An Efficient Routing Protocol with Successive Interference Cancellation in Wireless Sensor Networks

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ABSTRACT— Wireless Sensor Networks has a greater advantage in today's communication application such as environmental, traffic, military, health monitoring. To achieve these applications it is necessary to have a reliable routing protocol. In this paper, the focus is on the design of SIC routing protocol aiming at achieving high overall throughput compared to that of the hop count routing. A comparison of hop count routing and SIC routing is developed with respect to various parameters. The introduction of SIC improves the path bandwidth and high throughput.
Keywords— Successive interference cancellation, Hop count routing, SIC, Throughput, Sensing nodes

I.INTRODUCTION

In the Wireless Sensor Networks Interference is the fundamental obstruction to the throughput. It is very important to develop an energy efficient protocol in the wireless sensor networks. When the receiver receives more than one signal, it treats the weaker signal as noise and hence information is lost. If the weaker signal has to be decoded then we use a new technique called the Successive Interference Cancellation where only the interference is cancelled giving the required information. This is done by reconstructing the original signal. In a network, a node consists of sensor, Battery and Memory. The topology used is a grid topology and it comes under the Non-hierarchical category in the network.

II. PREVIOUS TECHNIQUE

In the previous approach namely Hop Count Routing (HCR) all the possible paths for about 2 neighbor set levels are discovered by using the process of flooding and forwarding. For each of the possible paths the routing metrics especially end to end delay is computed which is directly proportional to bandwidth. Finally the path which has the lowest number of hops is chosen to send the packets. The advantages of previous technique are: The route that is used for sending the packets has the lowest End to End Delay there by reducing the amount of time required for delivery of packets. The disadvantages of the previous technique are: Complexity is very high because of discovery of huge number of routes and also for each of the routes lot of control packets are wasted. The energy consumed is very high due to fact that the energy required for transmission and Euclidean distance are directly proportional to energy consumed hence as the number of links are high the energy consumed is high.

III. PROPOSED TECHNIQUE

In this project High Throughput SIC routing algorithm is proposed which adds computation of SIC parameters and if the links satisfies the bandwidth criteria then it is chosen as the next forward link during the routing process. Also the number of routes discovered is drastically reduced. The Advantages of Proposed Approach are End to End Delay is less, Energy consumption is reduced due to fact that the routes that are discovered are very less and also control packets exchanged is less, The algorithm takes SIC bandwidth criteria in order to pick the forwarding nodes or forwarding link hence the throughput is high because the route chosen is bandwidth aware.

$$SIC_{link}=\frac{P_{tx}\ d_{i,j}^{-\alpha}}{\sum^{N\,link}\ P_{\cdot}\ d_{\cdot}^{-\alpha}+\sigma^2} \quad (1)$$

Where P_{tx} is the Power required for transmission, $d_{i,j}$ is the distance between node i to node j, σ is the power level for noise and α is the path loss component

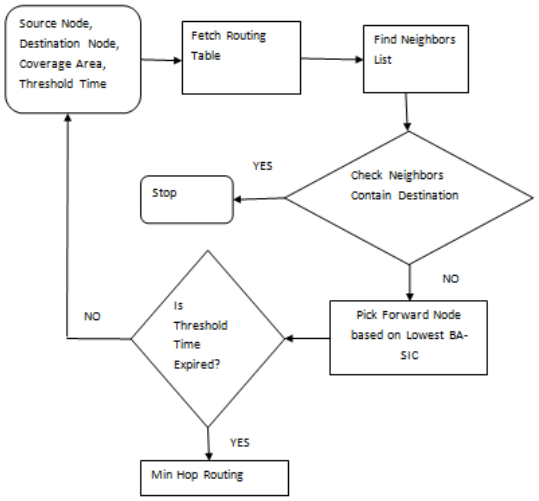

Fig. 1 SIC Algorithm

The SIC routing algorithm first finds the one hop neighbors and then each of the node acts like a source node. After finding the neighbor sets the node which has lowest SIC value is chosen. This process is repeated until threshold time expires or until destination is reached. Once the time expires min hop routing algorithm triggers which finds the ultimate link to destination. Like that multiple routes are discovered. Then the route which has lowest SIC value is chosen as the best route. In the figure 1, Source Node, Destination Node and Transmission Range acts and Threshold time as an input. The Source Node will find the set of nodes within transmission range known as neighbor nodes. If the neighbor nodes has the destination node then stop the process. If the neighbor nodes does not have the destination node then pick one of the neighbor as the next forward node which has lowest BASIC value. Check the

Threshold Time. If the time has expired continue. If threshold time expires then execute Min Hop Algorithm.

IV. RESULTS

In theoretical discussion, we studied about the formula to find the minimum SIC value. In Bandwidth awareness packets are classified into Higher Priority packets and Lower Priority packets. If we consider 64 nodes then it generates a random number of High Priority packets and Low Priority packets. A node at any instant of time its memory can have any number of packets. For example if it is used for military application then High Priority packets will be enemy detection and Low priority packets will be Weather Detection. Each and every node in its memory will have the combination of both High Priority and LowPriority packets. This combination is termed as the Buffer size.

Interference nodes refer to sensing nodes. For example, consider the transmission rate 20 and it is multiplied by 2, it becomes 40. Interference nodes are given by Number of nodes present in 40 minus Number of nodes present in the 20. It is chosen in such a way that interference should get cancelled because of this, and also we choose lower buffer size hence Bandwidth is high. This is because we are not choosing a node in which packets are more. If we choose a node in which the packets are more, we are trying to send one more packet, and it will be dropped. Therefore if to pick the forward node it should satisfy the lower buffer size, lower number of interference nodes and lower value of SIC criteria.

The figure 2 shows buffer size that is the number of packets is reduced from original and hence indicates that packets are delivered.

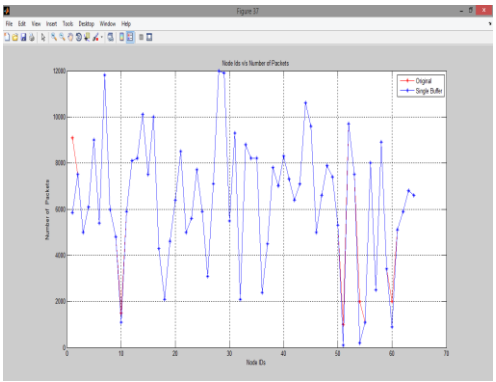

Fig. 2 Successful transmission of packets

This module is used to compare the two route discovery protocols namely HCR and SIC algorithm with respect to various parameters. The Number of intermediate links from the source node to destination node is called Number of Hops. The energy wasted for delivering the packets from the source node to destination node. Figure 3 indicates that number of routes is lesser in BASIC criteria than the Hop count Routing. The above figure 4 shows that Throughput is maximum in SIC criteria than the Minimum Hop count Routing.

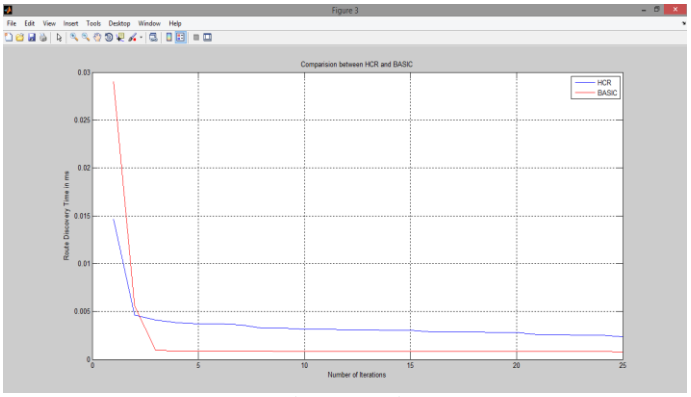

Fig. 3 Comparision of Number of route discovery

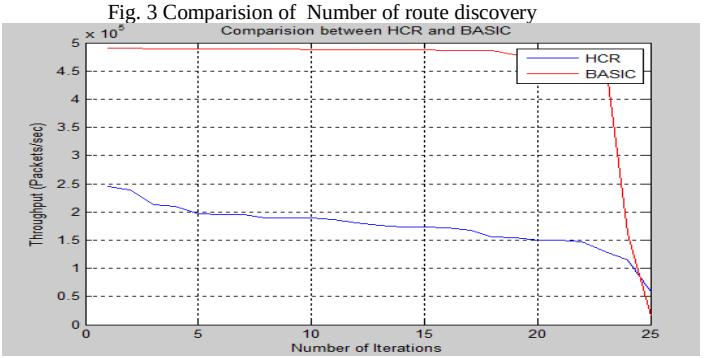

Fig. 4 Comparision of Throughput

IV. CONCLUSIONS

In this paper, we present a novel routing protocol, called SIC, that has high throughput and would actively explore SIC opportunities for multi hop wireless networks. We develop a methodology to analytically compute the available bandwidth of a given path with SIC. Simulations result shows that the SIC explores more opportunities, and thus achieves significant throughput gain over other protocols.

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