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Enhanced QOS aware Opportunistic Routing Algorithm for Relay Node Selection in Wireless Sensor Networks

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Abstract – The proposed system develops and implements an efficient QOS based distributed routing algorithm and Q-ORP (QOS based Opportunistic Routing protocol) for solving the routing issues in wireless networks. The work extends the regional Probe approach in the network with dynamic delay calculation. The delay calculation helps to know the overall cost of the link. This computes the queue delay, propagation and transmission delay. Implementation of the protocol assists to reduce the complexity of calculating load of every links over a period of time. Finally the proposed protocol Q-ORP works with the above QOS metrics such as follows. 1) Energy Equivalent Link (EEL) selection algorithm which guarantees QOS in opportunistic path. 2) A distributed packet scheduling algorithm to further reduce transmission delay, propagation and queuing delay 3) A mobility aware relay selection algorithm that adaptively adjusts segment size according to node mobility in order to reduce transmission time, 4) A data redundancy elimination-based transmission algorithm to eliminate the redundant data to further improve the transmission QoS. The proposed distributed enhanced routing approaches which will reduce link failures. Every link will be analyzed and updated in the routing table using the Q-ORP frequently. The proposed protocol adopts the resource reservation based QOS routing scheme. In this proposal a QOS-Oriented Distributed Opportunistic routing protocol (Q-ORP) to enhance the QoS support capability of wireless sensor networks. The proposed protocol can provide high QoS performance in terms of overhead, transmission delay, propagation delay, queuing delay, mobility-resilience, traffic reduction, and scalability.

Index Terms – Energy efficiency, opportunistic routing, relay node, wireless sensor network (WSN).

1. INTRODUCTION

Wireless sensor network (WSN) offers extensive applications in different domains. Such domains are traffic monitoring, robotic, industrial monitoring etc [1]. the invention of effective wireless communication in electronics provides low power and multi functional sensor nodes. Data dissemination and on time data delivery is a mandatory process in many areas such as fire detection and environmental monitoring [2][3]. So there is a need to achieve the QOS in every transmission in WSN. In this paper, we aims to simultaneously improve the QOS for high-integrity applications and decrease the congestion avoidance, end-to-end delay, even when the network is blocked-up. In this paper we aim to schedule the packets in a dynamic routing environment with different QOS metrics and opportunistic based. This performs a differentiated potential requirement aware routing. Initially the Q-ORP performs the finding of the idle and under loaded links by applying different delay analysis, then the second task is to cache the packets efficiently for subsequent transmission for congestion avoidance. Q-ORP transmits the packets according to the integrity requirement which will be forwarded to the next hop with smaller queue length via opportunistic nature. We aim to cover almost all QOS requirements related to congestion in WSN and this proposes a mechanism called Implicit Hop-by-Hop Rate Control is designed to make packet caching more efficient.

2. PROBLEM DEFINITION

The problem is defined as reliable data delivery of data transmission in highly dynamic and unstructured WSN. Frequently changing network topology and packet scheduling in WSN makes conventional wireless routing protocols incapable of providing satisfactory performance in the data transaction [4][5]. This also suffers from link break due to node mobility and high congestion in improper scheduling in dynamic routing. And extensive data packets would either get lost or experience high delay before renewal of connectivity. Dynamic routing with opportunistic protocol [6] should consider low delay and high data integrity in the sensitive application. But, a heavily loaded network will suffer QOS related issues [7][8][9] that increase the end-to-end delay and decreases the network performance. Several protocols dealt the above problem by applying different protocols which are based on throughput and delay considerations. But those systems failed to deal with the high mobility and buffer related information for in WSN environment [10].

The problem is defined as reliable data delivery of data transmission in highly dynamic mobile hybrid networks. Constantly changing network topology makes conventional wireless routing protocols incapable of providing satisfactory performance in the data transaction environment. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Hybrid wireless network topologies usually expose high link density. Low end commodity switches are widely used in most HWNs designs for economic and scalability considerations[5]. Wireless nodes management a challenging problem for QOS protocols. Several protocols dealt the above problem by applying different routing protocols, but those systems failed to deal with the high mobility in hybrid wireless network environment with both QOS and opportunistic considerations.

3. PORPOSED SYSTEM

This section describes the process of Q-ORP protocol and way to select and prioritize the forwarder set using optimal energy strategy on each node and how to choose the optimal relay node among potential forwarders that respond in a priority order. In addition, the transmitted data can be naturally classified into two categories:

1) The first hand data is the collected data of its own; and

2) The next hand data is the relay data from other nodes. This should distinguish incoming data (the data of second category) by tracing the ID of sender. Eventually, we introduce Q_ORP algorithm for energy saving to select the next relay node which has the highest priority in forwarder set to forward the incoming packet using EEL_OR algorithm (Energy Equivalent Link based opportunistic routing) .

The proposed work extends from the existing QOS aware opportunistic routing techniques. The proposed routing protocol performs the following functions with the supplementary parameters. It finds the geographical information's for relay selection in opportunistic routing and it also finds the impact of packet delay by applying QOS metric verification. ORP finds the optimal link and forwards the data via EEL (Energy Equivalent Link) and via the residual energy of each node into EEL for the selection of relay nodes. The protocol calculates the Equivalent cost by considering the geographical distance between hops, mobility of the node and the three kind of delay. At last it matches the throughput over multiple paths along with the mobility. It shows that the EEL-OR can be computed at the every forwarder nodes based on decomposition in network utility maximization (NUM). This helps to verify and re-navigate between links rather than path using the accurate throughput matching.

• It proposes methods which allow individual network nodes to locally characterize the congestion and traffic impact which helps for the throughput declaration and aggregate this information for the source nodes.

The protocol consists with the following calculations and algorithms which associate with the reliable routing in WSN. The proposed system overcomes the existing NP-hard problem by selecting optimal path with the consideration of dynamic path analysis and distributed adaptive routing.

This component retrieves the traffic/flow takes into account that Flow can be assigned to any available path without packet reordering, if the time between two successive packets is larger than the maximum delay difference between the parallel paths. The following process included in the proposed protocol. The protocol should include the process for effective traffic distribution over a WSN. The rules are the set of sub procedures which handles routing, congestion awareness, link state search, delay based cost calculation and distributed adaptive routing with all above QOS parameters.

An Overview of the Q_ORP Protocol

Scheduling feasibility is the knack of a node to guarantee a packet to arrive at its destination with all QOS requirements. Q_ORP has the following major goals. The first one is Generating and transmitting the data on multiple paths with schedule considerations. And Tuning the packet rate while congestion occurs and to ensure efficient link capacity utilization, by means of buffer and other QOS metrics. This will be done when some nodes in a particular route are inactive or in sleep mode. Q-ORP performs fair link selection and packet scheduling using the above four algorithms.

Pseudo code for the Q_ORP routing protocol executed by a source node.

1: if a node receive RREQ from a source node Sn then

2: if utility < threshold then

3: Reply to the Sn.

4: end if

5: end if

6: if receive forwarding request (Frr) replies from neighbor nodes then

7: Determine the packet size Sp(i) to each neighbor I.

8: Estimate the queuing delay Tw for the packet for each neighbor based on Equation (4).

9: Determine the qualified neighbors that can satisfy the deadline requirements based on Tw

10: Organize the qualified nodes in descending order of Tw

11: Allocate workload rate Ai for each node.

12: for each intermediate node ni in the sorted list do

13: Send packets to ni with transmission interval Sp(i) Ai

14: end for

15: end if

The packets travel from different sources which may lead to different packet transmission, queuing and propagation delay resulting in a jitter at the receiver side. The jitter problem can be solved by using the scheduling mechanism at the destination node to shape the traffic flows.

4. RESULTS AND DISCUSSIONS

The result analysis gives the comparative analysis of existing and proposed system in terms of different QOS metrics.

PACKET DELIVERY RATIO (PDR)

The ratio of number of packets send from source and number of packets reach the destination. The ratio of the number of packets received and the number of packets expected to be received. So the ratio is the total number of received packets over the multiplication of the group size and the number of originated packets.

The packet delivery ratio is calculated as follows:

PDR = (No of packets Received / No of packets send) * 100

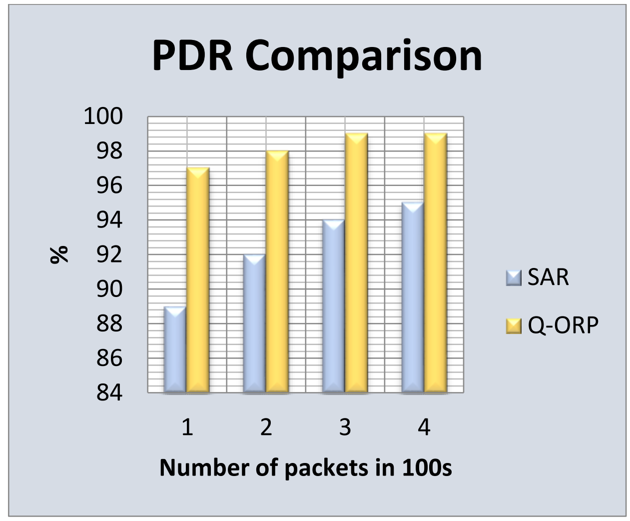

Fig 1.0 Performance comparison of proposed Q-ORP using EEL with existing SAR approach

From the above chart it shows the performance measure based on the packet delivery ratio of the proposed approach Q-ORP using EEL. In the existing system the packet delivery ratio decreases due to high mobility and delay in communication even though multiple redundant paths are available. The proposed system uses multiple options such as SAR, EEL and social previously known paths to send the packet from source to destination thus the packet delivery ratio increases.

ENERGY UTILIZATION

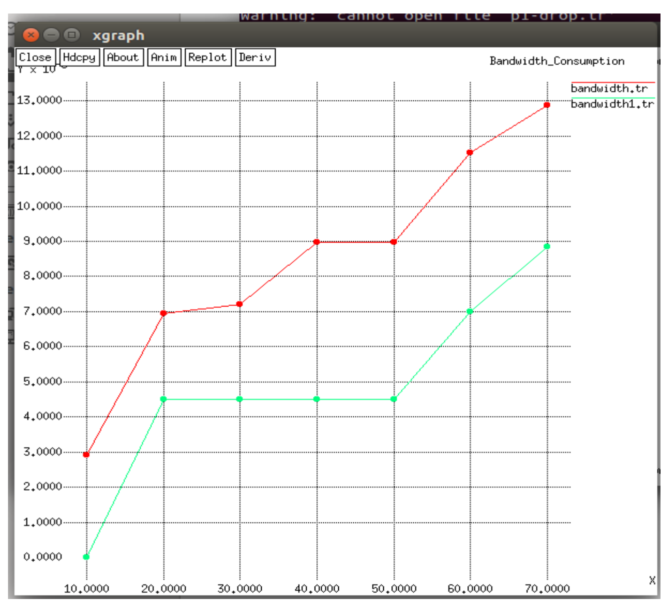

Fig2.0 energy comparison of proposed Q-ORP using EEL with existing SAR approach

The energy refers to the joules consumption of the link to transmit the data. The proposed system spread the message in the available virtual nodes and paths by proper utilization of energy in each path with the use of EEL.

5. CONCLUSION

An opportunistic routing protocol presents a promising scheme to improve the wireless network performance by exploiting the broadcast nature of the medium and thus improves the transmission ratio also. The main concern of this proposal is to create a new opportunistic protocol, which is named as Q-ORP; this relies on several parameters, such as different delay, node position, and energy equivalent link selection process. The neighboring nodes should forward the data packets and how to coordinate them to avoid duplicated retransmissions. The way to select the relays is supported by the above metrics. This paper has reviewed the main proposals for wireless networks and these have classified them according to the kind of metric used. The proposed protocol performs well in wireless network against network QOS issues. The simulation has been shown in Ns2 simulator. In future the proposed protocol can be extended with cost reduction techniques, which can even reduce the cost of the proposed work. Adding some other parameter and customized parameter selection may result better in future.

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