in WSNs. 2) The existing GOR protocols

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

cannot be directly applied to guarantee both reliability and delay Quality of Service constraints in an efficient manner. Considering the reliability and delay constraints as well as the energy constraint in WSNs, the design of GOR protocol will not achieve good balance among energy efficiency, end-to-end delay and reliability and the multipath routing approach may also not suitable to guarantee both reliability and delay Quality of Service constraints in WSNs. Hence, we propose an Efficient Quality of Service -aware GOR (EQGOR) algorithm based on the theoretical analysis and observations, for Quality of Service provisioning to exploit the opportunistic routing for multi constrained Quality of Service provisioning in WSNs for mission-critical applications such as end to end delay, reliability and delay constraints.

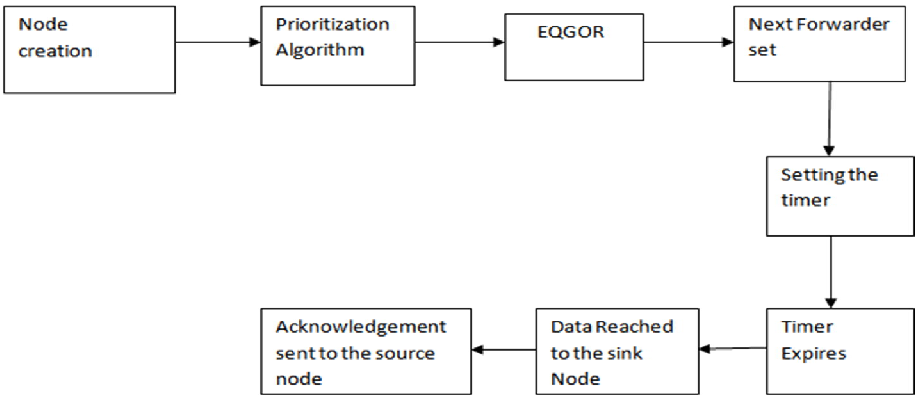

Fig. 1 Flow Diagram

A. METHODOLOGY

The proposed protocol - Efficient QoS-aware GOR (EQGOR) algorithm is to ensure better performance of the network. The proposed QoS requirement is to guarantee both reliability and delay QoS constraints in WSNs.

B. GREEDY PERIMETER STATELESS ROUTING (GPSR):

Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology. When a packet reaches a region where greedy forwarding is impossible, the algorithm recovers by routing around the perimeter of the region. By keeping state only about the local topology, GPSR scales better in per-router state than shortest-path and ad-hoc routing protocols as the number of network destinations increases. Under mobility's frequent topology changes, GPSR can use local topology information to find correct new routes quickly. Under GPSR, packets are marked by their originator with their destination's locations. As a result, a forwarding node can make a locally optimal, greedy choice in choosing a packet's next hop. Specifically, if a node knows its radio neighbors positions, the locally optimal choice of next hop is the neighbor geographically closest to the packet's destination.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

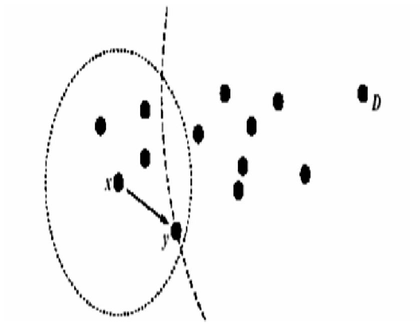

Fig. 2 Greedy Forwarding I GPSR

Forwarding in this regime follows successively closer geographic hops, until the destination is reached .
In the Fig. 2 above x selects a next hop from its neighbor (y) which is closer to the destination and forwards its data. Greedy routing may fail to find a path between sender and destination.

GREEDY-FORWARD(p)
1. nbest = self.a
2. dbest = DISTANCE(self.l, p.D)
3. for each (a,l) in N do
4. d = DISTANCE(l, p.D)
5. if a == p.a or d < dbest then
6. dbest = d
7. nbest = a
8. if a == p.a then break
9. if nbest != self.a then
10. return success
11. forward p to nbest
12. else return failure

C. EQGOR DESIGN

Candidate selection and prioritization algorithm in EQGOR for QoS provisioning inWSNs is provided. When node i is sending a data packet to the sink node, it selects and prioritizes forwarding candidates based on the Algorithm. Then it forwards the data packet following the GOR procedure .The design of Algorithm is described as follows. We introduce two adjustable parameters α and β, which
represent the minimum and maximum number of candidates to be prioritized, respectively. EQGOR will only prioritize the first k available next-hop nodes based on the observation of the similar pareto principle in GOR, where k=max{α,min{β,0:2 Ci }}. For sending node i, candidates in Ci are descendingly sorted according to the ''SPP × PRR'' metric. Initially, we include the first node of Ci into Fi and remove it from Ci. Then, we check nodes in Ci in sequence, where c1 always denotes the first node in Ci. When intending to add c1 into Fi, it should be within the transmission range of any node in Fi. Otherwise, it will be eliminated from Ci. If there is no packet duplication (i.e., c1 can overhear any node in Fi), we search the best place to insert c1 into Fi. The searching procedure is to try every possible inserting position in Fi, and calculate the expected single-hop packet speed values. For the remaining nodes in C, candidates will be selected to meet the hop QoS requirements at a minimum cost, i.e., simply appending to Fi. When the number of available next-hop nodes networks, the time complexity of EQGOR is approximate O(Ci).

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

VI. IMPLEMENTATION

A. CREATION OF NODES

This module contains the information from the users like their username, port number, internet protocol address. The details will get from the user and stored in the data base. This detail is for the single user identity and for the communication. The user can login with the concern username and the port number to send the data to the other node. If the login failed means the user cannot login in to the network

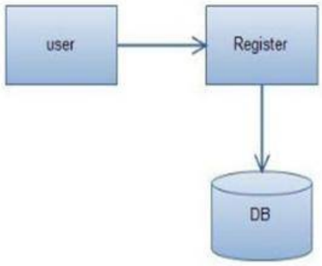

Fig 3. Creation Of Nodes

B. NEXT FORWARDER SET BY EQGOR

The fig.4 is described as following: when node i has a data packet to send to the sink node via multi hop communication, it selects the forwarding candidate set if based on its local knowledge of available next-hop forwarder set C. Then node is broadcasts the data packet where the list of candidates and their priorities are included in packet header. These candidates follow the assigned priorities to relay the packet opportunistically. For each candidate, if having received the packet correctly, it will start a timer whose value depends on its priority. The higher the priority is, the shorter the timer will be the forwarding candidate whose timer expires.

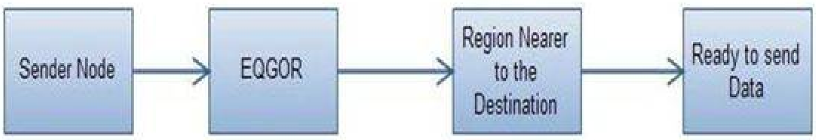

Fig.4.Next Forwarder Set by EQGOR

C. SETTING THE TIMER

The fig.5 shows forwarding candidate whose timer expires will reply an ACK, to notify the sender as well as all other candidates to cancel their timers. Subsequently, this forwarding candidate becomes the actual next-hop sender in an opportunistic manner. The forwarding process repeats until the packet reaches the sink node. If no forwarding candidate has successfully received the packet, the sender will retransmit the packet if the retransmission is enabled. Denote to as the single-hop medium delays of the kith candidate, which is the time from the sender broadcasts, a packet to the k the candidate claims it has received the packet.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

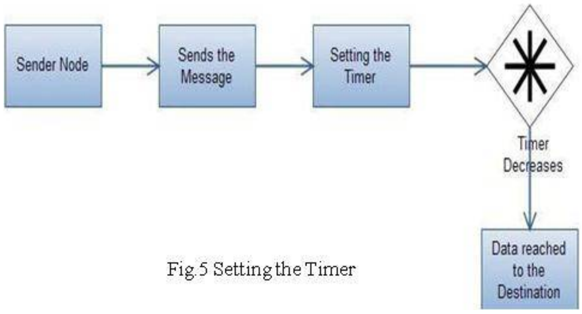

Fig.5 Setting the Timer

D. SENDING ACKNOWLEDGEMENT TO THE SOURCE NODE

The fig.6 shows the sink node sends the acknowledgment to the source node after receiving the data successfully. It sends the notification to all other nodes to cancel the timer. The Sink node timer also expires which has the highest probability. This saves the time and cost compare to the multipath routing. The send acknowledgment is successfully sent to the source node.

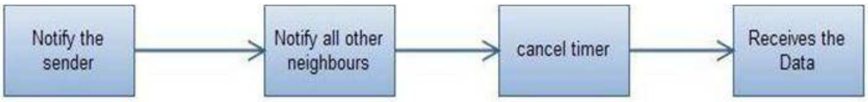

Fig.6.Sending Acknowledgement To The Source Node

VII. PERFORMANCE ANALYSIS

This proposed research work was implemented by NS2 Network Simulation Tool. Both theoretical and simulation results show that, the proposed scheme is more efficient than the existing system in terms of providing QoS in Multi-constrained Multipath Sensor networks

VII. IMPLEMENTATION RESULTS.

A. THROUGHPUT

Network throughput refers to the average data rate of successful data or message delivery over a specific communication link. Network throughput is measured in bits per second (bps)

$$\text{Throughput} = \frac{\text{No of packets delivered}}{\text{Time period}}$$

B. PACKET DELIVERY RATIO

The ratio of the number of delivered data packet to the destination

$$\text{Throughput} = \frac{\text{No of packets delivered}}{\text{Time period}}$$

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

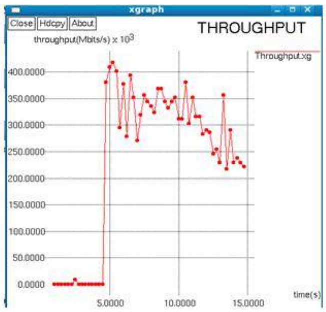

Fig. 7 Throughput graph for EQGOR algorithm

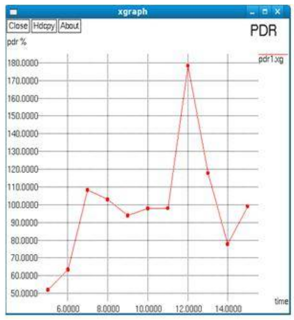

Fig. 8 Packet Delivery Ratio (PDR) graph for EQGOR algorithm

VII.C END TO END DELAY

The time taken by the source node to deliver the data successfully to the destination is called as End to End delay.

$$\text{End To End Delay} = \frac{A_R - S_R}{N}$$

Where AR= Arrival Time; N = Number of Connection; SR=Send time;

VIII. CONCLUSION

The efficient candidate selection and prioritization algorithm of QoS aware geographic opportunistic routing (EQGOR) for multiconstrained QoS in WSNs is exploited, which is more suitable than the multipath routing approach. The existing GOR protocol cannot be directly applied to the QoS provisioning in WSNs. Because the computations delay of a GOR protocol should be also considered in WSNs. So an Efficient QoS-aware GOR (EQGOR) algorithm for QoS provisioning in WSNs achieves a good balance between these multiple objectives, and has a very low time complexity, which is specifically tailored for WSNs considering the resource limitation of sensor devices. The performance of the proposed EQGOR is studied and the evaluation results demonstrate its efficacy for QoS provisioning in WSNs.

REFERENCES

[1] Yick. J., Mukherjee.B, and Ghosal. D., “Wireless sensor network survey,” Comput. Netw., vol. 52, no. 12, pp. 2292–2330, Aug. 2008.
[2] Niu. J., Cheng. L., Gu. Y., Shu. L., and Das. S. K., “R3E: Reliable reactive routing enhancement for wireless sensor networks,” IEEE Transaction on Industrial Informatics, 2013.
[3] Stojmenovic. I., Nayak. A., and Kuruvila. J., “Design guidelines for routing protocols in ad hoc and sensor networks with a realistic physical layer,” IEEE Communications Magazine, vol. 43, no. 3, pp. 101–106,2005.
[4] Kuruvila. J., Nayak. A., and Stojmenovic. I., “Greedy localized routing for maximizing probability of delivery in wireless ad hoc networks with a realistic physical layer,” Journal of Parallel and Distributed Computing, vol. 66, no. 4, pp. 499–506, Apr. 2006.
[5] Felemban. E., Member. S., gun Lee. C., and Ekici. E., “MMSPEED: Multipath multi-speed protocol for qos guarantee of reliability and timeliness in wireless sensor networks,” IEEE Transactions on Mobile Computing, vol. 5, pp. 738–754, 2006.
[6] Huang. X and Fang. Y., “Multiconstrained qos multipath routing in wireless sensor networks,” Wireless Networks, vol. 14, no. 4, pp. 465– 478, 2008.
[7] Yahya .B and Ben-othman. J., “An energy efficient and qos aware multipath routing protocol for wireless sensor networks,” in Proc. LCN ’09, 2009, pp. 93–100.
[8] Bagula. A. B and Mazandu. K. G., “Energy constrained multipath routing in wireless sensor networks,” in Proc. UIC ’08, 2008, pp. 453–467.
[9] Razzaque. M. A., Alam. M. M., Or-Rashid. M., and Hong. C. S., “Multiconstrained qos geographic routing for heterogeneous traffic in sensor networks,” in Proc. CCNC ’08, 2008 Jan., pp. 157–162.