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An Implementation Of Consistent Routing Protocol (Crp) With Long Lasting Energy Efficient Network (L2e2n)

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Abstract

The wireless sensor network has many limitations like packet delay, packet loss, acknowledgement loss, complexity, scalability, robustness and energy efficiency which reduces the performance and the lifetime of the network. To improve that, the novel Consistent Routing protocol (CRP) is introduced along with the cluster formation method which is Long Lasting Energy Efficient Network (LLEEN) also called as L2E2N. The CRP is the dynamic routing protocol, which is developed to reduce the packet delay and packet loss during the transmission and also the efficiency of the transmission like throughput will be maintained even though the length of the packet is varied. The L2E2N is proposed to improve the lifetime of the network by consuming less energy during the transmission. The nodes should react during transmission like the rate of accepting packets which is equal to the rate of delivering packets, that can be possible in this L2E2N without consuming more energy. The performance measure is taken as throughput for the clusters with different sizes with respect to the energy consumption as the packet length is increased in terms of bytes.

Keywords: Cluster Formation, Node Member Connection, WLAN, WSN, Consistent Routing Protocol (CRP), Long Lasting Energy Efficient Network (L2E2N)

1. Introduction

The method of adaptation of routing protocol is an important thing which should improve the reliability and the scalability of the network. The Opportunistic Source Routing (OSR) protocol is the one, which satisfies the above requirements. The formation of nodes, connection establishment and data transfer can be done with less loss of packets and less power consumption. It is also applicable for large WSNs by reducing the packet field length in the network [1]. The average energy consumption, round trip packet delay and the packet outcome rate from the node will be considered for the performance measure of the WSN which is operating in linear mode. The Joint routing along with the Media Access Control will be useful for the data transfer using Multiple routing nodes, in short it is called multi hop communication network [2]. To improve the reliability of the network, the cross-layer protocol such as the

MAC based routing protocol can be implemented. For node selection, the timer-based strategy is followed which has the metrics of RSSI and the residual Energy. Also, the probability of packet loss will be evaluated in the multiple sensor nodes [3]. In a standard IEEE 802.15.4 protocol, it is possible to implement the distributed graph protocol which decentralises the Wireless Sensors and Actuator Network for scheduling the routing graphs by the node itself, which reduces the response time of the network, and the channel hopping is also possible during that same time slots [4]. The hopping of nodes will be varying for shortest path routing and multipath routing which can be implemented in the same WSN using the cross-layer optimisation. The body-to-body network can be formed with the help of this technique and the performance can be measured by sensitivity of network, round trip delay and the throughput [5].

2. Related Work

The clustering and routing are the two important things to concentrate during the multi hop transmission of packets in the three-dimensional environment and the performance of the network is measured based on the lifetime of the network and load balancing capability of the network. In that, the cluster heads are managing the data transfer using the availability of the energy and the distance of the adjacent nodes [6]. The wireless sensor network can also be formed by using the software defined radio network which Is having the routing protocol based on the Quality of Service. The QOS is applicable to the routing and clustering algorithm for maintaining the local network which identifies the heterogeneous path, and the total setup is called QSDN-WISE which balances the load and energy in the network [7]. In a heterogeneous type of WSN, the load balancing and energy balancing can be simultaneously implemented using a hybrid mechanism called ETASA. Depending upon the rate of the traffic and the available energy in the node, the nodes can be switched to wake up mode and sleep mode to transmit the packets with scheduled time slot which achieves less traffic and more efficiency of energy [8]. The routing protocol is also designed using the reinforcement learning method for distributed network which helps to maintain residual energy in the network because of multiagent system. There is 90 % of packet delivery ratio is achieved with very less energy consumption in the limited 14 adjacent network nodes [9, 10].

3. Proposed Methodology

The cluster should be formed with the help of available active nodes and the distance between a node with all other nodes will be evaluated and simultaneously, the energy consumption is also evaluated. Based on the gathered information, the cluster head is detected and establishing the connection between all other nodes to start the data transfer between them [11, 12] which is shown in Fig.5. The sequence flow diagram of the proposed method is called Long Lasting Energy Efficient Network (L2E2N) with Consistent Routing Protocol (CRP) which is shown in Fig.1. The total energy consumed by the cluster is given in the following equation [10],

$$E_i^{DA}(n) = \sum_{\forall t} Q_{ti}(n) E_{aggBit} \qquad (1)$$

Where, the E_{aggBit} is the data aggregation energy per Bit, $Q_{ti}(n)$ is the queue state and the n is the number of nodes.

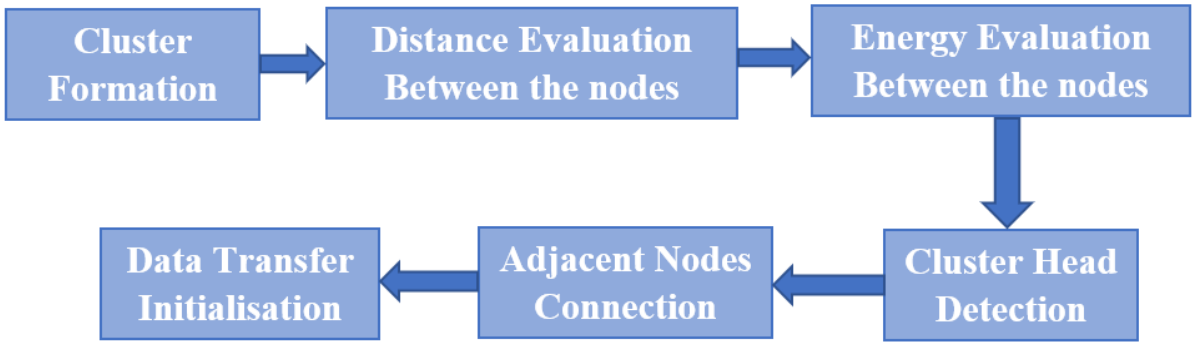

Fig.1. Flow Sequence of Proposed Method

4. Implementation Methodology

There are eight number of nodes are forming the cluster and the small cluster is called the direct connection between the nodes, the medium cluster is called the connection of two nodes between a node [13, 14], otherwise it is called the connection between the nodes with one hop node. The large cluster is the connection between the nodes with two or more hop nodes [15] which is shown in fig.3. Based on the analysis done by the L2E2N with CRP, the cluster Head is selected, and data transfer is implemented.

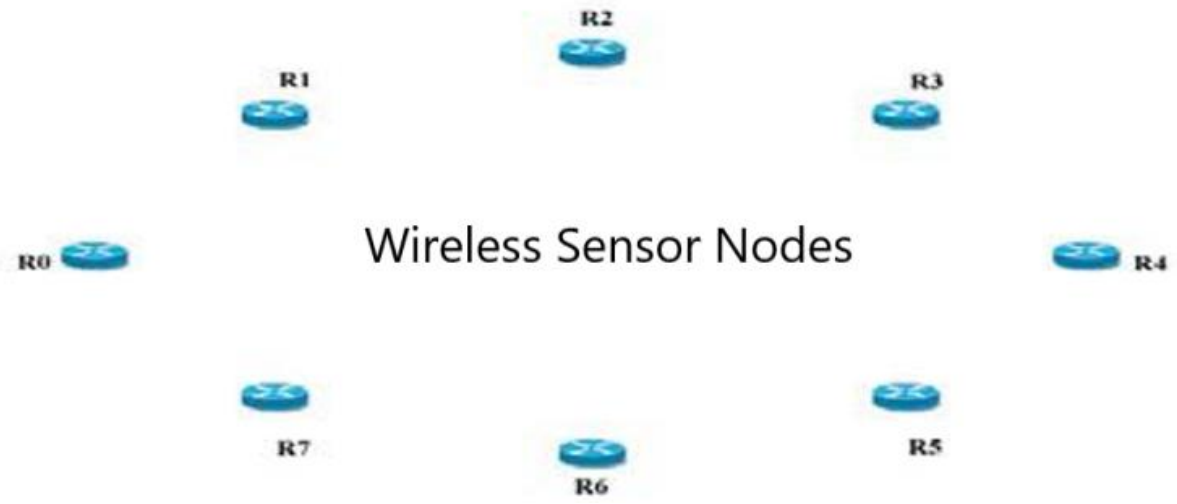

Fig.2. Cluster Formation with Wireless Sensor Nodes

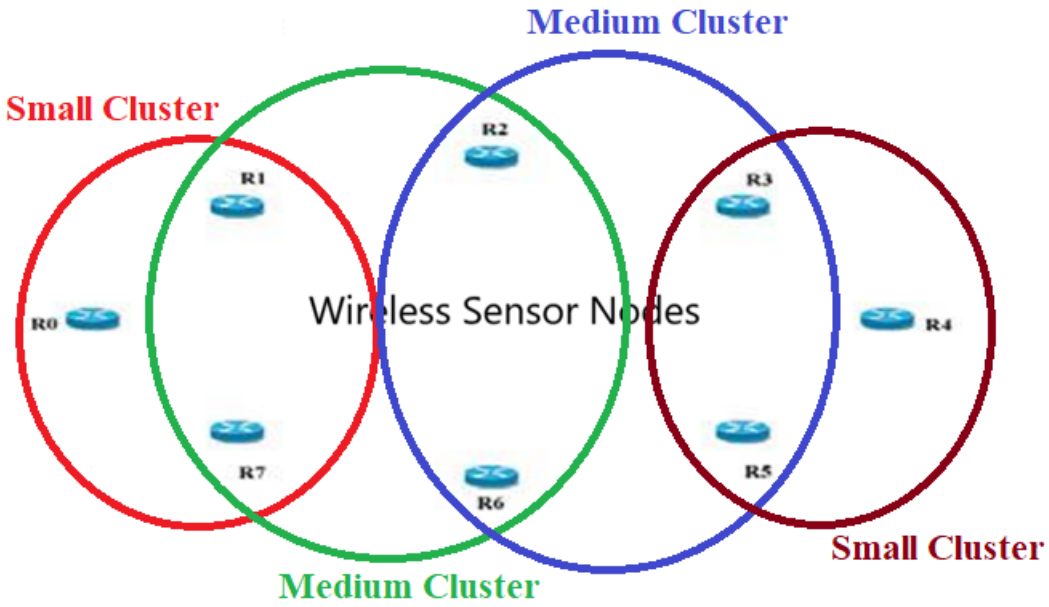

Fig.3. Cluster Variations between Wireless Sensor Nodes

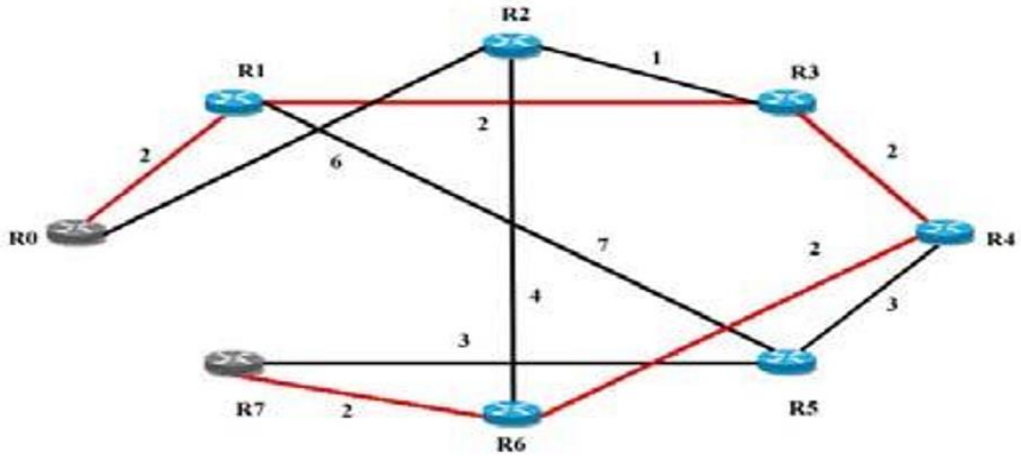

Fig.4. Distance and Energy Evaluation between Wireless Sensor Nodes

No.	No. of Routers	No. of Links	Source	Destination	Metric	BandWidth	No. of Message	Shortest Path	Simulation Time
1	8	11	R1	R8	Distance(k	0		R1-R2-R4-R5-R6-R8	8000
2	4	4	R1	R4	Distance(k	0		R1-R2-R4	2000
3	8	11	R1	R8	Distance(k	0		R1-R2-R4-R5-R6-R8	9000
4	8	12	R1	R8	Distance(k	0		R1-R2-R6-R8	9000
5	8	12	R1	R8	Distance(k	0		R1-R2-R6-R8	8000

Fig.5. Analysing Wireless Sensor Nodes for Cluster Head Detection

5. Results and Discussions

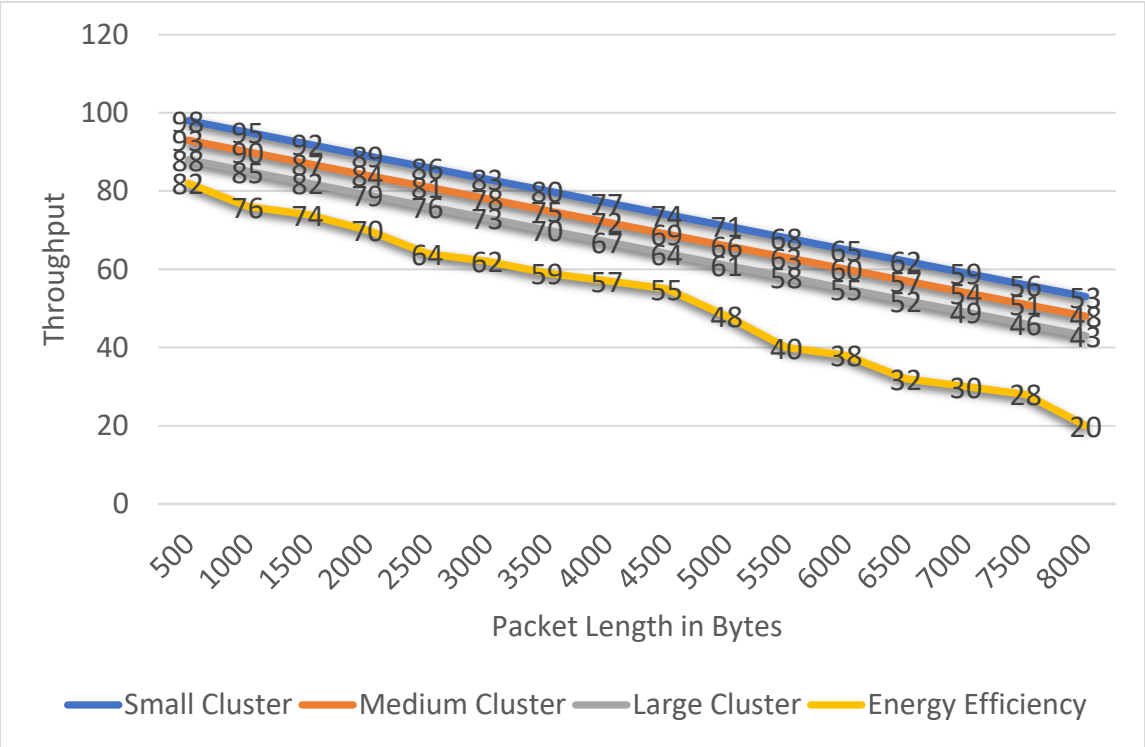

Fig.6. Throughput of Different Packet Length with Different Cluster Size with respect to Energy Efficiency

The transmission packet length is usually inversely proportional to the throughput which refers the number of bytes transmission per unit time. The unit time is also called as time slots which can be defined by the user for transmission and reception purpose which depends on the capacity of the node. The Fig.8. shows the Throughput of different packet length with different cluster size with respect to Energy Efficiency which will be reduced due to increase in packet length. The table 1 also shows the same with different values listed. The message behaviour as the number of nodes increases is plotted in Fig.7, and the time slot initialisation as the number of nodes increases is also plotted in Fig.8.

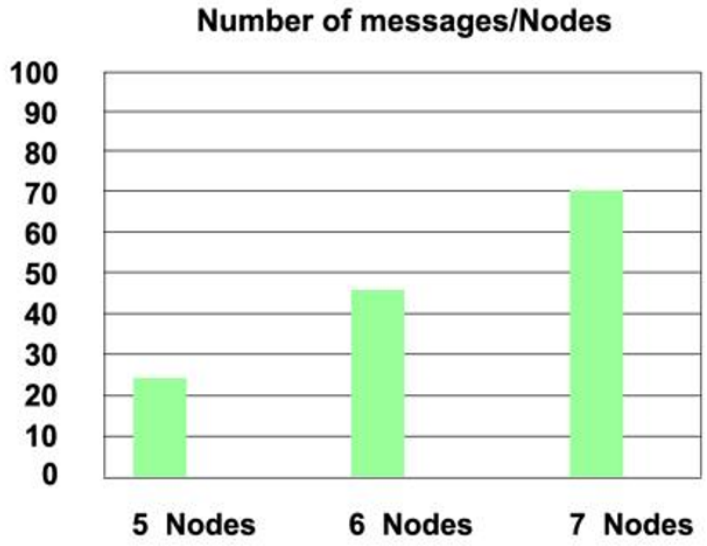

Fig.7. Number of Nodes with respect to messages

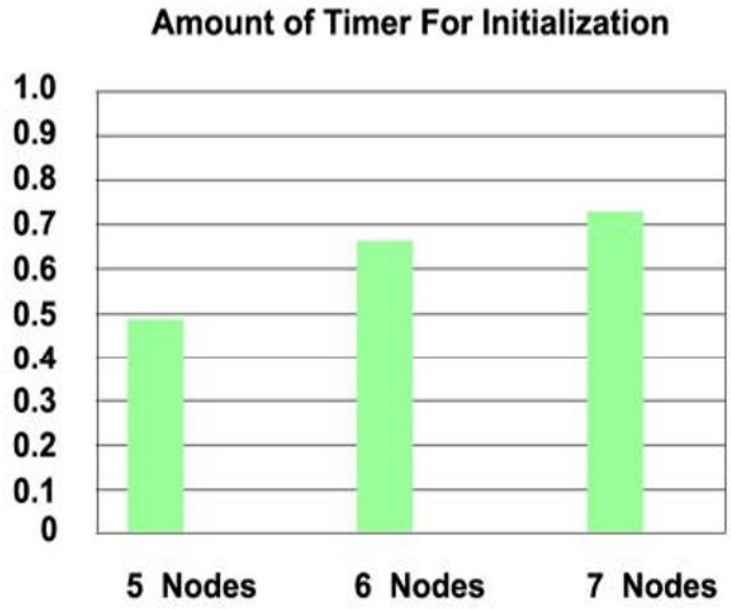

Fig.8. Number of Nodes with respect to Time

Table 1 Throughput of Different Packet Length with Different Cluster Size with Energy Efficiency

Packet Length in Bytes	Throughput of Small Cluster (No Hop) %	Throughput of Medium Cluster (one Hop) %	Throughput of Large Cluster (Two Hop) %	Energy Efficiency %
500	98	93	88	82
1000	95	90	85	76
1500	92	87	82	74
2000	89	84	79	70
2500	86	81	76	64
3000	83	78	73	62
3500	80	75	70	59
4000	77	72	67	57
4500	74	69	64	55
5000	71	66	61	48
5500	68	63	58	40
6000	65	60	55	38
6500	62	57	52	32
7000	59	54	49	30
7500	56	51	46	28
8000	53	48	43	20

6. Conclusion

The proposed consistent Routing Protocol (CRP) with Long Lasting Energy Efficient Network (LLEEN) also called as L2E2N reduces the packet delay and packet loss during the transmission and also the efficiency of the transmission like throughput will be maintained even though the length of the packet is varied. The L2E2N is proposed to improve the life time of the network by consuming less energy during the transmission. The outcome of this proposed method is common to the small cluster with no hop nodes, medium cluster with single hop node and the large cluster with more than two or multi hop nodes which is clearly shown in the table 1 listed above. The energy efficiency is also listed and the initialisation of timer for transmission and the relationship between the message and the number of nodes are also analysed to measure the performance of the network.

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