Improving Wireless Sensor Network's Performance through Intelligent Sensor Reinforcement Learning Algorithm (ISRLA)

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Abstract: **Currently, wireless sensor network is the top research area to uplift technological progress. From traditional sensing domain to critical areas, sensor network has played a vital role in every aspect. WSN is also facing various challenges while working with key areas like forest monitoring, environment monitoring, home security, precision agriculture and in defense systems. These challenges are packet delivery ratio, energy consumption, better throughput and end to end delays. We have taken the help of reinforcement learning algorithm with the combination of wireless sensor network to overcome these issues. In this research, we are proposing an intelligent sensor network algorithm (ISRLA) to overcome the existing challenges of wireless sensor network algorithm. Finally we have compared our research outcome with already available algorithms like RL-CRC (Le.T et al., 2016) to better proof our research results based upon certain performance matrices like throughput, energy consumption, PDR and end to end delay. Results showed that our proposed algorithm (ISRLA) performs well.**

IndexTerms **- Wireless Sensor Network, Q-Learning, Reward, Value Function and PDR.**

I. INTRODUCTION

Mainly wireless sensor network have the objective to achieve the sensing data from dynamic environment like environment, volcano, underwater, agriculture and defense systems. The wireless sensor network implementation is low cast comparative to remote sensing technologies like satellite. Wireless sensors are tiny in nature with the low capacity of computational power, memory constraints and limited battery power. To better utilize the available resources of sensor network, we can take the help of reinforcement learning algorithms which is situated in between supervised and unsupervised learning. Q-learning (Christopher et al., 1992) is the nested part of reinforcement learning. The hybrid of wireless sensor network and reinforcement learning techniques may achieve the resource optimization and may work with PDR, end to end delay and energy consumption issues (Somayeh et al., 2011) (Ibrahim et al., 2017). In this research study, we are proposing an intelligent WSN algorithm to overcome various challenges using q-learning under certain performance matrices.

Type Style LITERATURE SURVEY

II. LITERATURE SURVEY

According to authors (Christopher et al., 1992) and (Leslie et al., 1996), the authors have described brief overview of q-learning algorithms, RL Modeling, RL details, Learning theory, Award, Policy creation, and Model free methods which used have significant benefits in dynamic environments. According to authors (Yu-Han et al., 2003), the authors tried to make complete domain using multi agent RL and jointed different results in this area. Movement of sensors and routing are the key concern area. As per the authors (Jamal et al., 2004), the author showed different challenges of routing which are good to clear problem areas in WSN. As per the authors (Liu et al., 2006), the author presented framework of RL to make energy efficient protocols which can be developed for optimization of cross layer in ad-hoc sensor nodes. As per the authors (Niklaswirstrom et al., 2006), that explores when the WSN can utilize the self-configuration policies. Mainly, the policy decides how we can configure the node. They demonstrate what types of machine learning models can be developed in wireless networks to find the optimal policies for certain domain. Sensor duty cycle is the keen area for sampling and has seen as an optimization issue. Author (Somayeh et al., 2011) (Ibrahim et al., 2017) clearly showed that q learning technique can be used to detect the complete dynamically change.

III. INTELLIGENT SENSOR REINFORCEMENT LEARNING ALGORITHM (ISRLA)

Generally RL algorithm (Christopher et al., 1992) learns from experience and generates state and action to create the dynamic policy function (Anna et al., 2007) (Mihil et al., 2009). The below proposed algorithm (ISRLA) works well to achieve the objective in wireless sensor network.

Start
While (Every State Si: S) \\ Create Action
Start
Select the first state FSi
Search move positions (Left, Right, Up and Down)
Validate for target (Status of Goal)
Check (If Goal is equal to first state)
Update Discount Rate
Perform updation on the rate of discount with increment
(DR1=DRγN1- i and i=i+1)
Else (Status of Goal not equal to Start State)
Copy the value of (state, action) data into table (look up)
Jump to start
End While
End \\ Objective achieved

IV. SIMULATION & RESULT

After creation of algorithm, the simulation of proposed algorithm (IRSLA) (Figure 1) works well in MATLAB based upon following parameter specified Table 1.

Table 1: Simulation Parameters	
No of Nodes	50
Learning Rate (α)	0.5,0.6,0.7
Discount factor (ϒ)	0.2,0.3,0.4
Initial Energy (in jule)	1000 mJ
Range of transmission	200 m
Range of interference	50 m
Rate of Packet Generation	20 s
MAC protocol	CSMA
Physical layer protocol	IEEE 802.15.4
Dissemination of Data	0.7 s , 01.5 s and 02. S

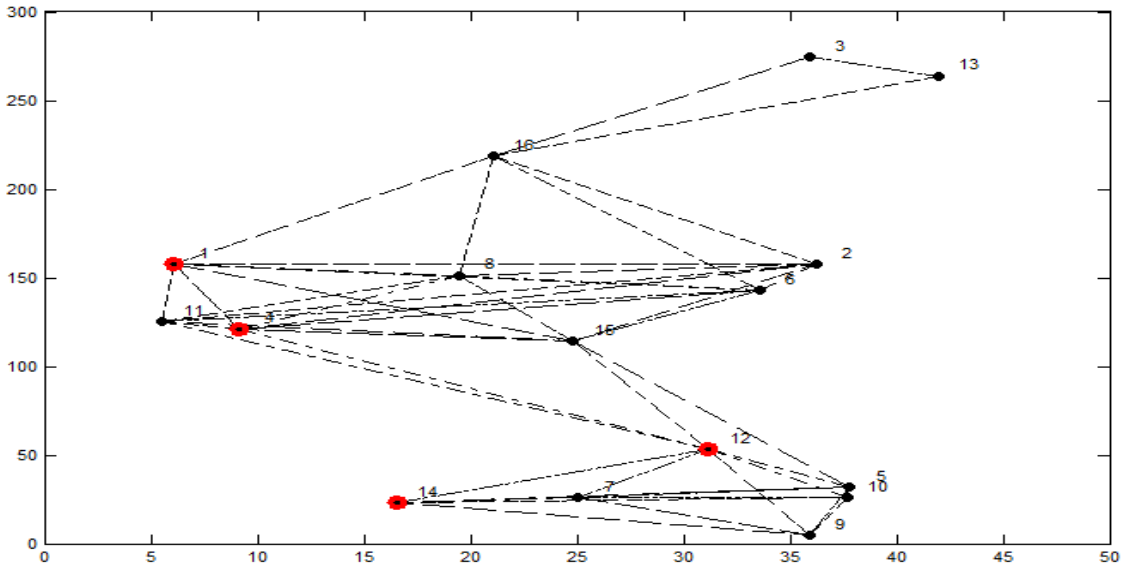

Figure 1: Proposed algorithm (ISRLA) simulation in MATLAB

The simulation (Figure 1) represent that , our proposed algorithm did good performance than comparable algorithm RL-CRC (Le et al.,2016) on the bench of certain performance parameters like PDR ratio, Delay, and Throughput along with consumption of energy. These performance monitoring criteria is shown here with the help of different graphs below:

(i) PDR

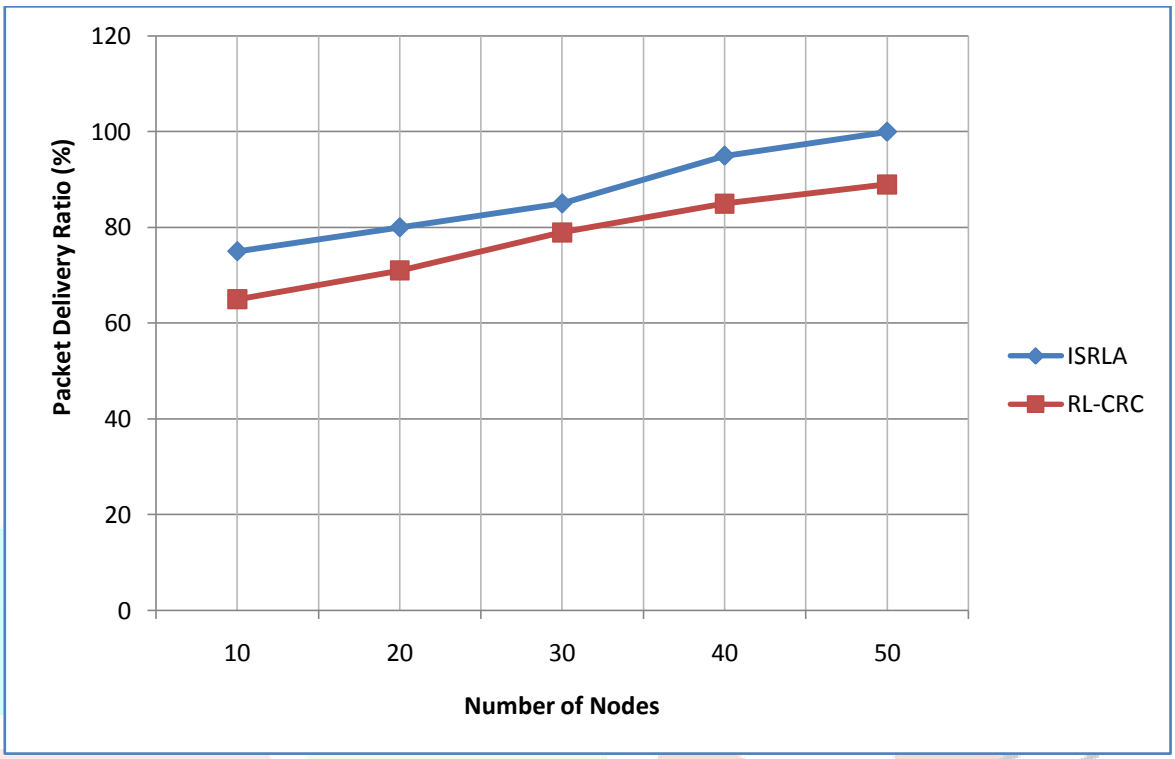

Figure 2: PDR Ratio

(ii) END TO END DELAY

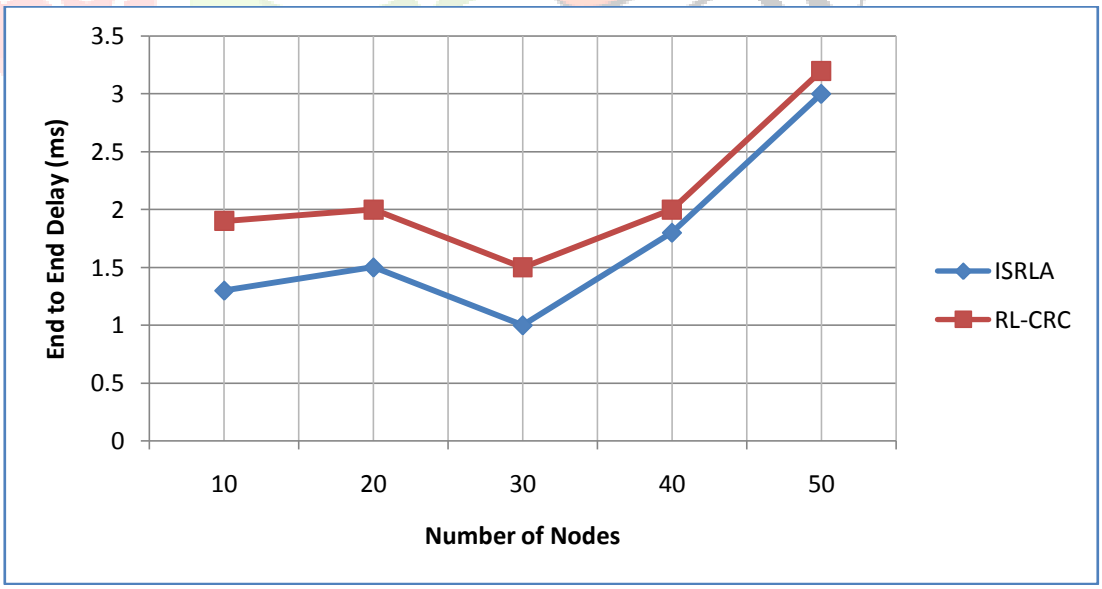

Figure 3: End to End Delay

(iii) THROUGHPUT

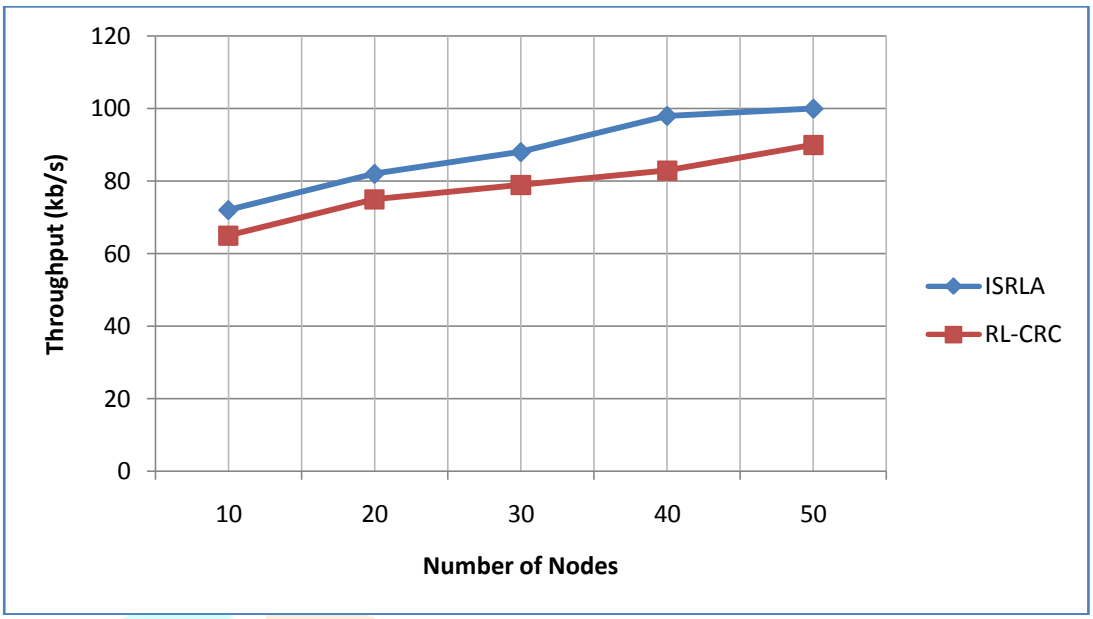

Figure 4: Throughput

(iv) ENERGY CONSUMPTION

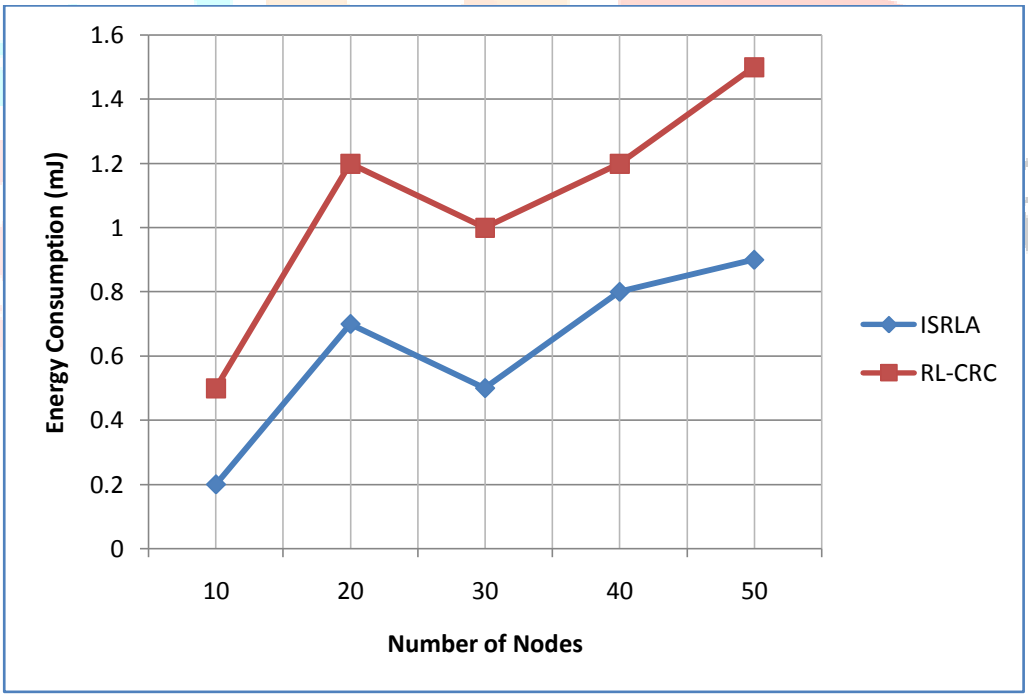

Figure 5: Energy Consumption

V. CONCLUSION AND FUTURE SCOPE

We have simulated the proposed algorithm (ISRLA) (Fgure 1) in MATLAB 2012(a) with parameters given in table 1. We have compared our proposed ISRLA algorithm with existing algorithm RL-CRC. The findings reflect that our proposed algorithm (Figure 1) performs better with certain performance matrices like PDR ratio (Figure 2), delay (Figure 3), throughput (Figure 4) and energy consumption (Figure 5). In future, we will test algorithm on real wireless sensor network with more than 50 sensor nodes.

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