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# Routing Imperative Data Packets in Wireless Sensor Networks using Congestion Free Path

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## Abstract

The congestion problem in Wireless Sensor Networks (WSNS) is quite different from that in traditional networks. Most current congestion control algorithms try to alleviate the congestion by reducing the rate at which the source nodes inject packets into the network. Congestion occurs when too many source nodes are sending data for network to handle. It causes missing of data packets, increases energy efficiency and transmission delay. Transferring crucial data in critical situation is a challenging problem in WSNS. In sensor network two types of paths are constructed for data transmission, they are single path and multi path. Single path data transmission leads to more congestion as all data are send through a single path. Multi path data transmission reduces congestion by sending data based on the urgency. The proposed work dynamically schedules different type of data flow. To assign priority for each data packets it avoids the starvation problem by finding buffer occupancy of each intermediate node by finding the shortest path. Imperative data packets routed using congestion free path with minimum delay in WSNS increase the network throughput and efficiency.

**Keywords:** Buffer Occupancy, Congestion, Multi path, Priority, Routing

## 1. Introduction

Wireless Sensors Networks (WSNs) consists of spatially distributed autonomous sensors to monitor physical or environmental condition such as forest fire detection, animal tracking, biomedical and battlefield surveillance. Sensor nodes are small in size and less battery power. Different type of sensor nodes is available which are deployed to track event based detection and continuously monitor the environment. While transferring sensed information towards the sink it faces lot of problems like packet drop, congestion on link and node levels, topology changes. When too many source nodes are start to send the data at same time towards the sink its leads congestion on network. In WSNs, there are two types of congestion namely 1. node level 2. link level. Node level congestion is called as persistent congestion. Incoming packet rate is high compare to the service rate of the packet. Link level congestion is called as permanent congestion. Based on the queue occupancy link level congestion is detected. Biomedical wireless sensor networks detect multiple events such as ECG, BP, PULSE RATE and TEMPERATURE. These kinds of informations are used to monitor the patients health continuously without moving from their place. The sensed informations are very urgent to transfer without any transmission delay and packet loss. In this paper, in order to avoid congestion we propose an efficient congestion control algorithm based on buffer occupancy to increase the network throughput and efficiency. In previous priority assignment method, assigning priority based on distance and energy does not depend on urgency. The proposed priority assignment mechanism gives importance to urgency of data. Sensed information is compared with theoretical threshold based on which priority is assigned to each data packets. Constructing queuing model for data transfer involves logically splitting a single queue into two sub queues. One queue has urgent priority packets and another one

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has normal priority packets. Higher priority packets and normal priority are routed through different paths. On demand differentiated routing algorithm is used to find the shortest path based on the buffer occupancy of intermediate nodes. The proposed work is implemented and simulated using NS2 (Network simulator).

## 2. Related Work

Now a days, many works are going on congestion detection and avoidance in wireless sensor networks. Here we discuss various existing methods in congestion control and avoidance.

Rasa and chaudhry[1] propose a Optimised Priority Assignment Mechanism (OPAM) for reducing congestion in wsns. Opam not use any congestion control and detection method instant of that assigning priority to each data packets and reducing queuing delay. Priority values are collected from theoretical threshold. Sensed information compare with the threshold value based on the comparisons assigning priority to each data packets .Higher priority packets are routed immediately after that low priority packets routed. It reduces the higher priority data packet drops.

Patil and dhage[6] propose a priority based congestion control protocol it reduced upstream congestion in wsn. It creates priority table based on important of each node and send information to all node in the same network and measure congestion level in the network using ratio of packet inter-arrival time along over packet service time. It uses single and multiple path for data transmission it reduce packet loss and increase throughput.

Sajal K. Das[4] propose a traffic aware dynamic routing algorithm to route packets around the congestion areas and scatter the excessive packets along multiple paths, here ideal and unloaded nodes are properly utilized .To construct two independent potential fields using depth and queue length the depth field find shortest path and queue length exceed certain threshold value it mean congestion .the queue length potential field provides the basic routing backbone to direct the packets to sink.

Raju kumar[11] propose a congestion aware routing protocol to discover the congested zone of the network that exists high priority data sources and the data sink propose the use of data prioritization and a differentiated routing protocol and prioritized medium access scheme to mitigate its effects on high priority traffic. To strive for a solution that accommodate low priority and high

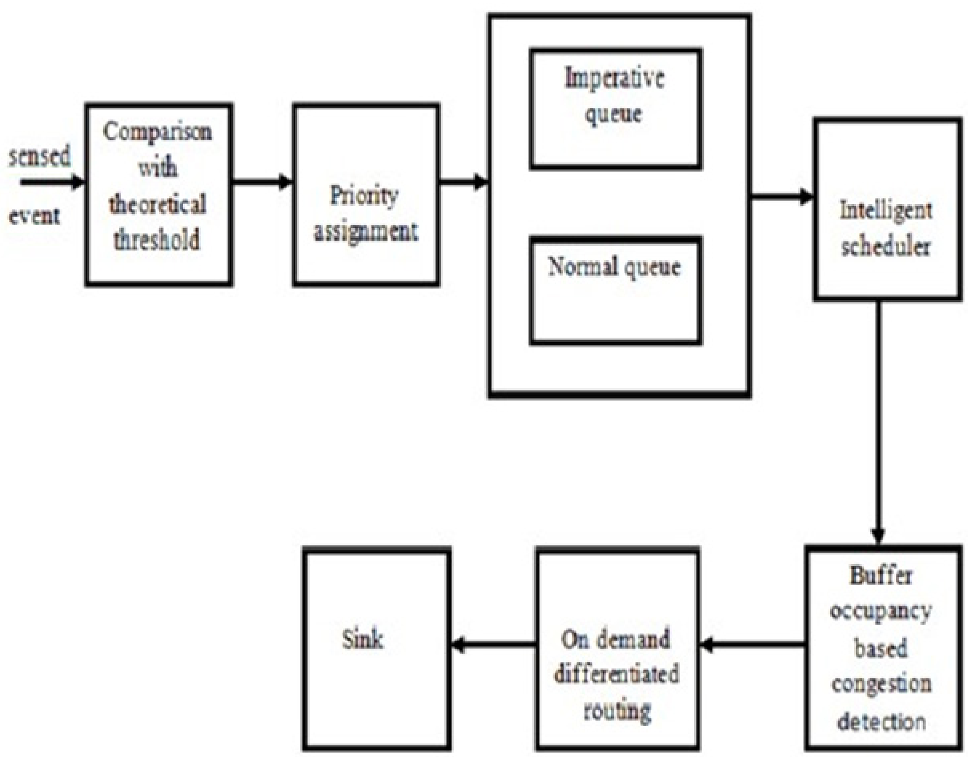


**Figure 1.** Sytem Model.

priority traffic when the network is static or near static and enabled fast recovery of low priority traffic in networks with mobile high priority data sources. The solution of the problem is to differentiated routing approach to effectively separate high priority traffic from low priority traffic in the sensor network.

## 3. Proposed Work

In this part we explain in detail about our proposed routing of imperative data packets in wireless sensor networks using congestion free path.

### 3.1 System Architecture

Overall system architecture is given in Figure 1. Sensed information is compared with theoretical threshold value based on priority assignment. Here, queue is logically split up into two parts, one for imperative and the other for normal data. Based on this priority, data is send into different queues. A scheduler first schedules imperative data queue if imperative queue is empty. In case the queue is not empty move them in to normal queue. Source node chooses the best path for imperative queue using shortest distance and buffer occupancy.

Queue is logically split into two parts to reduce imperative packet drop during congestion. Figure 2 represents queue model.

Imperative Data Queue: It routes imperative packets which contains sensed information whose priority is greater than the threshold value of the event.

### 3.2 Queuing Model

Normal Data Queue: It routes normal packets which contains sensed information equal to the threshold value of the event.

Step 1:
Input: priority packet (pp), non-priority packet (np)
Output: schedule to different queue

Step 2:
```
For (every incoming packets)
 {
     If (input=pp)
         Update (imperative data queue)
     Else
         Update (normal data queue)
 }
```

### 3.3 Congestion Free Path

Source node finds the buffer occupancy of each participating to forward the data packets. Based on the buffer occupancy of each node, shortest path is calculated and packets are then routed through that path.

Priority Q:
```
If (source node buffer size<TH_MIN)
    Set default sending rate
Else if(source node buffer size>TH_MIN<TH_MAX)
     {
         Sending rate=sending rate/2
             Update (back pressure message to1 hop
downstream nodes)
     }
Else if (source node buffer size>TH_MAX)
     {
         Sending rate=sending rate/4
             Update (back pressure message to1 hop
downstream nodes)
     }
Else if (incoming packet size exceed queue length)
     Update (non-priority queue header)
```
This process is repeated for all the N nodes.

Non priority Q:
```
If (source node buffer size<TH_MIN)
     Set default sending rate
Else if(source node buffer size>TH_MIN<TH_MAX)
     {
         Sending rate=sending rate/2
```

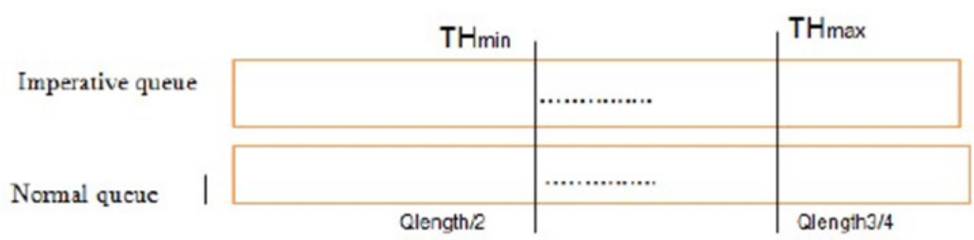


**Figure 2.** Queue Model.

Update (back pressure message to1 hop downstream nodes)

}

Else if (source node buffer size>TH_MAX)

{

Sending rate=sending rate/4

Update (back pressure message to1 hop downstream nodes)

}

This process is repeated for all the N nodes.

### 3.4 Differentiated Routing

Source node broadcasts RREQ packet to the destination through the intermediate neighbor node. In response to the RREQ packet the destination sends RREP packet along with buffer occupancy to the intermediate node. Then source node chooses the best path using shortest distance and buffer occupancy. Through the shortest path urgent data packets are routed. And for the rest best disjoint paths are chosen for normal data packet transmission.

Step1:

Input: sensed information

Output: the shortest path

Step2:

Source node:n

Neighboring node:x

Sink: S

Step3:

Source node n send the route request message to neighboring nodes x1,x2,….xn .

Step4:

Neighboring node transfers the route request and finally reaches the sink S.

Step5:

Route reply message received from neighboring node with buffer occupancy of each intermediate node are routed to the ultimate destination.

## 4. Conclusion and Future Work

The proposed congestion control algorithm assigns priority to the data dynamically based on the threshold values of the event .Then the data are categorized and they are queued separately in the sub-queue of the sensor node .Based on the congestion, the datas are routed to the sink node either using one or two paths with minimum transmission delay . The proposed algorithm has to be evaluated based on network throughput and efficiency. Our future work is to design a congestion free routing algorithm for mobile sinks to evaluate the network throughput and efficiency. And also a random topology can be used in the deployment of wireless sensor networks.

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