QoS and Energy Aware Geographic Routing Protocol for WSN

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Abstract—Due to the approved content nature, mostly collected of images and/or video streams with high throughput and delay restrictions, Quality of Service in the framework of WSN is a critical issue. In this paper, we propose a QoS and energy aware geographic routing protocol for WSN. To advance the efficiency of QoS routing in WSNs, we sketch the problem of efficient GOR for multiconstrained QoS provisioning in WSNs, which can be expressed as a multiobjective multiconstraint optimization problem. Based on the investigation and interpretations of different routing metrics in GOR, we then suggest an Efficient QoS-aware GOR (EQGOR) protocol for QoS provisioning in WSNs. EQGOR selects and orders the advancing candidate set in well-organized method, which is suitable for WSNs in respect of energy efficiency, latency, and time difficulty.

Index Terms—Wireless sensor networks; Multiconstrained QoS, Geographic opportunistic routing.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) have fascinated the care of many researchers. Wireless Sensor Networks (WSNs) are used for various applications such as surroundings monitor, automation, cultivation, and security measures. While recurrent sensors are usually organized on distant and remote spaces the intake and maintenance should be easy and accessible. Wireless sensor network comprise of large number of miniature nodes. The node after that sense environmental alteration and report them to other nodes over flexible network architecture. Sensor nodes are great for misuse in hostile environments or over large geographical areas. Wireless sensor networks have recently come into importancesince they grip the possible to transform many sections of our financial system and life, beginning environmental monitor and conservation to industrial and business dominance organization to automation in the transportation and health care industry. The project, execution, and deed of a sensor network requires the meeting of a lot of authority, other than signal processing, network and protocol embed system information management and distributed algorithm. Such network is again and again organized into resource-constrained environment, for example through battery operate nodes running undeterred.

Fig 1 Wireless Sensor Networks

This restraint mandate that sensor network determination are best method in a hostile technique by prearranged considering the physical, network and application layer and making chief design modifications across the layer. The Wireless Sensor Network achieve function simultaneously where nodes are self-governing bodies integrated in the field spatially for the correct result; the information transmits over proper channel taking the information gathering it in the form of data and send to the base. Sensor networks spread the present Internet bottomless into the bodily atmosphere the resulting state-of-the-art network is orders of flagrancy more extensive and active than the current TCP/IP networks and is making completely new kinds of traffic that are fairly dissimilar from what one treasures on the Internet at present. Information composed by and conveyed on a sensor network labels conditions of physical surroundings...
for example, temperature, wetness or shaking and requires advanced inquiry boundaries and search engines to meritoriously support User-level functions. Sensor networks may inter-network with an IP core network via a number of gateways. A gateway path user inquiry or commands to suitable nodes in a sensor network. It also paths sensor data, at times collective and brief to user who has appeal it or are acknowledged to use the information. A data artillery or storage space facility may be present at the gateway, in addition to data logging at each sensor.

II. RELATED WORK

The problem of using multi-path routing in wireless sensor networks and suggested the Energy-constrained Multi-Path routing (ECMP), an advance to the MCMP model. The chief awareness driving the ECMP model is that in the framework of wireless sensor networks, effective resource practice should reproduce not only efficient bandwidth operation but also a negligible usage of energy in its firm term. The strong point of the ECMP model lies in the detail that it crafts between minimum number of hops and minimum energy by picking out a path with minimum number of hops only when it is the path with slightest energy or a longer path with slightest energy satisfying the restrictions.

Fig 3 Virtual overlay of multiple speed layers.

In current years, there has been a rising attention in Wireless Sensor Networks (WSN). Current improvements in the field of sensing, computing and communications have fascinated researchers in the direction of the field of WSNs.

Jianwei et al., [4] have presented R3E, which can supplement most prevailing reactive routing protocols in WSNs to deliver dependable and energy-efficient packet delivery contrary to the untrustworthy wireless links. It can efficiently advance robustness, end-to-end energy efficiency and latency.

Cheng et al., [5] have demoralized the Geographic Opportunistic Routing (GOR) for multi constrained QoS provisioning in WSNs, which is extra appropriate than the multipath routing approach.

Ravindra et al., [6] have suggested a technique in which defective sensor node is noticed by measuring the round trip delay (RTD) time of distinct round trip paths and linking them with threshold value.

Yuli et al., [7] have suggested fractional quality-of-service (QoS)-oriented relay selection scheme with a decode-and-forward (DF) relaying protocol, to decrease the feedback quantity essential for relay selection.

Samina et al., [8] have developed cross layer techniques appropriate for Wireless Sensor Networks (WSNs) that are adept of multichannel devices for the QoS provisioning are comprehended in a contained way lacking global network material by using localized geographic packet forwarding greater than before with dynamic reward, which recompenses for local decision inexactness as a packet travels towards its destination. MMSPEED can promise end-to-end necessities in a localized way, which is required for scalability and flexibility to great scale dynamic sensor networks.
access. Additional detail, energy and cross-layer aware routing patterns are proposed for multichannel access WSNs that interpretation for radio, MAC contention and network constraints. Yunbo et al., [9] have developed an inclusive cross-layer investigation framework, which pays a stochastic queueing model in accurate channel surroundings. This framework is nonspecific and can be parameterized for a wide change of MAC protocols and routing protocols which affect numerous network parameters like end-to-end delay. Fenye et al., [10] have suggested a rank ed dynamic trust management protocol for cluster-based Wireless Sensor Networks, as two features of honesty, specifically, social trust and QoS trust. A probabilistic model is established for using stochastic Petri nets techniques to investigate the protocol performance and authorized personal trust against objective trust attained based on ground truth node position.

III. PROPOSED SYSTEM MODEL

We deliberate have a multi-hop WSN in a two-dimensional planar area. We assume the network is thickly organized, i.e., each node has adequately of neighbors. We also assume that the MAC layer offers the connection quality assessment service, e.g., the packet reception ratio (PRR) information on each link can be gained by counting of the lost inquiry messages or data packets. Presumptuous node i is sending a data packet to the sink node (denoted as Dest), and j is one of i’s neighbors which is closer to the sink than i. Define \( a_j \) in Eq. 1 as the single-hop packet progress (SPP) to the Dest when a packet is advanced by neighbor j. \( C_i \) is well-defined as the obtainable next-hop forwarder set of node i, where all nodes in \( C_i \) have positive SPPs.

\[
 a_j = \text{Dist}(i, \text{Dest}) - \text{Dist}(j, \text{Dest}) \quad \text{………} \quad \text{(1)}
\]

where Dist (i, Dest) is the Euclidian distance between node i and the Dest. Let \( p_j \) represent the PRR between node i and j. For any neighbor j, node i preserves the pair information \( (a_j, p_j) \) in its neighbor table.

**Geographic opportunistic routing Procedure**

1) When node i has a data packet to send to the sink node via multi-hop communication, it picks out the advancing candidate set \( F \), depending on its native information of available next-hop forwarder set \( C_i \).

2) Then node i transmit the data packet wherever the list of candidates and their significances are included in packet header.

3) Now candidates track the allocated precedence to relay the packet resourcefully.

4) For each candidate, if having acknowledged the packet appropriately, it will start a timer whose value depends on its precedence.

5) The higher the precedence is, the shorter the timer will be. The forwarding candidate whose timer perishes will respond an ACK, to inform the sender as well as all other candidates to abandon their timers.

6) Consequently, this forwarding candidate converts the actual next-hop sender in resourceful manner. The forwarding process duplicates until the packet extents the sink node.

7) Now if no forwarding candidate has successfully acknowledged the packet, the sender will resends the packet if the retransmission is permitted.

**EQGOR DESIGN**

The pareto principle (also known as the 80-20 rule in the field of economics) shapes that, for several proceedings, roughly 80% of the things come from 20% of the causes. That is, utmost forwarding tasks for each hop are taken by the first two or three candidates in the well-ordered forwarding candidate set. This specifies that it may only want to order a same small number of candidates to achieve a close optimum solution in our proposal, by which the algorithm’s time difficulty can be meritoriously condensed. Table 2 exemplifies the number of forwarding candidates involved in the proposed candidate selection and ordering algorithm in [3].

<table>
<thead>
<tr>
<th># of available next-hop nodes</th>
<th>Avg. # of forwarding candidates</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>8.87</td>
<td>0.902</td>
</tr>
<tr>
<td>15</td>
<td>12.56</td>
<td>1.227</td>
</tr>
<tr>
<td>20</td>
<td>18.09</td>
<td>1.511</td>
</tr>
<tr>
<td>25</td>
<td>22.15</td>
<td>1.621</td>
</tr>
</tbody>
</table>
Algorithm 1: Candidate selection and prioritization at forwarding node i in EQGOR

The above hypothetical investigation and observations inspire us to propose a custom-made candidate selection and ranking algorithm in EQGOR for QoS provisioning in WSNs. Once node i is sending a data packet to the sink node, it chooses and arranges forwarding candidates based on the scheme as proposed in Algorithm 1. Then it forwards the data packet following the GOR procedure for further analysis.

### Evaluation metrics

We pick out six main assessment metrics to assess the usefulness of EQGOR for QoS provisioning in WSNs.

- **End-to-end Delay:** The time occupied for a packet to be conveyed from the source node to the sink node. Given the end-to-end delay QoS requirement, this metric measures the on-time packet delivery ratio.
- **Packet Delivery Ratio:** It is the ratio of the number of packets acknowledged by the destination to the total number of packets sent by the source.
- **Data Transmission Cost:** It is measured as the total number of data transmissions for a fruitful end-to-end data delivery.
- **Control Message Cost:** It is well-defined as the total number of control message transmissions for sending a single packet to the destination, such as RTS, CTS, and ACK.
- **Single-hop Packet Progress:** It is the ratio of the sum of single-hop packet headway in each hop to the number of hops in a simulation run.
- **Link Quality per Hop:** It is the average link quality for fruitful data transmission at each hop.

### IV. RESULTS

![Fig 4](image1.png) Here we compare the average delay probabilities with transmission services.

![Fig 5](image2.png) Here we compare single hop packet progress with node density.

### V. CONCLUSION

In this paper, we proposed to use the geographic opportunistic routing (GOR) for multi-constrained QoS provisioning in WSNs, which is supplementary suitable than the multipath routing method. Based on our investigation and interpretations, we then proposed an Efficient QoS-aware GOR (EQGOR) algorithm for QoS provisioning in WSNs. EQGOR attains a good equilibrium among these multiple objectives, and has a very low time trouble, which is...
exactly adapted for WSNs allowing for the resource constraint of sensor devices.

REFERENCES