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# MITIGATING CONGESTION FOR HETEROGENEOUS TRAFFIC IN MULTIPATH WIRELESS SENSOR NETWORK

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**Abstract:** In this work we present algorithm which enables the reliable delivery of data. The algorithm provides an efficient way to prevent the packet loss at each node. This results in congestion management in the sensor networks. Through monitoring and controlling the scheduling rate the flow control and congestion control are managed. Different types of data generated in heterogeneous wireless sensor networks have different priorities. In multi path wireless sensor networks, the data flow is forwarded in multiple paths to the sink node. Each sensor node route is own data as well as the data generated from other senor nodes. The parent node of each sensor node allocates the bandwidth based on the source traffic priority and transit traffic priority of the data from heterogeneous applications in the child nodes. Congestion is detected based on the packet service ratio.

**Keywords:** Traffic Control; Congestion Control; heterogeneous traffic; multi path;

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## INTRODUCTION

Wireless Sensor Network consists of one or more sinks large number of sensor nodes scattered in an area. The downstream traffic from the sink to the sensor nodes usually is a one-to-many multicast. The upstream traffic from sensor nodes to the sink is a many - to- one communication. Due to the focused nature of upstream traffic, congestion more probably appears in the upstream direction. Congestion control is achieved by distributing the network bandwidth across multiple end -to- end connections.

Network congestion occurs when offered traffic load exceeds available capacity at any point in a network. In wireless sensor networks, congestion causes overall channel quality to degrade and loss rates to rise, leads to buffer drops and increased delays (as in wired networks), and tends to be grossly unfair toward nodes whose information needs to traverse a larger number of radio hops.

Two types of congestion could occur in WSNs they are node-level congestion and link-level congestion. The node-level congestion that is common in conventional networks. It is caused by buffer overflow in the node and can result in packet loss, and enhanced queuing delay[1].

Two general approaches to control congestion they are network resource management and traffic control. Network resource management tries to extend network resource to mitigate congestion when it occurs[8]. In wireless network, power control and multiple radio interfaces can be used to increase bandwidth and weaken congestion. This approach, it is necessary to guarantee precise and exact network resource adjustment in order to avoid over- provided resource or under-provided resource.

As many researchers in wireless sensor network worked on the problem of congestion and propose a technique such as priority based congestion control protocol, congestion detection and avoidance in sensor networks. Whereas these techniques does not solve the problem of heterogeneous traffic in WSN. Heterogeneous traffic is major concern related to congestion[2] .

WSN consist of heterogeneous traffic the problem of congestion lies in this, to tackle this problem heterogeneous traffic will devided into different classes and sends them to appropriate queue. Each queue is assigned with a priority. The multi path multi hop heterogeneous network model considered in the work. In case of multipath routing, each node divides its total traffic into multiple traffic flows and those flows pass through multiple downstream nodes. This will achieved by dividing bandwidth of parent nodes to child nodes[3].

As congestion enter into a network with the parameters such as packet loss, interference and delay, this propose work find out solution for improving the effect of these parameters[5].

## II. SYSTEM ARCHITECTURE

Fig.1 represents the system architecture of the proposed work. The Congestion Detection Unit (CDU) calculates the packet service ratio. When the value of packet service ratio is less than 1, it indicates congestion. With the help of Traffic Adjustment Unit (TAU), each parent node diverted the traffic to child nodes according to the source traffic priority and transit traffic priority. According to the queue length congestion is find out and traffic diversion is takes place to child node[9].

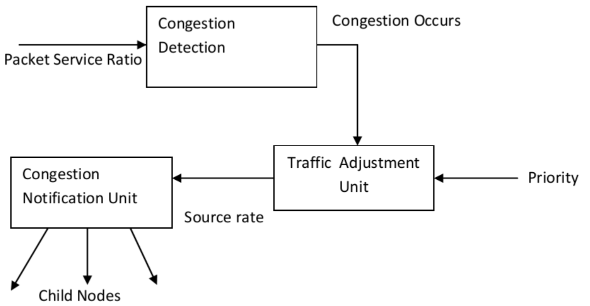


Fig 1. System Architecture

## III.SYSTEM DESIGN

Steps:

01 *Initialization ( )*

02 $d^{'}(P_{i,0}) = 1,\ 0'(P_{i,0}) = O, r^{i}_{svc} = r_0;$

03 $GetSvcRate\ (t_s^{pin}, t_a^{pio}\ GP\ (P_{i,0}), O(P_{i,0})\ r^i_{svc,}\ GP(i))$

04 $d(pi,_0) = t_s^{pin} / t_s^{Pi0};$

05 $total\_rate = 1 / t_s^{Pio};$

06 $If\ (O(P_{i.0}) < O'(P_{i,0}) r^i_{svc} / d(P_{i,o});$

07 $If\ (O(P_{i,o}) > O'(P_{i,0}))\ r^i_{svc = total\_rate} * GP(i)$ 08 $If(O(P_{i,o}) = O'(P_{i,o}))$ {

09 $If(d(P_{i,0}) < d'(P_{i,0})) r^i_{svc} = r^i_{svc} / d(P_{i,o});$

10 $If(d\ (P_{,0}) > d'(P_{i,0}) r^i_{svc} = base\_rate * GP(i)/GP(P_{i,o});$

11 }

12 $d'(P_{i.0}) = d'(P_{i,0}), O'(P_{i,o}) = O(P_{i,o});$

13 $r^i_{svc} = min\ (r^i_{svc}, 1/t^i_s);$

14 $return\ \ r^i_{svc} * h;$

15 $GetSrcRate(r^i_{svc})$

16 $r^i_{src} = r^i_{svc} SP(i)/GP(i);$

17 $return\ \ r^i_{svc};$

## IV. SIMULATION RESULTS AND DISCUSSIONS

The simulation determines the threshold value of Packet Service Ratio. The details of simulation parameters are as follows: In an area sensor field, 50 sensors are deployed randomly. Sensors are having a transmission range of 200 m.

The maximum queue length is considered to be 800 packets, with a packet size of 30 bytes[7].

a) Data packet delivery ratio,

The data packet delivery ratio is the ratio of => (the total number of delivered data packets at the destination I the total number of data packets sent).

b) Average end-to-end delay of data packets,

The average end-to-end delay is the transmission delay of data packets that are delivered successfully. This delay includes of propagation delays, queuing delays, retransmission delays, detection delay and buffering delays[10].

c) Packet loss

Packet loss, no of packets lost during the transmission of packets from source to destination which includes the due congestion; queue overflow. We fixed the deadline as 200ms. The deadline fixed as 2000ms for the exploratory packets[4].

d) Packet Service Ratio

Reliability of data in wireless sensor networks depends on the packet reliability which requires the successful reception of the packets at the sink node within the specified success ratio. The packet service rate is the inverse of the delay at the sensor node. This delay time will include the time from which the packet has been received at the receive buffer at the node, till the time at which the packet is retransmitted from the node. Packet service ratio, $r_i$ can be used as a measurement to control the scheduling rate at each node i. It is the ratio of average packet service rate denoted by $R^i_s$ and packet scheduling rate $R^i_{sch}$ in each sensor node i as follows:

$$r_i = R^i_s / R^i_{sch}$$

**A. Network Scenario**

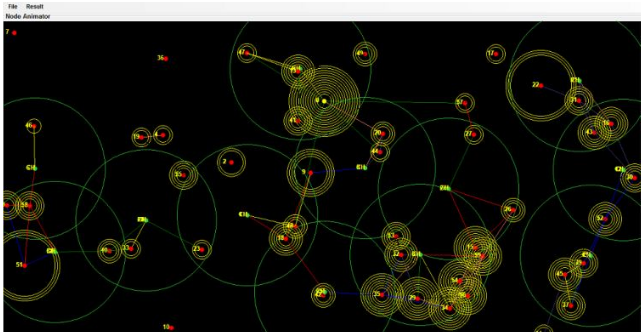

**Fig 2. Network Scenario**

### B. Packet Service Ratio

Reliability of data in wireless sensor networks depends on the packet reliability which requires the successful reception of the packets at the base station within the specified success ratio. The packet service rate is the inverse of the delay at the sensor node. This delay time will include the time from which the packet has been received at the receive buffer at the node, till the time at which the packet is retransmitted from the node. Packet service ratio, $r^i$ can be used as a measurement to control the scheduling rate at each node i. It is the ratio of average packet service rate denoted by $S^i_r$ and packet scheduling rate $Sch^i_r$ in each sensor node i as follows[6]:

$$r_i = S^i_r / Sch^i_r$$

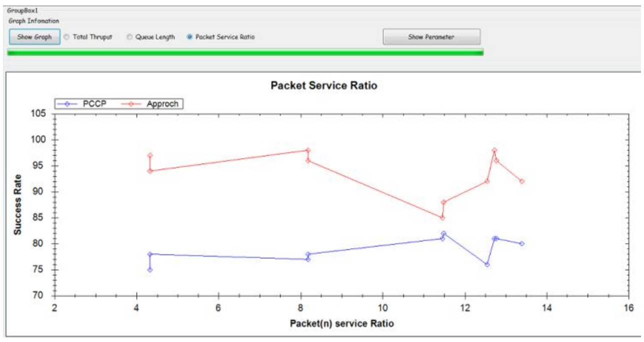


**Fig 3. Packet service Ratio vs Success rate**

### C. Packet Drop Ratio

As the simulation result shows packet drop ratio of new approach is very less as compared to the predictive congestion control mechanism.

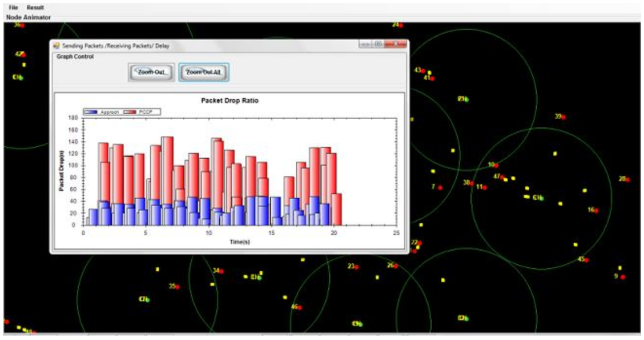


**Fig 4. Packet Drop Ratio**

### D. Queue Length Over Time

Fig. illustrates the status of average queue length over

time. It shows that the moderate queue length is maintained. for about 20 second simulation time while all of the parents are congested in the interval [5 10]. It shows that the average queue length never exceeds the maximum queue length (8000). This illustrates that the proposed scheme avoids packet loss due to buffer overflow[11].

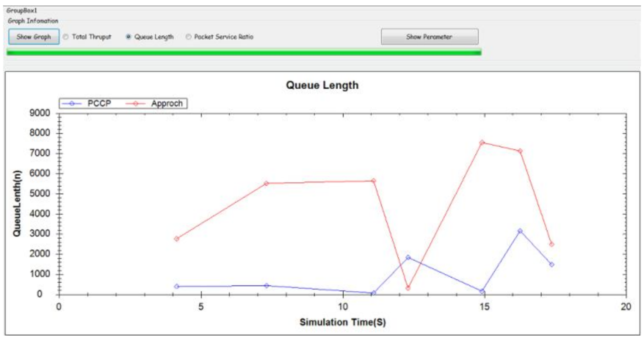


**Fig 5. Queue Length**

### E. Traffic Switching

Fig.6 shows switching of traffic for node number 10 over the simulation time [15 seconds]. According to the queue length and congestion at each node traffic is diverted to child nodes.

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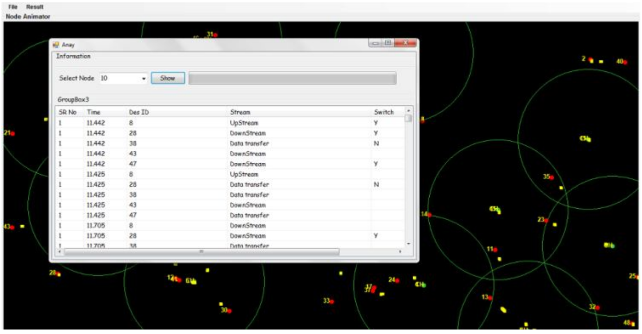

**Fig 6 : Traffic Analysis**

### F. Performance Analysis

Fig.7 shows comparison between new approach and old approach .In new approach simulation delay and packet drop ratio is decrease and parameters such queue length, total throughput, packet service ratio increases.

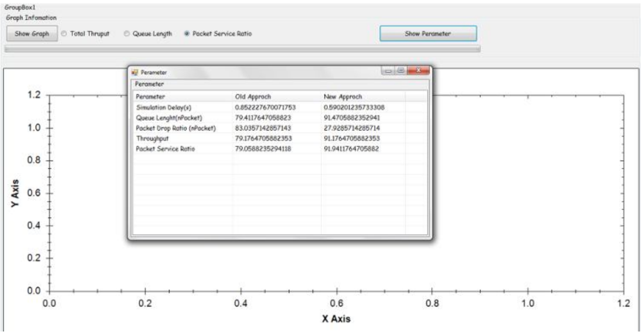


**Fig.7 Performance Analysis**

## V. CONCLUSION

In this paper, we have presented an efficient multipath congestion control mechanism for heterogeneous data originated from a single sensor node We have demonstrated through the simulation that our scheme achieves: i) Desired throughput for diverse data according to the priority specified by the sink, ii) Higher Packet service ratio iii) Lower packet drop rate.

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