ANALYSIS OF ALGORITHM FOR VOID FREE ROUTING IN WIRELESS SENSOR NETWORKS

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ABSTRACT

An extensive study has been carried out to understand the concepts of void free routing in WSNs. The various issues related to routing are studied and also considered in design of protocols. To enhance the life time of the network, more importance should be given to the energy efficient parameters. Because, when the node is drained with energy, it generates the voids. The life of a sensor is dependent on the activity that involves with the nodes like sensing, processing and transferring of messages to base station. It is very much important to impose the limitations not only on communication and energy saving but also on the data being transferred to base station and cloud.
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Keyword: Algorithm, Routing, Wireless, Sensor, Energy.

1. OVERVIEW

WSNs are envisioned to operate in an autonomous and untethered fashion. The main task of WSN is to sense and collect data from a target domain, process the data, and forwarding data directly to the target node, but this task would not be feasible as the required transmission energy increases proportionally to the square of the distance. Therefore, data is routed using multi-hop communication. Achieving this task efficiently requires the development of an energy efficient routing protocol to set up paths between sensor nodes and the data sink. As several alternative routes to a destination node may exist, the routing decision has a significant effect on load balancing, end-to-end reliability and latency. The path selection must be such that the lifetime of the network is maximized. Due to resource constraints, WSN poses considerable challenges ranging through network organization, topology discovery, communication scheduling, routing control and signal processing. Also, tight energy budgets enforce energy efficient designs for hardware components, network stacks and application algorithms.

Data routing in WSNs can be made robust and energy-efficient by taking into account a number of pieces of state information available locally within the network such as link quality, link distance, residual energy, location information and mobility information.

The basic service of a routing protocol is the multi-hop forwarding a packet from a source to a destination. However, a routing protocol may also provide end to end latency, reliability, or energy usage (QoS metrics), efficient packet delivery to several nodes at once (multicasting or broadcasting) and node mobility [13].

2. THE PROPOSED WORK

Clustering is used to group sensor nodes, and energy is distributed evenly among sensors in the network. The cluster head collects data from cluster member nodes, aggregates the data, and forwards it to the base station.

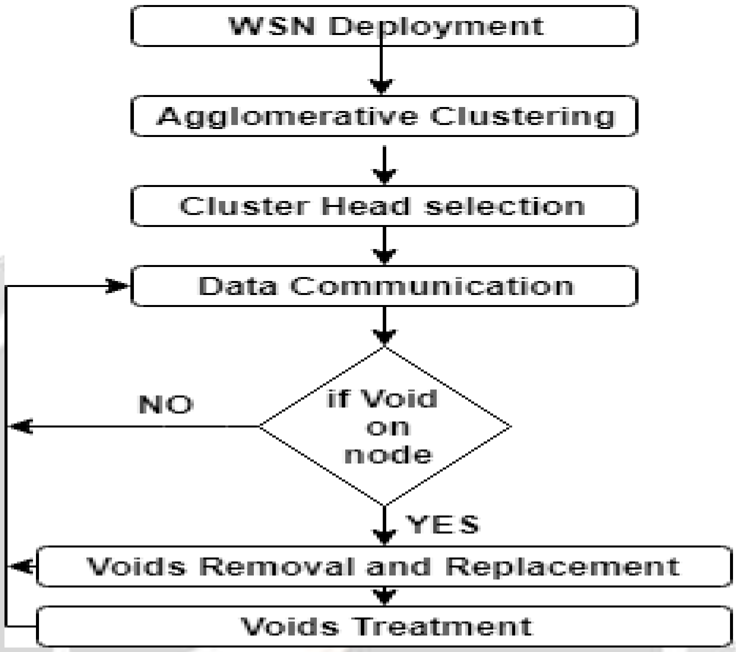

Fig.1. A Flowchart of the Proposed Work

The proposed Dynamic Election of the Cluster Head and Void Removal (DECHVR) algorithm, a flowchart of which is shown in Figure 3.2, is initiated with the agglomerative clustering strategy. This is followed by cluster head election, void elimination and void treatment. This algorithm runs centrally on all nodes in multiple rounds. Initially, clusters are formed using the agglomerative algorithm, following which the CH selection process is begun by every node in every cluster. A CH is selected, based on the metrics of node energy and distance. The CH is also responsible for assigning the TDMA schedule to the corresponding cluster members. The next step has member nodes communicating the sensed data to the corresponding CH nodes. During each round of algorithm execution, protocol is distributing and consuming the energy on sensors within the network. During the communication process, if voids are found chiefly on account of energy depletion, void removal is initiated

The overall performance of the network is degraded when packets are blocked in a void node, especially when the node is activated from the initial setup. Nodes move better without void disruptions. The introduction of voids in the network negatively impacts the packet delivery ratio, bringing it down to the minimum. This happens when packets get stuck in a void node for a particular period of time, resulting in an increasing number of packet drops. Our results demonstrate how voids are reduced and network performance maximized.

Table 4.1 NS2 Simulation Setup

Parameters	Data Values
Number of nodes	75
Area	300*400
Speed	10 m/sec
Traffic	CBR with 128 bytes as packet size
Simulation time	105 sec
Radio range	6m
Bandwidth	914 kbps
Threshold energy	6J
Energy	120

2.1 Algorithms Used for Comparison

The On-Demand routing protocol with Void Avoidance (ODVA), proposed, helps in routing and delivering packets efficiently, thereby improving network lifetime.

In the ODVA protocol, the in-degree and out-degree ratios are calculated at each node and the results stored in a variable. This protocol increases the degree of fairness and reduces the number of voids, referred to as routing holes in the network. Each node actively balances the load and helps in network lifetime recovery. The simulation results prove that the ODVA protocol produces a shorter network lifetime, progressive packet delivery ratio and greater energy use.

Void identification is done with different parameters like the weight matrix and hop count. The performance of the DRA, comparatively speaking, was somewhat below par with respect to packet loss and throughput.

Regular Hexagonal-based Clustering Scheme (RHCS) of sensor networks and analyzed the reliability of the RHCS, based on the Markov model, and presented a Scale-Free Topology Evolution Mechanism (SFTEM). They also analyzed the dynamic characteristics of SFTEM using the mean field theory. Simulation results show that the node degree distribution of SFTEM follows a power law distribution and fault-tolerance. This study has not taken into account the transformation of the backup nodes after node failure.

3. A COMPARATIVE STUDY

The experimental results indicate that the DECHVR mechanism saves network energy, guarantees fast malicious node detection, detects hidden data attacks, and recovers nodes within a permissible delay range. It does these by detecting voids using the in-degree and out-degree of the nodes and their energy levels. It also shows that the DECHVR is most appropriate for WSNs.

Figure 2 shows a comparison of network lifetime between the proposed DECHVR and existing RHCS, DRA and ODVA algorithms. Network lifetime is calculated, based on the remaining energy of the node. Residual energy is comparatively more in the DECHVR than in other algorithms. There is an issue that the DECHVR has with voids at the boundary. If the boundary void dies, communication with the base station will not take place, increasing packet loss and delay. The DECHVR algorithm helps improve network lifetime. Each node evaluates its residual energy and sends the value to the cluster head. Having received the residual energy of all the nodes in the cluster, the nodes with the highest residual energy are chosen as cluster heads till packet transmission commences. Residual energy is observed at regular time intervals. It is seen that the network's remaining energy is preserved better in the DECHVR than in other protocols. This is because the number of alive nodes in the

DECHVR is maintained by detecting and eliminating, from the network, any barriers to performance. Owing to the long lifetime of the network, packet transmission is completed.

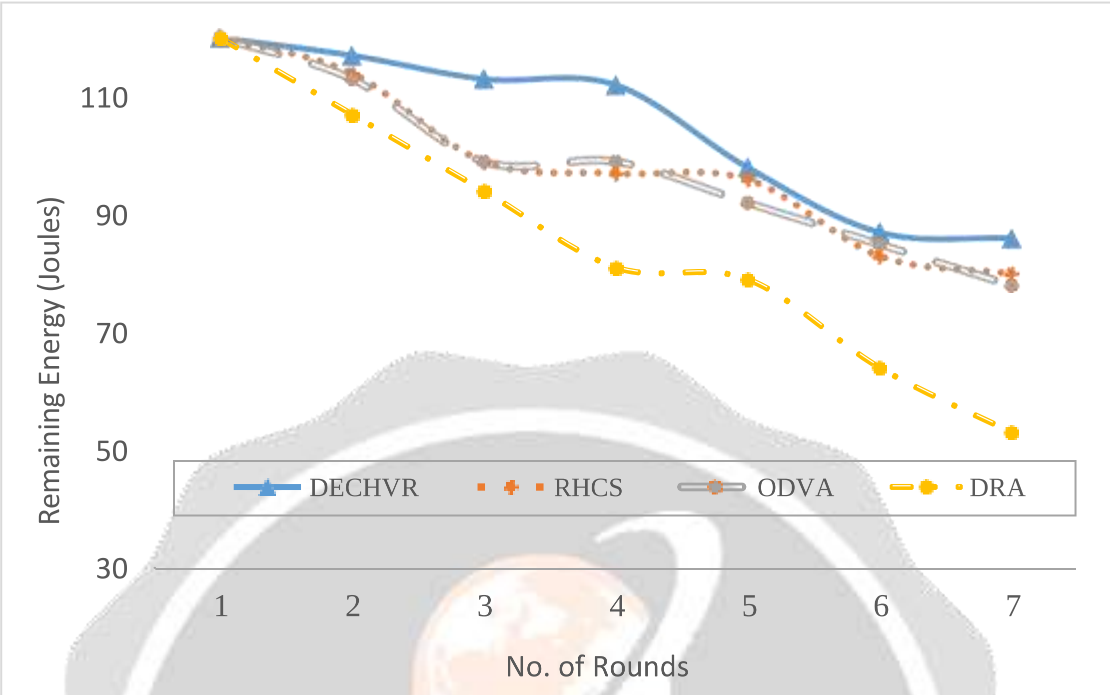

Fig 2: Residual Energy Calculation Based on Network Lifetime

Figure 1 shows that the DECHVR has a higher data forwarding rate than the RHCS, DRA and ODVA. Here, the number of packets sent by the proposed DECHVR and other algorithms is compared. In our method, however, once the mobile node replaces a void relay node, packets are delivered without much data loss in transmission. Thus, packet transmission and forwarding rate show a relative improvement in the DECHVR. Packet loss is comparatively lesser in the DECHVR than in the ODVA and DRA, because void nodes are identified and immediately replaced with other nodes. Other methods replace nodes, based on the next available neighbor node. In the DECHVR, however, replacement is done only with the mobile node which has the most energy to survive the longest in the network. In this way, the WSN lifetime is also increased. The DECHVR works better than other algorithms for transmission by detecting and predicting void clusters. Through void detection and void avoidance in the network, the DECHVR improves packet transmission and reduces packet loss. Void-repaired nodes are permitted to be added to the network, improving packet transmission without data loss.

Figure 2 show that the DECHVR detects the presence of voids better than the RHCS, DRA and ODVA algorithms. When the number of rounds increases, the number of voids in the network also increases correspondingly. In the 4th round, we detected a maximum of 17 void nodes using the DECHVR. The percentage of void detection in the network is better than that of the RHCS, DRA and ODVA. Figure 3 show that the DECHVR detects the maximum number of voids while the ODVA, RHCS and DRA find the minimum.

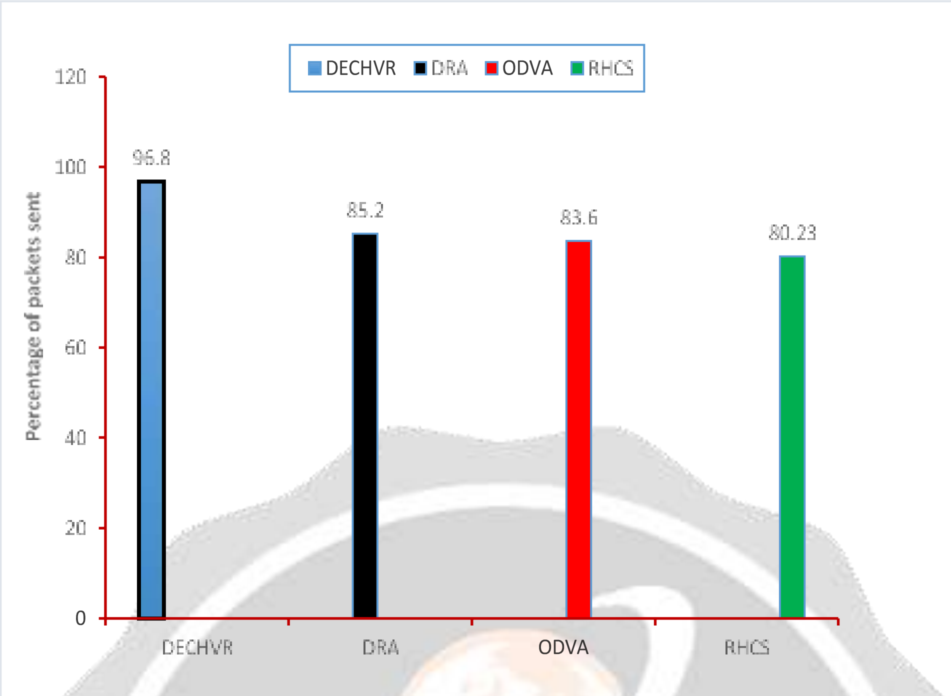

Fig. 3. Performance of Packet Transmission

Void nodes are detected at periodic time intervals, and the number of packets transmitted can be reduced more effectively than with regular time intervals. Network lifetime depends on the detection of void nodes and node mobility. Nodes that are dynamic in nature consume the most energy for movement. In Figure 4, as a result, we have reduced the speed of single nodes in the DECHVR. Comparatively slow-moving nodes consume less energy, and the number of voids in the network, resulting from diminished battery levels, is reduced. The graph clearly shows that eliminating voids in the network improves network sustainability by maintaining energy levels in the network.

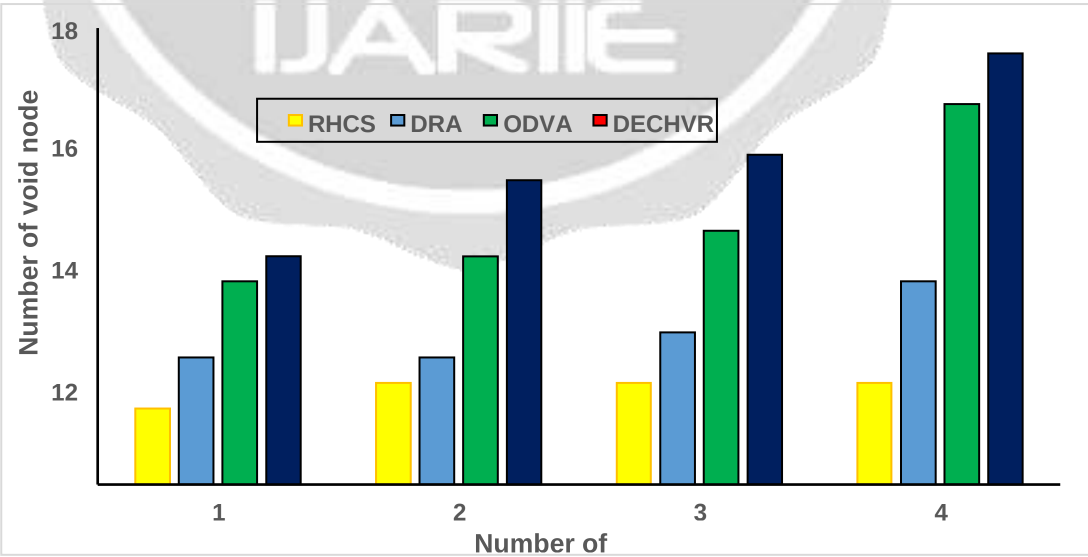

Fig. 4. Detection of Void Nodes by Different Algorithms

The DECHVR detects and eliminates more void nodes than the ODVA, RHCS, and DRA methods. This is because the DECHVR detects voids using the in-degree and out-degree of the nodes, as well as their energy levels. The energy level of nodes is not discussed in other methods.

4. CONCLUSION

Presented works Involves with finding voids and removing voids from normal nodes, boundary nodes and cluster head of the network by measuring nodes in degree, out degree values, density, mobility and distance as parameters. The unique approach of this thesis is adding of void nodes again to the network by repairing them and it also accurately marks the voids and void expecting areas in the network. Our results also show that our algorithm is improved in performance with the metrics of average delay, packet delivery ratio, energy consumption, number of records creation on Index, retrieval time, complexity of sensitive data. This dynamic and adaptive routing method minimizes the voids on network and enhances the way of storing the data on cloud and provided with rapid retrieval of data from cloud based on user queries.

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