A SURVEY OF OPTIMIZATION OF ROUTING PROTOCOL IN WIRELESS SENSOR NETWORK USING REINFORCEMENT LEARNING TECHNIQUE

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ABSTRACT

Wireless Sensor Networks (WSN) are used to monitor the environment by sensing and collect the data about the environment. It is becoming more and more challenging to explain the design issues needs related hardware and software support due to the materialisation of numerous applications-specific routing protocols. A huge part of the research on sensor networks is focused on the detailed study of networking protocols for sensor networks. This work proposes a survey of optimization of routing protocol in wireless sensor network using Reinforcement learning technique.

Keywords: *WSN, Routing Protocol, Reinforcement Learning*

1. INTRODUCTION

A sensor network consisting of many numbers of sensor nodes and deployed over a large area named as field to monitor and collect information in a specific application environment and send the information to the base station through sink node. Several WSN applications are highly depends on efficient and reliable data communications, however in the network source node send the data through the multi hop path some times in single hop path to the sink node, here the routing issues is how the source node know which path data is to be sends through. There are different possibilities of sending the sensed information from the source node to the sink node. Different routing protocols that have been proposed for sensor networks.

Machine learning (ML), its introduction as an artificial intelligence technique in the late 1950s, it has been widely used for a variety of tasks, including classification, regression, and density estimation in fields speech recognition, computer vision, fraud detection, and advertising networks. the creation of computer models for learning procedures that address the issue of knowledge acquisition and improve the functionality of created systems[1].

A supervised learning strategy for WSN routing optimization is introduced to enhance situation awareness and improve communications, the algorithm makes use of machine learning techniques. Basically, it makes use of machine learning to automatically identify relationships between input features (such node-level and network-level data, like buffer occupancies, packet length, and node residual energy) and output (e.g., link quality, optimal route)[2].

2. ROUTING PROTOCOL FOR EFFICIENT DATA TRANSMISSION

Various design challenges are involved in WSN, While designing new routing protocols, energy efficiency, complexity, scalability, delay , robustness, data transmission model and sensor location are the essentials should be fulfilled by a network engineer depends on the application environment [3].

A set of algorithms and techniques that can learn from datasets and generate predictions or assist in creating them are referred to as machine learning (ML), a discipline of computer science and statistics.

Reinforcement learning (RL), a class of machine learning system can learn from its prior interactions with its environment to effectively choose its future behaviours with the help of. In order to create autonomous

systems that get better over time, RL has been used to a variety of application areas, including game playing, robotics and control, networks, and telecommunications. It is well acknowledged that RL may be used to solve optimization issues pertaining to distributed systems in general and network routing in particular. In comparison to other optimization methods applied to the same issues, RL also has a moderate overhead in terms of control packets, memory, and computation [4].

AdaR that adaptively learns an optimal routing strategy, depending on multiple optimization goals based on a least square's reinforcement learning technique, which is both data efficient, and insensitive against initial setting, thus ideal for the context of ad-hoc sensor networks. this approach effectively balance several optimization objectives in order to maximize network lifetime [5].

Deep learning based an energy efficient deep belief network (DBN) based routing protocol, is proposed for IoT based WSN and the proposed DBN's performance is compared with five existing algorithms they are Genetic based energy efficient clustering (GEEC) protocol, TTDFP, EADCR, CLONALG-M, and Deep neural network (DNN). Lifetime and energy efficiency have been achieved by choosing the shortest path for data transfer. Complexity analysis and statistical analysis are also assessed for the suggested architecture [6].

Multi-agent reinforcement learning based routing protocol with QoS support for WSN is proposed to achieve globally optimal performance by using a distributed reinforcement learning method. In this the sensor node calculates QoS routes and only locally observed network information and little information sharing with neighbours [7].

A Reinforcement Learning (RL) and Unmanned Aerial Vehicle- (UAV) aided multipath routing scheme is proposed to increase network lifetime by improving the Energy Efficiency (EE) of the Public Safety Network. Routing topology that considers both the immediate energy cost and the total distance cost of the transmission path. The network lifetime achieved through EE [8].

A reinforcement-learning-based routing system was suggested to optimise network lifetime in all specified areas. The intelligent algorithm of reinforcement learning is used by reinforcement learning-based routing protocol to find the best routing path for transmission of data. Link distance, residual energy, and hop count are examples of variables that are used in the definition of the reward function. The sink is considered in order to decrease overall energy usage, balance energy consumption, and enhance packet delivery. The proposed method optimises the network lifetime in three ways compared to energy-aware routing, BEER, Q-Routing, and MRL-SCSO [9].

3. CONCLUSION

In this paper we presented an overview to the techniques using reinforcement learning concept for achieving adaptivity and finding optimal routes in a resource-constrained environments of WSNs. The common objective is to improve the life time of the sensor network without compromising the QoS. In general, routing protocols can be divided into four groups: data-centric, hierarchical, location-based, and QoS-based routing protocols. According to how each protocol operates, these protocols are further divided into those with low, moderate, and high overheads as well as low and high QoS-based routing strategies. The protocol or method employed relies on the service requirements and the type of operating environment.

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