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Loss Monitoring of Star Topology Sensor Network Based on Scheduling Algorithm for Assessing Structural Health Information

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ABSTRACT

Sensor network is the new invention for assessing civil building structural health information. The new challenge to sensor network: large volume of received data, analyzing result at the computing section, patient coverage area, accuracy and reliability of the system, real time response, optimization development. To cover the entire patient region, sensor topology network is as a key characteristic of Sensor Network (SN). In this article, we investigated the loss of the star topology base sensor network and also find efficient queueing method based on Constant Bit Rate (CBR) traffic and DropTail (DT), Stochastic Fair Queueing (SFQ), Random Early Discard (RED) queuing mechanism.

Keyword: Sensor Network Topology, CBR, SFQ, Star Topology, RED, Loss Monitoring

1. INTRODUCTION

In recent years, Sensor Networks (SNs) have become an efficient technology for monitoring civil building structural health and to detect event (e.g., fire protection and natural event like flood) and tracking object. SNs usually consist of three basic elements: (i) Sensor coverage area (ii) communication system and (iii) computing and analysis. Most of the sensor application operates with very low battery power, which determines the overall system lifetime section (Francesco *et al*., 2011). There are many factors that affect the communication system in practical environments. Many Researcher assume that, working with Wireless Sensor Network (WSN) many issue arises among those in terms of communication system: (a) Interference, (b) noise and due to increasing amount ISM band application interference become a strong issue (Boers *et al*., 2012).

The quality of radio link signal of Wireless Sensor Network (WSN) is affected by many factors and it's become unpredictability about footprint. The transmission link quality fluctuates over time, space and connectivity. Those factor responsible for degrading the link quality: (a) Patient area environment, which is responsible for multipath propagation and reflection, (ii) interference it may be co-channel interference or adjacent channel interference (iii) transceiver which causes the transmit or receive signal may be distorted due to receiver internal noise. Since, sensor operate with low power and transmit low frequency signal power, the transmit signal is easily susceptible to noise, interference and multipath distortion. In WSNs, these radio transceivers transmit low-power signals, which make radiated signals more prone to noise, interference and multipath distortion (Baccour *et al*., 2012). The author haque show that the signal power is the main fact for reliability and accuracy of the transmission link. Lifetime of the sensor network is fundamental issue because it's also determining the whole system aliveness and depends on single node lifetime. Network lifetime is one of the most performance indicators for real life application (Dietrich and Dressler, 2009). Among many

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of the information processing task, Bayesian mechanism is presently used for describing sensor network information. But, this approach have vastly used offline sensor data analyze and redesign of the sensor network due to its computational complexity (Osborne *et al*., 2012). In our environment, infrastructure like building, bridge, bridges are as an important asset for human life. The damage of those infrastructure occur uncertainty due to natural event and their terrorist attacks. In addition, due to certain attack of those event the overall life span of the structure gradually decreases and structural health become damage like corrosion, fatigue, vibration. Therefore, an automated monitoring system is necessary to asses those damage known as Structural Health Monitoring (SHM). The material and/or geometric properties of that structure affect the overall monitoring system performance. The typical assessment of such types structure is cost highly, unable to frequency monitoring, inaccurate position of instrumentation, huge task need to do for the collection of large sensor data those are done by expert with manually with specific parameter (Giuseppe *et al*., 2009). To collect the sensor data, data cable are used in the conventional SHM monitoring system. The cable base sensor is high cost and difficult to installation, maintenance and repair. There are many problem arises on cable base sensor. Among those: More cable require for covering large service area, lost sensor data due to high temperature, difficult noise elimination (Haque *et al*., 2012).

1.1. Sensor Network

In the sensor network, each sensor contain have each transmitter that transmit the sensor information to the corresponding connect node/gateway/base-station. In such way every node connects to another node/base-station/gateway or receiver section. After collecting the entire sensor node signal through the respective gateway at a receiver section the received signal is to analyze. The connection between two nodes or node to gate-way or gate-way to base-station or base-station to analysis section may be wire or wireless. Wire base connection has many drawbacks, high cost, more complex to install to cover large geographical patient area. But, the security and quality of the transmitted data is more reliable then wireless. However, many researcher show during from several decade FFT and mode shape base parameter of wireless sensor network recognize as a prevailing element for identifing the damage of the civil structural Recently wavelet packet transform emerging as a new technique to the sensor received signal provides easy to maintenance, low power profile and reconfigurable. Wavelet entropy is used to describe the damage identification information of sensor. Particularly, Monitoring system that determine the early warning about damage of structure and diminishing the system cost of planning, meintenance, scheduling and hence improving the strutural life span. Those monitoring assesment based on material performance and define the environmental condition. Early, the strenth of the fresh concreate is determined by the reuseable transducer (Barroca *et al*., 2013).

1.2. Star Topology Loss Monitoring

Topology determines how sensor network nodes are connected. Common configurations include the bus topology, mesh topology, ring topology, star topology, tree topology and hybrid topology. ZigBee supported different types of network topology to create Wireless Personal Area Networks (WPAN) (IEEE 802.15.4). In the market three kinds of ZigBee device are available now. First one is ZigBee Coordinator (ZC) responsible for configuring channel and ID for the network. Second one is ZigBee Routing (ZR) its maintain the routing table of the network. Finally, third one is ZigBee end device its only communicate with the parent node (router or coordinator). ZigBee support three types of network topologys-tree topology, star topology, mesh topology (Visan *et al*., 2010).

1.3. Loss Monitoring Method and System

Firstly, we define a sensor node every sensor node and connect the sensor as above shown **Fig. 1**. The transmission link types between two sensor nodes are duplex. After that, configure the Sensor Node-3(SN-3) as a gateway node. After locating sensor node, create CBR traffic and attach them to the source node SN-0, SN-1, SN-2, SN-5 respectively by UDP agent. At the node-4, create four types of sink which follow the respective source node. The traffic generator at the source is exponential traffic. At the node-4, the received signal bandwidth is calculated and writes to the respective sink file. The simulation is continuing with in define star and finish time. At the receiver the received signal are given below for different queueing method.

From **Fig. 2**, we can say that transmission rate for the sources are 500 kb, 550 kb, 800 kb, 850 kb respectively and the link rate is 500mb and the transmission delay is 10ms. The packet size, brust time, ideal time for burst are 300 kb, 3 s, 2 s respectively.

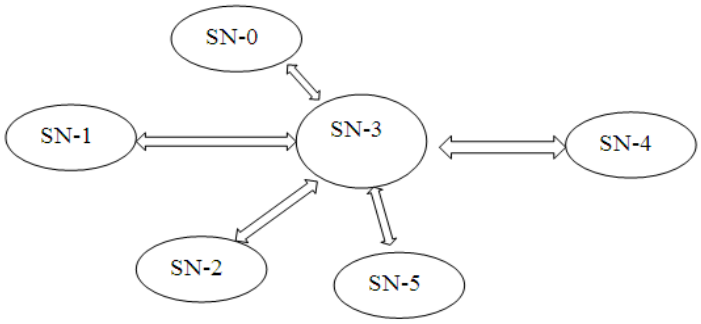

Fig. 1. Star topology loss monitoring on different queueing method

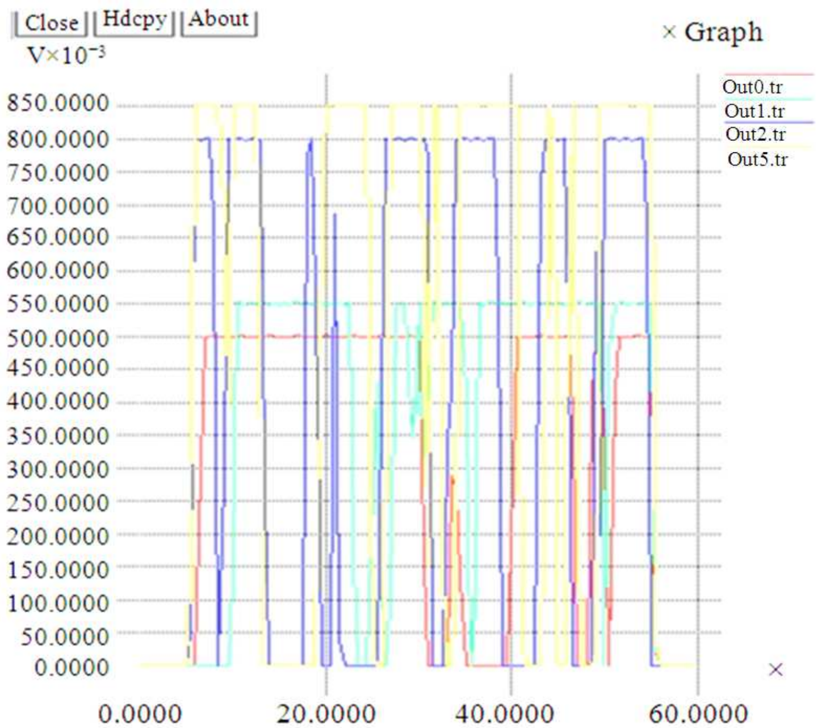

Fig. 2. Loss monitoring for droptail queueing method

Figure 3 and 4 represent the first halt and 2nd half of the main signal for DropTail queuing Method. At the receiver the peak flow for the of the transmitted signal 500, 550, 800 and 850 kb but the fluctuation of the received signal increases. As a result the data rate quality is better in case of lower transmitter data rate signal because the receiver received the maximum data rate generated by transmitter. **Figure 3 and 4** represent the first halt and 2nd half of the main signal for DropTail queuing Method. At the receiver the peak flow for the of the transmitted signal 500, 550, 800 and 850 kb but the fluctuation of the received signal increases. As a result the data rate quality is better in case of lower transmitter data rate signal because the receiver received the maximum data rate generated by transmitter. It may be due to good synchronization between Tx and Rx or matching data rate traffic and link. From **Fig. 4**. We can see that the received signal peak burst rate in case of random early discard method 0.5, 0.55, 0.8 and 0.85 mb respectively which is same as the droptail queuing method. The signal oscillation and duty cycle also same.

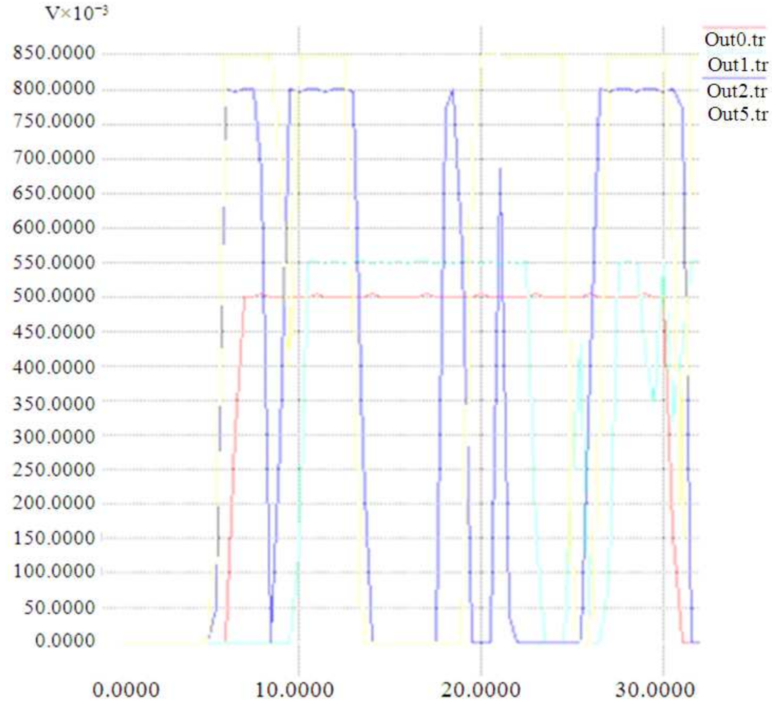

Fig. 3. 1st half signal of droptail method

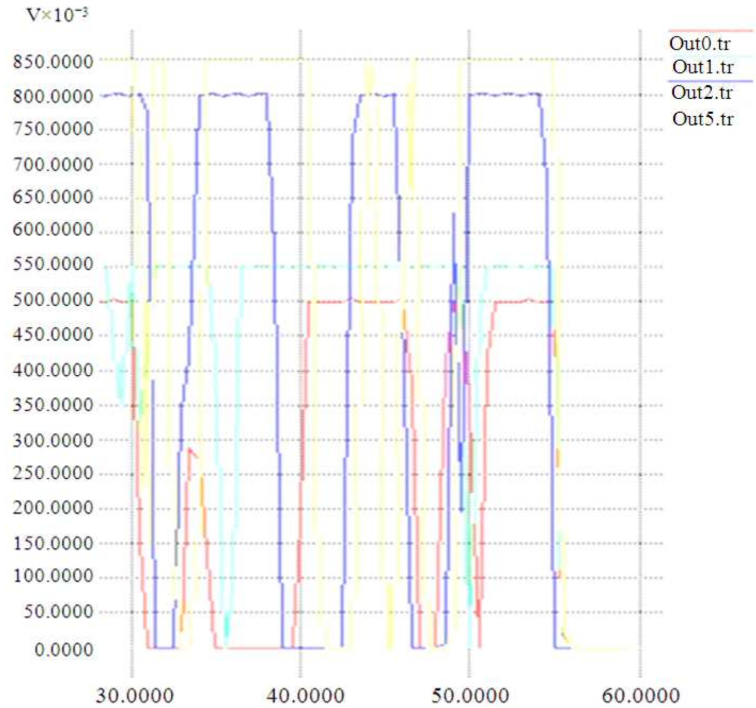

Fig. 4. 2nd half signal of droptail method

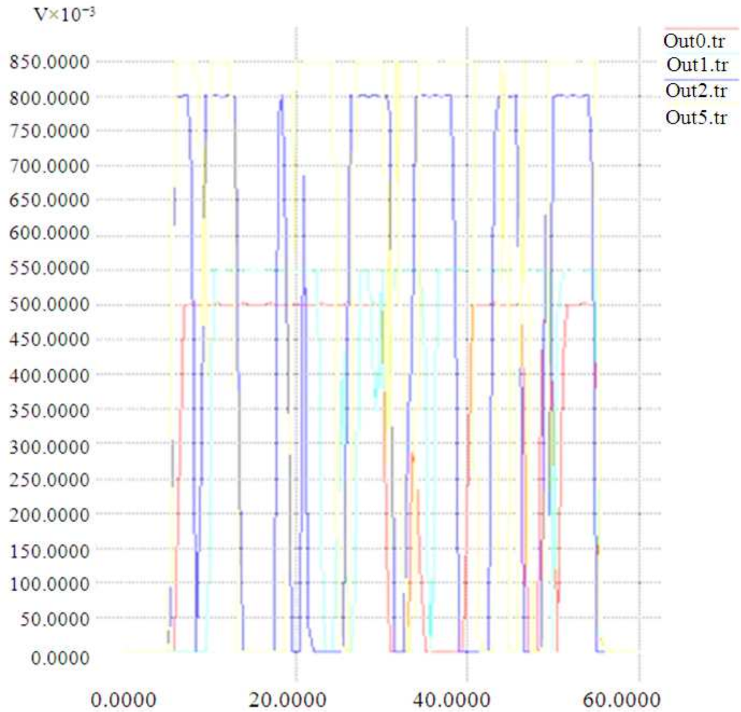

Fig. 5. Received bandwidth for RED queuing

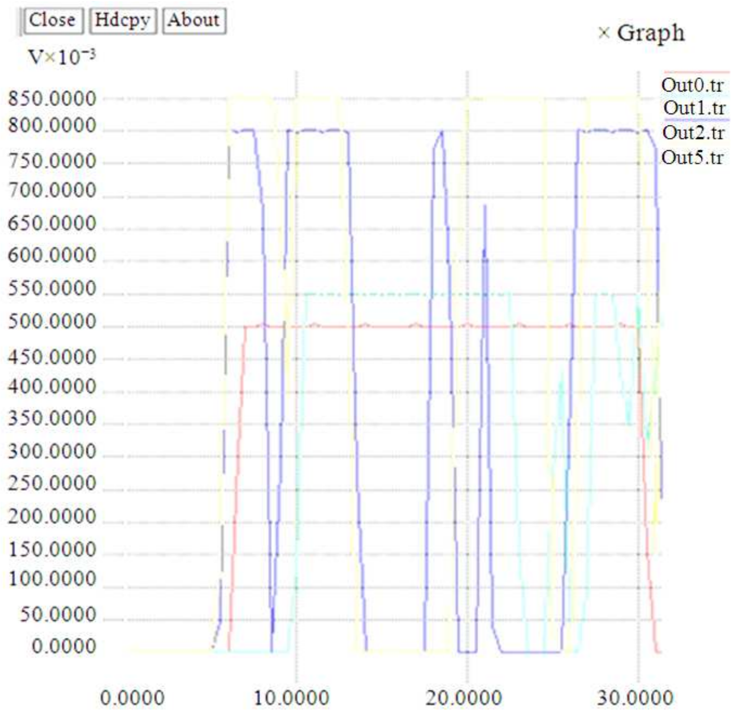

Fig. 6. 1st half received signal of RED

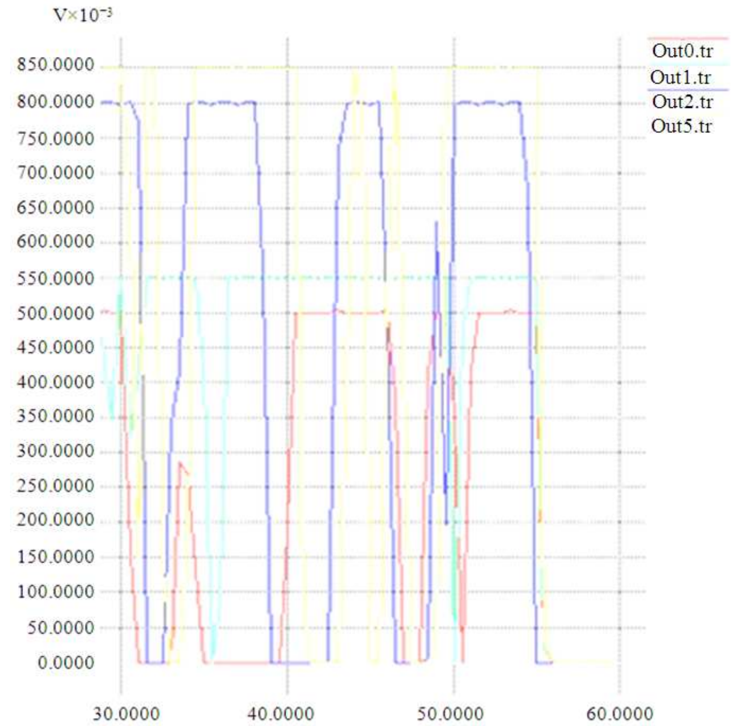

Fig. 7. 2nd half received signal of RED

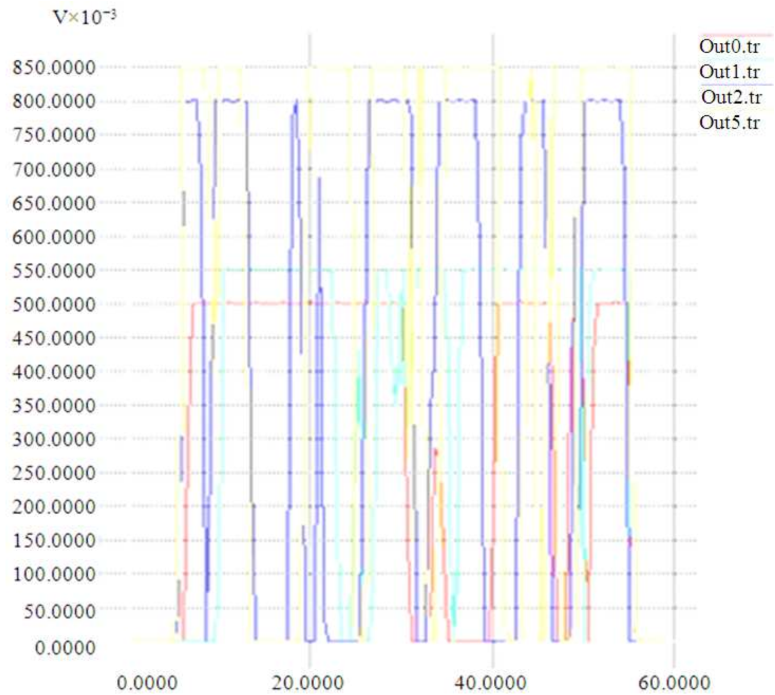

Fig. 8. Received signal for SFQ method

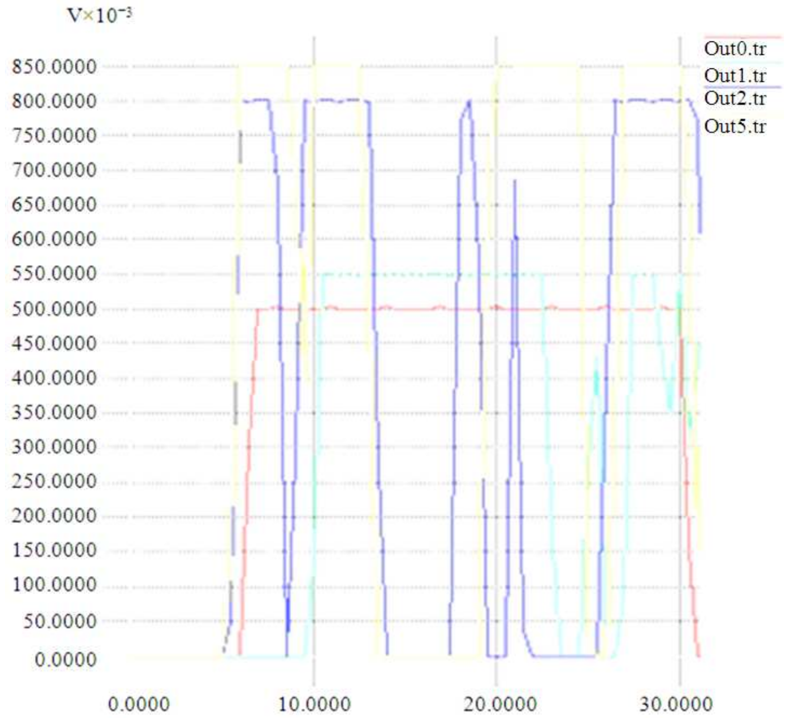

Fig. 9. 1st half received signal of SFQ method

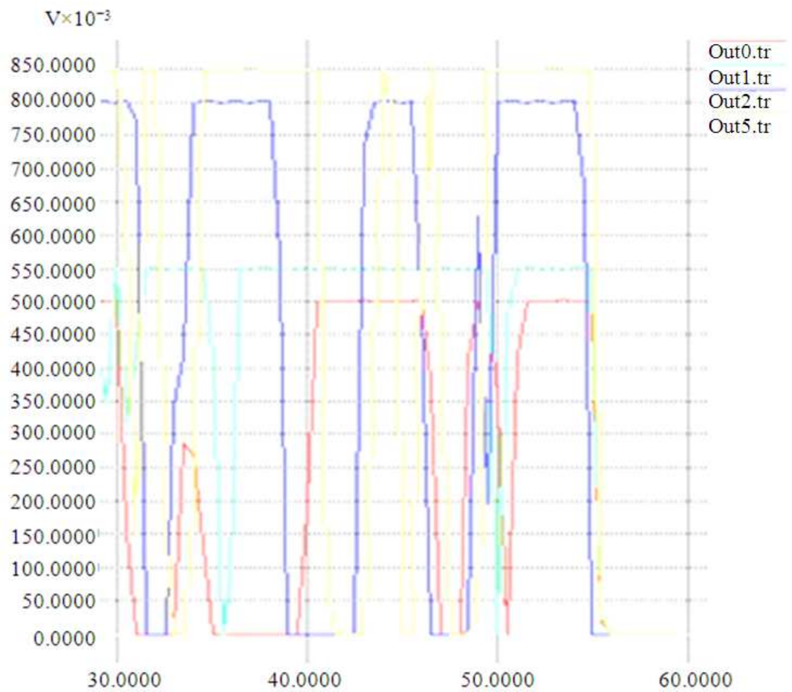

Fig. 10. 2nd half received signal of SFQ method

RED based received BW is painted in **Fig. 5**. The 1^{st} half and of the RED based transmission loss are depicted in **Fig. 6 and 7**.

Finally, we conclude that the duty cycle and transmission rate for both droptail queuing and random early discard is like same. May, be there are some other computing parameter in which case the result will be differ. The 1st half and 2nd half received signal of the DT and RED queuing method are also same. In the case of SFQ queuing method, main signal is represent by **Fig. 8** and its 1st and 2nd half are exposed in **Fig. 9 and 10** and the received signal data rate same like as DT, RED queuing method and 1st and 2nd signal also like same.

2. CONCLUSION

In this article, we investigated the received signal loss at the higher transmission data rate. From above investigation we can told that, the loss of the transmit signal bandwidth not only depend on traffic data but also link rate and other parameter that associated with the system. From above investigation, the loss of the star topology sensor network is same in case of QropTail, Random Early Discard and Stochastic Fair Queueing Mechanism. Those method may be effective for computing another network component.

3. ACKNOWLEDGMENT

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