

A Review on Opportunistic Routing Algorithm in Wireless Sensor Networks

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ABSTRACT: Challenged networks are needed to design where network contacts are discontinuous or where link performance is deeply variable and mostly there is no complete path from source to destination to connect properly. Sometimes path can be so unstable and may change or break instantly. Intermediate nodes may take observance of data during the blackout continuously and pass it to the next node when the connectivity resumes making communication possible. Opportunistic Routing used broadcast transmission for sending packets through various and multiple relays. Opportunistic routing has ability to produce more throughput than traditional routing. In this paper presenting a review on Opportunistic Routing Algorithm used in Wireless Sensor Networks.

KEYWORDS: Wireless sensor network, Opportunistic Routing.

I. INTRODUCTION

WSN can have thousands of tiny sensor nodes. Large number of sensor nodes permit for sensing larger geographical area with more accuracy. There are five types of the sensor network. To achieve the task of transferring data, sensor nodes need routing protocols. Routing protocols for WSN are used for finding the best path to create communication in the networks. Routing in WSN is requiring completing challenging task because of the integral characteristics of WSN like energy, communication, architecture and deployment of nodes [1]. Many researchers have proposed different routing protocols with their advantages in respective application. Researchers see Wireless Sensor Network (WSN) as an “exciting generating domain of highly deeped networked systems of low-power wireless nodes with a very less amount of CPU and memory power. A Wireless Sensor Network is a self-designed network that contains small sensor nodes communicating among themselves with radio signals, and deployed in quantity to sense, monitor and understand the physical world. Smart sensor nodes those are currently in use have low power devices equipped with one or more than one sensors, power supply, a processor, memory and an actuator. Some of the important applications of WSN include vehicle tracking, medical device monitoring, robot controlling etc [2]. Wireless sensor networks have their own characteristics that create new challenges for the design of routing protocols for these networks. Initially sensors are very limited in terms of transmission power, storage capacity, computational capacities, and most of all, importantly in purpose of energy. Secondly, the design of a sensor network routing protocol changes with application requirements. Thirdly, data traffic in WSN has more redundancy because many of sensors based on a very basic phenomenon probably having the ability to collect data. Fourth, mostly nodes present in WSN become generally stationary after deployment. However, in recent development, sensor nodes are allowed to move and change their location to monitor mobile events. Energy Saving via Opportunistic Routing reveals a new technique called Energy Equivalent Node (EEN) for relay node selection in WSN for the efficient transmission. This is significantly used to derive the optimal transmission distance for saving the energy and to maximize the network lifetime [3]. EEN is a virtual relay node whose energy consumption equals the total amount of energy of the real nodes. It is not easy to calculate the optimal transmission distance based on the individual sensor’s information such

As the distance between the sink and sensor node and the residual energy. Therefore, in addition to these factors, residual energy, receiving packets ratio and first dead node are found to be necessary for opportunistic routing relay node selection. ENS_OR selects a forwarder set and does the ranking according to priority for making the data transfer.

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Forwarder set i.e., group of nodes in a path is based on optimal transmission distance and residual energy level of the sensor nodes i.e. remaining energy. Ranking among the forwarder set is done with respect to the nodes, which are nearer to EENs and have more residual energy. Thus, this method can improve the energy efficiency and network lifetime. Generally, the assignment of initial energy to the sensor nodes can be done in two ways, i.e., uniform and non-uniform [4].

II. NETWORK DESIGN OBJECTIVES

Mostly sensor networks are application specific and having different applications according to their requirements. Thus, all or part of the following points should be considered and attention able in the design of sensor networks:

Small node size: sensor nodes are most of the time deployed in a harsh or hostile environment so it is important to reduce node size which lead to assist node deployment and also reduce the power consumption and cost of sensor nodes.

Low node cost: Since sensor nodes are more in quantity and generally deployed in a rough or adverse environment. That is why that cannot be reused for further requirement. So try to reduce the cost of node such that cost of complete network reduces.

Low power consumption: sensor nodes are always powered by battery so it becomes very difficult or sometimes even impossible to charge or recharge their batteries instantly. So it is important to reduce the power consumption of sensor nodes such that the lifetime of the sensor nodes, as well as the whole network is continued.

Reliability: Network protocols designed for the sensor networks should provide error controlled and correction mechanisms to confirm reliable data transfer over noisy, and varying wireless channels and medium.

Self-configurability: In sensor networks, once distribution of nodes occurs, sensor nodes should be able to itself organize themselves into such a communication network that reconfigure or resumes their connectivity when topology changes and node failures occurs.

Channel utilization: Since sensor networks have very few bandwidth resources. That is why the communication protocols designed like this so that sensor networks efficiently use the bandwidth to improve channel utilization.

Fault tolerance: Sensor nodes are disposed to failures due to random deployment of nodes. Thus, sensor nodes fault tolerance should be good and have the abilities of self-testing, self-recovering etc.

Security: A sensor network should introduce effective security mechanisms to prevent the data information present in the network. It should also needed to save sensor node from unauthorized access or malicious attacks.

QoS support: In sensor networks, various applications may have different quality-of-service (QoS) requirements in terms of delivery ratio and packet loss. So, network protocol design should consider the QoS requirements of specific applications.

III. OPPURTINISTIC ROUTING FOR RELAY NODE SELECTION

Opportunistic Routing is basically a process of to find or select a subset of the nodes between the source and the destination node and the node that is nearest to the destination will always try to retransmit packets first [5]. The main two steps are following

1. Selection of only the potential nodes between the source and destination so that routing efficiency can be increase.
2. The highest priority node should be at nearest to the destination.

Energy Efficient Opportunistic Routing (EEOR): EEOR is an algorithm works on basis of finding or selecting forwarders' list and give the priority to nodes according to the their energy level. The main scenario has been presented in the paper for adjusting the power of the nodes during transmission. In first scenario, there is assumption that the sensor nodes not be able to adjust the power available with them. In other case, the sensor nodes are able to

Adjust the transmission power with each and every transmission. When the forwarder list has been formed, the approximate cost of transmission has been recorded against each forwarder node entry. Initially the cost will be zero for all available nodes [7]. Distance vector routing algorithm has been used to decide the route after the expected cost has been calculated. The advantage of this EEOR is the end-to-end delay is smaller than EXOR routing. EEOR is also better in others terms also such as the packet loss ratio, energy consumption, and the average delivery delay.

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Energy Aware Opportunistic Routing (EAOR): Energy Aware Opportunistic Routing has the same transmission and broadcasting method as the opportunistic routing has. However, the main distinguish in this method is the next relay node selection. The communicate node that will respond first to an RTS packet is different than that of opportunistic routing. In energy aware opportunistic routing, a sensor node continuously checks its energy level. If the energy level is low, then it does not respond with CTS. In this manner, the lifespan of each client is increased. When a node has high power usage, the probability to get a DATA packet is more depressed. However, the sensor node can still involve you in some of the DATA packet transmissions [7]. If a neighboring node has a high energy level, but it is not that close to the destination as compare to other neighboring nodes, it will start participating in packet transmissions when some of the neighboring nodes consumed very high amount of energy. Energy aware opportunistic routing tries to send the packets over nodes that are near to the destination and accept a high energy level. In this manner, it can create more routing paths as compared to the opportunistic routing process. These paths do not always consist of a similar number of hops that the opportunistic paths, however, they consist of nodes that have not been used that much and have high energy levels. EOAR does not use beaconing mechanism, for that reason it avoids the disadvantages of beaconing and this is the advantage of this EOAR protocol.

Simple Opportunistic Adaptive Routing (SAOR): In this routing each sensor node periodically calculates and distributes link quality in terms of ETX. According to this information, a sender chooses the default path and a list of next-hop that are suitable for forwarding the data. It then broadcasts a data packet together with this information. Upon consideration the transmission, the nodes were not present on forwarding list, just discard the packet. Nodes were present at the forwarding list store the packet and set-forwarding timers based on their nearness to the destination [8]. Smaller timer is set if the node is closer to the destination and forward the packet earlier. Upon examining this transmission, the other nodes will eliminate the resultant packet from their queues to avoid redundant transmissions. Similar to all the existing opportunistic routing protocols, SOAR broadcast data packets at a fixed PHY data rate.

EFFORT: EFFORT based on the OEC (Opportunistic End-to-end Cost) metric, which represents the predictable end-to-end scarcity energy cost for each data transmission. Effort having three main components is:

- Method for OEC computation,
- Select Candidate and relay priorities
- Data forwarding and OEC is updating.

The first component enables each sensor node to calculate its optimal OEC in a dispersed manner. The second component lets every sensor node put its optimal forwarding set of its neighbors and verify the relay sequence. The third component tells how the chosen forwarders help with each other to relay data and update the OEC value consequently. Main advantage of this EFFORT routing, i.e., the improvement of transmission reliability and path diversity, to develop a distributed routing scheme for keeping up the network-lifetime of a WSN.

IV. CONCLUSION

Relay node selection in Opportunistic Routing theory is implemented for minimizing the energy consumption and maximizing network lifetime of a sensor network for static sensor nodes. This is performed to balance the network energy efficiency by calculating the distance of the sensor nodes to the sink and the residual energy of each node. Hence, we study brief about wireless sensor networks and opportunistic routing algorithm for relay node selection, with a brief review about network selection objectives.

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