Hybrid Fuzzy Data Aggregation and Optimization-Based Routing for Energy Efficiency in Heterogeneous Wireless Sensor Networks

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Wireless sensor networks (WSNs) are networks with many sensor nodes that are utilized for various purposes, including the military and medical. In hazardous circumstances, precise data aggregation and routing are essential, and the energy consumption of the sensors needs to be closely controlled. Nonetheless, there is a significant chance of redundant data because of external factors and nearby sensors. A multitude of information can be found in large datasets, some of it unnecessary and others useful. This redundancy negatively impacts performance in terms of redundant transmission and computing costs. However, data aggregation might help a network get rid of unnecessary data. In this work, we present a hybrid protocol called fuzzy data aggregation with fuzzy spider monkey optimization routing protocol (FDA-FSMORP) that represents an intelligent approach to collecting sensor data in HWSNs considering energy consumption. The results indicated that the suggested method beat in minimizing data latency our approach reduced energy consumption by 73% using energy more effectively when compared to our simulated outcomes.

Povzetek: Predstavljen je hibridni protokol FDA-FSMORP, ki z uporabo mehke optimizacije poveča energetsko učinkovitost heterogenih brezžičnih senzorskih omrežij in podaljšuje življenjsko dobo omrežja.

1 Introduction

Wireless Sensor Networks (WSN) are composed of numerous networked nodes, each of which can recognize and communicate changes in their immediate surroundings. Wireless sensor networks (WSN) have numerous potential applications, including smart buildings, the internet ecosystem, battlefields, industry, healthcare, and agriculture [1]. The longevity of the network decreases as sensors lose power. Overcoming these obstacles requires making the most efficient use of energy. Repetitive information is produced by nodes that are close to one another or receive input simultaneously [2], [3]. Consequently, a network's life energy is less depleted during data processing, transmission, and reception. Before being transferred to the sink via routing protocols, data is first collected and then aggregated using functions like sum, average, etc. [4]. This gets rid of the necessity to send the sink a single sensed value at a time. There are several methods for lowering the amount of data in WSNs, including compression at the cluster head (CH) or the sink. Alternatively, several mobile sinks may be used to aggregate data in a heterogeneous WSN using a clustering approach. This clustering technique is especially advantageous for assisting CH in identifying the N-sensors that comprise its cluster and in recognizing their CH on the N-sensors. Following the arrangement of the sensors proposes a smart approach to aggregate the sensing data in HWSNs to consider the energy consumption. After that, the work proposes a new routing protocol for HWSNs to send the aggregate data from the sensor to the sink through the CHs is used to figure out how to make sure the network lasts as long as possible, and that energy isn't wasted. To reason about the best way to route HWSNs both between clusters and within clusters, it looks at three routing metrics for each node. These three metrics are (the highest remaining energy within the node, the smallest number of hops, and the least amount of traffic within the node). Although rapid advancements were experienced, small sensors could perform tasks at higher levels, such as multimedia data processing and transmission [2]. Many WSN researchers have focused on energy-saving solutions, such as energy-aware aggregate and routing algorithms, which aim to reduce processing and communication resource requirements by limiting the use of WSNs to simple data-gathering and reporting applications.

The relevant works' approach, performance, and outcomes are compiled in Table 1. Therefore, choosing