Trust-Based Hierarchical Routing Protocol for Wireless Sensor Networks

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Network Lifetime is an important issue in Wireless Sensor Networks. It depends on many factors like the amount of data to be communicated, number of nodes in the network and initial energy of the sensor nodes. This paper proposes a novel routing protocol by name Trust-Based Hierarchical Routing (TBHR) protocol for multi-hop hierarchical wireless sensor network. The proposed protocol is based on trust evaluated for every sensor node in the network. Trust of a sensor node comprises of components derived from communication and social networks. Trust of a sensor node depends on the residual energy of the node and the number of transactions it has with its neighbors and its cluster head. The proposed protocol has two fold benefits. First it allows more number of nodes in the network to participate in transmission to balance energy in the nodes and thus improves the network lifetime. Second it ensures better packet delivery ratio though the number of untrustworthy nodes increases in the network. The data packet is flooded in the network by the source node when the number of trustable nodes in the network falls below 35\% of total nodes in the network. Flooding achieves optimum packet delivery ratio in the network. The same facts are verified by simulation results by analyzing the factors sensor node trust, network lifetime and delivery factor.

Keywords: Clusters, Malicious Node, Trust, Wireless Sensor Networks.

1. INTRODUCTION

Wireless Sensor Network consists of tiny self-powered sensor nodes which can sense, process and transmit data to other nodes in the network [1]. It is composed of a large number of spatially distributed autonomous sensor nodes to cooperatively monitor physical and environmental conditions, such as pressure, temperature, vibration, sound, and pollutants. The function of sensor node deployed in the wireless sensor networks, is to sense the information and transmit, or, forward the information to the sink node. The base station or the sink node is connected to the source nodes through one-hop or multi-hop routing. Networks with multi-hops are either star connected, or, clustered. Applications that require efficient data aggregation are natural candidates for clustered networks.

While sensor nodes are popularly used for various monitoring purposes such as wild animal tracking, weather monitoring and for battlefield surveillance, they have severely restricted resources such as energy, memory, and computational power. In addition to the restrictions on resources, the sensor nodes need to follow security implications. Further, wireless environments give more design challenges to network functioning due to inherently unreliable communication. But some applications require a combination of wired and wireless communication technologies [2].

Sensor networks usually perform unattended operations. So, it is important to design network protocols in such a way that network function is not affected by the presence of compromised or malicious nodes in the network. The sensor nodes sometimes perform malicious attacks such as packet dropping or packet modifications. The normal operation of a wireless
6. CONCLUSIONS

The role of different components of trust in routing information from source to destination in hierarchical wireless sensor network is discussed in this paper. The results indicated that Trust-Based Hierarchical Routing protocol performs around 10 % better than Trust-Based Geographical Routing with respect to network lifetime and nearly 5 % better than AODV protocol when the packet delivery ratio is considered. Throughout the simulation period the number of active nodes in Trust-Based Hierarchical Routing is more than or equal to the same in Trust-Based Geographical Routing. The flooding performed towards the end of simulation introduces additional end-to-end delay in packet transmission. One of the future directions in this research work is to reduce the end-to-end delay in packet transmission in the network.

REFERENCES


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