Performance Analysis of RFDMRP: River Formation Dynamics based Multi-Hop Routing Protocol in WSNs

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In Wireless sensor networks, sensor nodes sense the data from environment according to its functionality and forwards to its base station. This process is called Data collection. The Data collection process is done either directly or by multi-hop routing. In direct routing, every sensor node directly transfers its sensed data to base station which has an impact on energy consumption from sensor node due to the far distance between the sensor node and base station. In multi-hop routing, the sensed data is relayed through multiple nodes to the base station, it consumes less energy. This paper presents and analyzes the performance of a data collection routing protocol called RFDMRP: River Formation Dynamics based multi-hop routing protocol. The performance of RFDMRP is tested and analyzed for network parameters such as Network lifetime, Energy usage, and Node density and data aggregation impact on network lifetime. The simulated results are compared with two algorithms LEACH and MOD LEACH. The comparison reveals that the proposed algorithm performs better than LEACH and MOD LEACH with respect to Network lifetime.

Keywords: Data Collection, Energy efficiency, Network lifetime, River Formation Dynamics.

1. INTRODUCTION

Wireless Sensor Networks [1, 2, 3] (WSNs) are widely used in various real time applications such as military, medical, disaster detection, structural monitoring, etc. These WSNs consists of huge set of small sensor nodes, deployed in the environment for monitoring environmental conditions such as humidity, temperature, pressure, etc. The wireless sensor nodes sense the data from environment based on the application and forwards to the central base station or sink for further processing [4]. This process is called data collection, which is the primary task of the WSNs. In data collection process [4], the sensor nodes forward the data to the central base station either by direct communication or by multi-hop communication.

The direct communication from sensor node to base station is energy expensive due the distance between sensor nodes and base station is more, this reduces the lifetime of the network. Alternatively, Multi-hop communication [5, 6, 7] schemes are used for better network lifetime and performance due to its effective utilization of resources. In multi-hop communication, every sensor node is busy in forwarding the sensed/received data to nearest intermediate (neighbor) nodes or to the base station using multi-hop routing paths. In this process, selection of next (neighbor) node in routing path is very important for forwarding data.

The next node or forwarding node in the routing path is not only meant for relaying the data, but also useful for aggregating the data. Data aggregation or Data fusion techniques are used to reduce the size of the data packet to be transmitted to next node by aggregating the data or by eliminating similar data, received from previous nodes [2]. Multi-hop techniques improve the energy conservation of node and the lifetime of the network.

Swarm intelligence is one of the mechanism used for finding the suitable nodes in the routing path between sensor nodes and the base station. In WSNs, swarm intelligence mecha-
tion and this affects the network lifetime of existing protocols. Where as in Proposed protocol, the multi-hop mechanism balances the energy consumption and maintain the network lifetime equally in any type of network with any number of nodes.

The lifetime of the network was calculated by changing the $\gamma$ value in the Equation 10 and Figure 12 was plotted. In Figure 12, lifetime of the network was considered as a simulation round when the last node dies. The lifetime is decreasing when the $\gamma$ is increasing from 0 to 1. Here the $\gamma = 0$ indicates the full aggregation of data, which results the aggregator takes b-bit data and aggregates that into single data packet. This leads to decreasing in transmission packets, which in turn reduces the energy consumption for transmission. In the case of $\gamma = 1$, The aggregation will not taken place due to this aggregator simply forwards the packets as many as it received. This consumes energy more hence decreasing in network lifetime.

7. CONCLUSIONS
In WSN, multi-hop routing is an effective mechanism for data collection. In multi-hop routing, the selection of forward node for relaying data plays a vital role. One of the swarm intelligence mechanisms, RFD, is used to propose RFDMRP. RFDMRP, is an RFD based multi-hop routing protocol for data collection in WSN to save energy and enhance the lifetime of the network. In RFDMRP, RFD considers the hop count value and residual energy as parameters for forward node selection. In this paper, the RFDMRP performance was analyzed and compared with LEACH and MOD_\text{LEACH} by considering the performance metrics such as network lifetime and energy consumption, Node density, and data aggregation. From the results, it is observed that RFDMRP performs better than the existing algorithms.

REFERENCES
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