



QoS Based Routing in Wireless Sensor Network

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Abstract: - In case of Sensor network the nodes lose some amount of energy after performing the communication. To reduce the delay in the network, an approach is required that provides end to end guarantees by maintaining a desired delivery speed. Such approach is used by SPEED protocol. SPEED also contains a congestion control mechanism. Many problems arise when the network meets some kind of attacks, performance of the network further degrades. The presented work is the improvement over the SPEED protocol, respective to some parameter. Here we are using the three performance parameters throughput, bit error rate and accuracy for comparison purposes that will be evaluated in the presence of attack like attack and in case when our proposed algorithm is used. All the simulations are carried out in MATLAB.

Keywords: Wireless Sensor Network, SPEED, throughput, bit error rate, accuracy, attack.

I. INTRODUCTION

Due to recent advances in technology, it is technically and economically feasible to manufacture small and low-cost sensors. These sensors measure ambient conditions in the environment surrounding them and then transform these measurements into signals that can be processed to reveal some characteristics about phenomena located in the area around these sensors. A large number of these sensors can be deployed in many regions that require unattended operations, thereby producing a wireless sensor network (WSN) [1]. Basic terminologies used in WSN are as given below:

Sensor: Sensor is a transducer. It measures physical quantities like, heat, light, motion, vibration, sound and convert the result into electrical signals.

Sensor Network: Sensor network consists of a large number of sensor nodes and nodes are deployed either inside or very close to the sensed phenomenon.

Sensor Nodes (nodes): Sensor nodes are battery operated nodes with limited computing and processing capabilities. Sensor nodes have limited energy and have the same architecture. Sensor nodes work together to form a network and then they monitor the target region, collect the data and send various kinds of messages about the monitored environment (e.g. temperature, humidity, etc.) to the sink (base) node, which processes the information and reports it to the user [2].

Base Station (BS): Base station is a node with high computing capabilities. Base Station without energy restriction is far away from the area of sensor nodes.

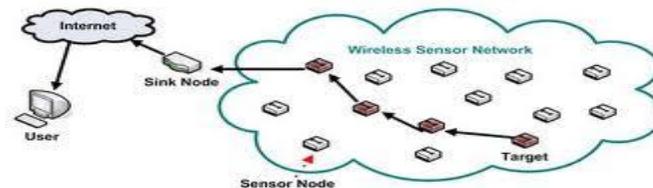


Fig. 1 Wireless Sensor Network

All above given terminologies works together as all sensor nodes are immobile in nature. They use the direct transmission or multi-hop transmission to communicate with the BS. Sensor nodes sense environment at a fixed rate and always have data to send to the BS. Sensor nodes can revise the transmission power of wireless transmitter according to the distance. Cluster head performs data aggregation and BS receives compressed data. The lifespan of WSN is the total amount of time before the first sensor node runs out of power.

II. CHALLENGES IN WIRELESS SENSOR NETWORKS

a) Node deployment: Node deployment in WSN is application dependent and affects the performance of the routing protocols. The deployment of nodes can be either deterministic or random. In deterministic deployment, the sensor nodes are placed manually and data is routed through the paths that are pre-determined. However, in random deployment, the sensor nodes are arranged in a random manner.

b) Energy consumption without losing accuracy: Sensor nodes can use up their limited supply of energy while performing computations and transmitting information in a wireless environment. The lifetime of sensor node depends on the battery lifetime. In a multi hop WSN, each node has a dual role as data sender and as data router. The malfunctioning

of some sensor nodes due to power failure can cause significant topological changes and might require rerouting of packets and reorganization of the network.

c) Node Capability: Depending on the application, a sensor node can have a different role or capability such as relaying, sensing and aggregation if all these functions are performed by the same node it would drain the energy of that node more quickly. Sensor node deployment varies with respect to the demand of the application, therefore the number of sensor nodes can be hundreds, thousand or even more. To handle network scalability, routing algorithm should have the capability to cope with scalable network.

III. ATTACKS IN NETWORK

Denial of service (DOS) attacks have become a major threat to current computer networks. Denial of service (DOS) attacks can block system for some period of time. When dos attack generates then only a particular channel is blocked, but other channels are working. Distributed denial of service attack (DDOS) is an extension of DOS. The Purpose of both attacks is to block channels or service, but area is different where these attacks affect. DOS is like an attack on a website, but DDOS is like an attack on the server. Due to attack on the server all websites belonging to it are blocked. A Distributed Denial of Service (DDoS) is an attack on the availability of services of a given target system or network which is indirectly launched with the help of many compromised computing systems. The service or system which is directly under attack is called “primary victim” while the systems used to launch the attack are called the “secondary victims or zombies”.



Fig. 2 DDoS Attack

IV. RELATED WORK

In [3] authors discussed the SPEED protocol that supports soft real-time communication which is based on feedback control and stateless algorithms for large-scale sensor networks. It is one of the QoS based routing protocol. Various components of this protocol are discussed like an API, a neighbor beacon exchange module, delay estimation module, the Stateless Non-deterministic Geographic Forwarding module (SNGF), Neighborhood Feedback Loop (NFL), Backpressure Rerouting and Last mile processing. The protocol is implemented on GloMoSim and Berkeley notes and performance was compared to five other ad-hoc routing protocols and conclusion is drawn that SPEED has improved performance as compared to other protocols.

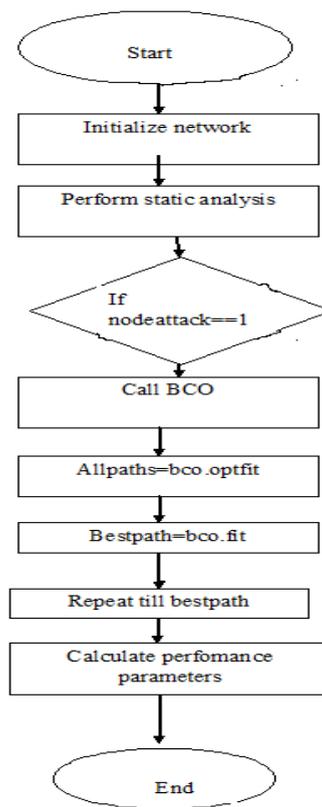
In [4] author discussed wireless sensor network characteristics, various types of attacks in the network, Denial-of-Service (DoS) attacks are recognized as one of the most serious threats due to the resource constrained property in WSN. This paper presents an evaluation of the impact of DoS attacks on the performances of Wireless Sensor Networks by using the OPNET.

In [5] authors present a protocol based on an ant colony for finding dynamic routes and a cooperation mechanism which provides better quality of service (QoS) management problem in WSN. They proposed Qos_Aco a routing protocol based on Ant colony with QoS support requirements in WSN. The approach allows finding the path with the least delay (end to end), more bandwidth, and the shortest number of hops for data transmission.

In [7] authors analyzed the intelligent algorithms like GA and ACO, then proposed an optimized routing method based on swarm intelligence algorithm of artificial bee colony which increases convergence and diversity, observing the nature of this colony. The proposed method has less execution time than typical genetic methods, more efficiency is expected, based on simulations .

V. WORKING OF OUR ALGORITHM

It is implemented as:



VI. ENHANCED SPEED (E-SPEED)

SPEED is a real time communication protocol that reduces, delay in the network. Although SPEED protocol acts in a good manner, it suffers from many drawbacks like it does not take into account energy consumption. It can't cover a large area. It does not use any mechanism to differentiate between the different types of packets. It is known for giving the same preference to both real time and non-real time packets. It lacks scalability, as it maintains same speed for each packet, and if the parameter is changed then performance of network degrades. Due to disadvantages of SPEED, improvements are required for getting better results. Many research works have been carried out to improve the SPEED to achieve better results. Optimization technique used is Bee Colony Optimization.

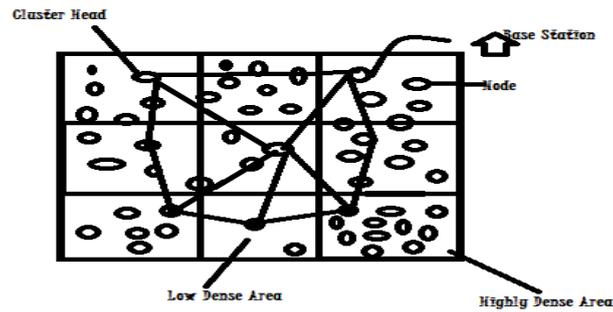
In the ABC mode three groups of bees: employed bees, onlookers and scouts are present in the colony. For each food source there is only one artificial Employed bee. For all the employed bees in the colony equal to number of food sources are present around the hive. Employed bees first go to their food source and then come back to their hive and dance. The employed bee whose food source has been abandoned becomes a scout and starts to search a new food source. Onlookers are those who watch the dances of employed bees and choose food sources depending on dances. The following steps describe the working:

1. Initially for all employed bees the food sources are produced.
2. REPEAT UNTIL (requirements are met)
 - a. Each employed bee first goes to a food source in her memory and tries to find a neighbour source, then evaluates its nectar amount and starts dancing in the hive.
 - b. Each onlooker bee observes the dance of employed bees and then decides one of their sources, and then goes to that source. After choosing a neighbor, next task is to evaluate the nectar amount.
 - c. Abandoned food sources are found and are replaced with the new food sources discovered by scouts.
 - d. The best food source found so far is registered.
3. If the best food source is found then end.

In ABC, a population based algorithm, the position of a food source denotes a possible solution to the optimization problem and the nectar amount of a food source represents the quality or fitness of the associated solution. The number of the employed bees and the number of solutions in the population are always equal. The first step involves an initial population [7] to be generated which is randomly distributed. After initialization, the population has to repeat the cycles of the search processes for all types of bees. An employed bee changes the position of source in her memory and discovers a new food source position, on the condition that the nectar amount of the new source is more than that of the previous source, the bee remembers the new source position and forgets the old one. After all employed bees complete their search process; they exchange and distribute the position information of the sources with the onlookers in the dance area. Each onlooker assesses the nectar information taken from all employed bees and then decide source of food

depending on the nectar amounts present in the sources. The sources abandoned are determined and new sources are randomly produced to be replaced with the abandoned ones by artificial scouts.

VII. PROPOSED NETWORK MODEL



The steps used for implementation are

- Network of size 1000 m*1000m is constructed.
- Region formation is done as it can cover the maximum number of nodes.
- Run the network to get the optimal values of the path.
- If any failure occurs, check objective function using bco in the terms of speed
- Check the nodes in terms of movement in bco.
- Repeat till the optimal node does not become the last node.

VIII. SIMULATION RESULTS

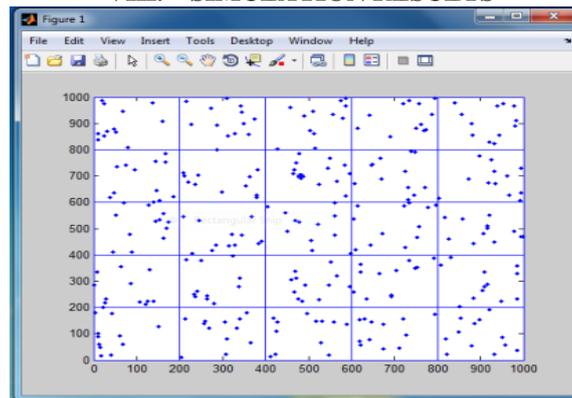


Fig 3 shows the simulation scenario of our network

We have created a network having 25 regions.

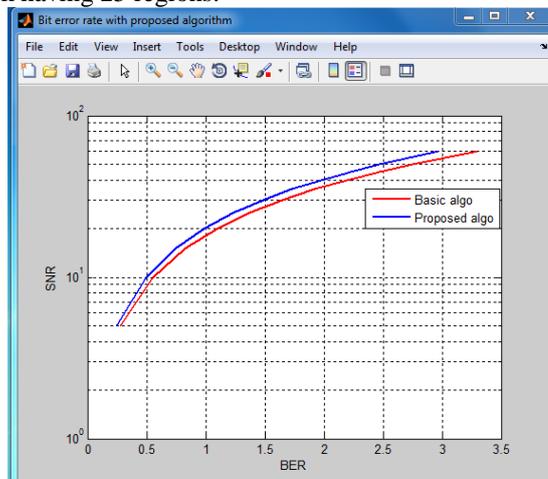


Fig 4 Comparison on the basis of bit error rate

A graph is plotted between bit error rate and signal to noise ratio. Bit error rate is taken on x axis and SNR is taken on y axis. Bit error rate in case of basic algorithm is shown in red colour and bit error rate in case of proposed algorithm is

shown in blue colour. From the figure 4 we observe that bit error rate in case of basic algorithm is greater than 3 and when proposed algorithm is used it is less than 3. Low bit error rate is desirable.

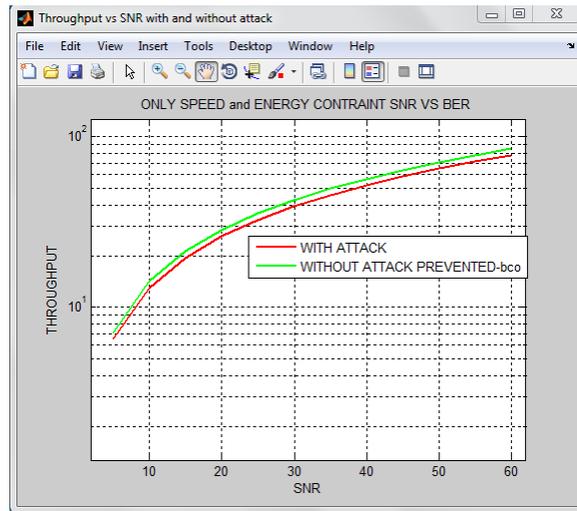


Fig 5 Comparison on basis of throughput.

Next we compare the throughput and graph shows that our proposed algorithm results in higher throughput.

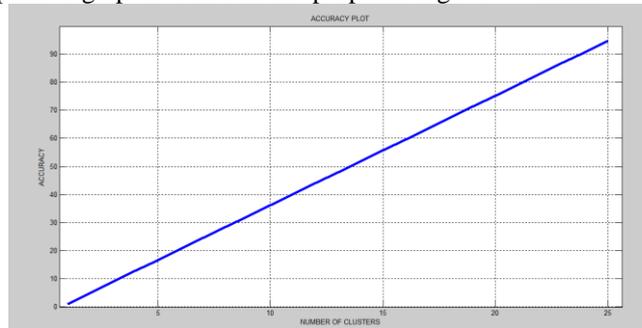


Fig 6 graphs represent the accuracy of our algorithm

IX. CONCLUSION

In order to improve the QoS parameters we have implemented our proposed scheme in MATLAB. One major advantage of this work is its simplicity. Nodes move in static order. As soon as nodes deviate from their static path attack is detected using our proposed algorithm. From the results we can conclude that our proposed algorithm performs better. Our proposed algorithm shows good performance for all the metrics. It shows the lowest BER as the SNR increases, the highest Throughput as the BER increases and again the highest Throughput as the SNR increases. At the end, we came to the conclusion from the simulation and analytical study of Wireless Sensor Network (WSN) that all routing protocols cannot give good performance with respect to all the parameters. Selection of the appropriate routing protocol is also a big decision, which also depends upon the purpose for which the network is used.

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