Chapter 5
An Artificial Intelligence Model for Effective Routing in WSN

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ABSTRACT

In WSN, sensor nodes will be distributed heterogeneity concerning their basic requirements such as location, power backup, and the distance between the nodes. With these metrics, research is carried on energy conservation, media-based problems, packet aggregation, effective routing, quality of link, etc. But the energy consumption and data processing system in WSN makes a scenario for not using an artificial intelligence (AI)-based system in network structure. In this chapter, a heuristic packet routing (HPR) strategy for effective path identification on the packet transmission between the nodes is given. The proposed methodology also improvises the routing process on diffusion and energy management methodology defined in previous research work. A comprehensive study was done with the help of a network simulator. Based on the result, the work is compared with various research work defined previously.

1. INTRODUCTION

In WSN, sensor nodes have an extensive development in their physical and power management processes with smaller in size and less expensive. Sensor nodes will be deployed in a challengeable environment for measuring some parameters of the application-defined with thousands of nodes in the network density. With some basic needs such as minimum energy consumption, effective routing, erroneous data transmission is a challenging task. In (E et al., 2005) energy management, data reliability, data security is important metrics in designing of a network. Hence, it is a important for consideration of collision on data transmission, intrusion attacks.

Also (Akyildiz et al., 2002; Karl & Willig, 2003) states an effective routing methodology in packet transmission with effective multi hopping in data path. The path establishment was effectively carried out. But data path establishment was done on expensive energy usage which leads to minimize nodes'

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power backup. As the power of a node is not rechargeable, usage of explainable Artificial Intelligence is introduced on the network designing and data packet transmission cycles. With this enhancement, we can monitor the network working strategy and efficiency of packet transmission. Here we proposed an artificial intelligence bases data routing method for improving network lifetime with efficient usage of energy for making a successful data transmission.

A multi-hopping protocol in Wireless Sensor Networks (WSNs) is a routing protocol that enables communication between sensor nodes that are beyond the direct wireless transmission range of each other. In multi-hopping, data is relayed through intermediate nodes to reach a destination node that is located far away. The main objective of multi-hopping protocols is to extend the network coverage area and overcome the limitations of individual node transmission range. By utilizing intermediate nodes as relays, data can be transmitted over multiple hops to reach a destination node that is out of range for direct communication.

1. ***Ad-Hoc On-Demand Distance Vector (AODV):*** AODV is a reactive routing protocol that establishes routes on-demand. When a node wants to send data to a destination node, it initiates a route discovery process by broadcasting a route request packet. Intermediate nodes receiving the request packet can forward it or reply with a route reply packet if they have a valid route to the destination. A route is established by accumulating replies from multiple nodes.
2. ***Dynamic Source Routing (DSR):*** DSR is also a reactive protocol that discovers routes when needed. It utilizes source routing, where the source node includes the entire route in the packet header. Intermediate nodes store the routes and forward the packets based on the source routing information. DSR allows for flexibility in route selection and can handle topology changes dynamically.
3. ***Destination-Sequenced Distance Vector (DSDV):*** DSDV is a proactive routing protocol that maintains routing tables at each node. It uses sequence numbers to differentiate between new and old routes and to avoid routing loops. The protocol updates the routing tables periodically or when a topology change occurs. Nodes exchange routing table updates to ensure consistent and up-to-date routing information.
4. ***Routing Protocol for Low-Power and Lossy Networks (RPL):*** RPL is a routing protocol specifically designed for WSNs with resource-constrained nodes. It supports both proactive and reactive routing approaches. RPL organizes nodes in a hierarchical structure, where nodes are assigned specific roles such as root, parent, and child. It enables efficient routing by leveraging the hierarchical topology. A multi-hopping protocol in WSN is designed to enable efficient communication between sensor nodes by allowing packets to be relayed through intermediate nodes. Here's a high-level description of the flow for a multi-hopping protocol:
    1. ***Initialization:*** The protocol begins by initializing the network and sensor nodes. Each node is assigned a unique identifier and initial parameters.
    2. ***Data Collection***: Sensor nodes in the network start sensing the environment and collecting data. They periodically sample the environment and generate data packets.
    3. ***Packet Transmission:*** When a sensor node generates a data packet, it first checks if it is the final destination node. If it is, the packet is sent directly to the sink node or the base station. Otherwise, the node looks for the next hop neighbor node to relay the packet.
    4. ***Next Hop Selection:*** The node evaluates its neighboring nodes to determine the best next hop for packet transmission. This selection is typically based on factors such as signal strength, energy level, distance, or routing metrics.