An Efficient Routing Protocol in Wireless Sensor Networks

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Abstract: In wireless sensor networks, faster and efficient data transfer is required. So a shortest path should be established as a first step. Previous methods use hop-by-hop communication for path establishment. Because of its high time consumption it is inefficient for faster communications. ‘Adaptive Bidirectional Protocol’ is used in this work. This protocol provides the shortest path from source to destination. This method can be incorporated in sensor networks for better data transmission.

1. Introduction

Wireless sensor networks are spatially distributed sensors to monitor physical or environmental conditions. The sensed data are passed through the intermediate sensor nodes from source node to destination. For each application there will be different source node and destination node[6]. In order to transfer the data from source to destination a path should be established between them.

Most of the previous methods use ‘hop-by-hop communication’ for path establishment[1],[2]. Based on reliability path will be created. Even though, the source and destination nodes are nearer path may be longer. This will lead to more time consumption for transmission[3],[4]. Number of nodes participating for data transmission also increases[5]. For rectifying these drawbacks ‘Adaptive Bidirectional Routing Protocol’ is used in this work. The combined forward and backward traces of source and destination nodes help to obtain shortest path between them.

A brief description of previously used hop-by-hop communication is given in section 2. Section 3 describes the proposed method. The results and comparison are given in section 4. Limitations and future scope are given in Section 5. Finally, conclusion is in section 6.

2. Previous Method : Hop-by-Hop Communication

In this method, first we have to assign number of nodes. Then source node and destination node can be selected randomly according to the application. Then reliability is calculated between every adjacent nodes. Energy per distance is the reliability value. After that source node links with the node, who has more reliability. In that way, a path will be created.

It will take more time for establishing the path. Only forward trace is done here. So energy and consumption is higher.


Figure 1: Adaptive Bidirectional Routing

In this protocol, first we assume source and destination nodes. Then node-to-node reliabilities are assigned. Source node searches its nearest neighbours to reach the destination based on reliability. At the same time destination node also searches its nearest neighbours to reach source based on reliability. When these two searches coincide then we get shortest path. Reduction of nodes in the path leads to easy key establishment. So time consumption and power consumption are reduced. Cost will be minimum.

4. Results and Comparison

MATLAB software is used for this work. Here, total number of nodes is selected as 10. Source node and destination node are selected randomly.
We have to obtain path from source to destination. Here we consider 15 test cases. In each cases, source node and destination node varies. Path establishment stage using previous method and proposed method for 5 test cases are shown below:

Figure 2: Test case-1 (Path establishment)

Green node denotes the source node and red node denotes the destination node. Red coloured path is obtained by using the previous method and green coloured path by using proposed method. As shown in figure 2, paths obtained by using both methods are the same.

Figure 3: Test case-2 (Path establishment)

Figure 4: Test case-3 (Path establishment)

Figure 5: Test case-4 (Path establishment)

Figure 6: Test case-5 (Path establishment)

Figures 3, 4, 5 and 6 show the paths obtained by using both methods. When hop-by-hop communication is used, number of nodes in the path is higher than that of the proposed one. As the
number of nodes decreases, length of path reduces and thus faster communication can be done.

The performance of the proposed method in terms of energy consumption and time consumption are shown in figures 7 and 8 respectively.

When the path obtained is same one, then energy consumption and time consumption are also same. If the paths obtained are different, the shortest path is obtained by using proposed method. Though the path is reduced, time consumption is also reduced.

![Figure 7: Energy consumption graph](image1)

![Figure 8: Time consumption graph](image2)

5. Limitations and Future Scope

Energy and time consumption are improved using adaptive bidirectional routing protocol. But at a time only one path is created. In case, this path is attacked, then we have to obtain another path. Then time lag may happen. This limitation can be solved by using multipath routing protocol.

6. Conclusion

There are many applications where immediate data transfer is needed. Existing hop-by-hop communication has less efficiency. Path establishment stage may take more time and more number of nodes are needed. This problem is solved by using ‘Adaptive Bidirectional Routing protocol’. Source node and destination nodes searches more reliable path at the same time. When these searches coincide, the path will be created. Number of nodes in the path is reduced. Thus we obtain shortest path which is useful for faster data transmission. Performance analysis has done for the same.

7. References


