Lifetime Maximization Using Grey Wolf Optimization Routing Protocol with Statistical Technique in WSNs

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The main challenge in Wireless Sensor Networks (WSNs) is to maximize the lifespan of sensor nodes powered by low-cost batteries with limited power. Energy conservation is crucial, and routing mechanisms play a vital role in preserving energy. Energy-efficient routing methods can save battery power and extend the network's lifespan. This study introduces the Grey Wolf Optimization Routing Protocol (GWORP), enhanced with a novel routing mechanism that detects the statistically optimal path. It enables the discovery and reuse of an ideal route from the source to the destination, ensuring balanced energy consumption across WSN nodes and reducing path discovery time. GWORP outperforms the PSORP (Particle Swarm Optimization Routing Protocol) algorithm, significantly reducing energy usage and minimizing end-to-end latency. The findings suggest that GWORP could potentially increase the network lifespan by approximately 73% compared to PSORP.

Povzetek: Namen raziskave je bila primerjava energijske učinkovitosti protokola GWORP z algoritmom PSORP v brezžičnih senzorskih omrežjih.

1 Introduction

Wireless Sensor Networks (WSNs), have a pivotal role in the endeavors taken to build and deploy systems attempts to achieve the mentioned objectives of the Internet of things (IoT**)**. They are formed by many small sensor devices that have wireless transceivers in each of them. WSNs are built without infrastructure and they can self-configure themselves to accommodate some changes. WSN technologies enabled pervasive sensing that covers many areas of modern life. This makes it possible to measure, infer and understand the indicators of an environment, from tiny objects and natural resources to civil environments[1],[2]. The growing number of these devices in a network of communication and actuation results in the creation of IoT, where sensors and actuators are integrated with the surrounding environment conveniently. A WSN consists of a large number of sensor nodes that are scattered in a dense form in an area of interest to monitor the changes in one or more physical phenomena[3]. The network can include different sensors with different tasks such as temperature sensors, pressure sensors, humidity sensors, movement sensors, etc. These sensors gather data relevant to the measurements of specified physical phenomena and process the sensed data in the network before the eventual data collection which is made by a central unit called a sink or base station[4]. The sensed data can be transmitted cooperatively toward the sink through a series of nodes (hops) called multi-hop data transmission. In multi-hop communication, sensors send their data or forward data on behalf of another sensor to deliver the data to the sink for further processing and analysis[5]. Therefore, various applications of WSNs are witnessed including monitoring (environments monitoring, earthquake monitoring, etc.), control (detection and tracking of objects), and surveillance (battlegrounds observation)[6],[7].