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A Survey on the Lifetime Enhancement Algorithm in Wireless Sensor Network

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Abstract — *Wireless Sensor Network (WSN) are powered by Battery but in most cases it is difficult to change the battery hence the Design of WSN should be modified so that we can optimize the lifetime of batteries by dealing the trade-off between Lifetime and Quality of service (QOS).This Protocol increases performance of WSN by decreasing the Packet Loss Percentage by 94.1% as resulted by the Simulation.*

Keywords- *WSN; QOS; Protocols; Simulation; Lifetime*

I. INTRODUCTION

WSN has now become very advance due to the focus of various Researchers in this area, over the last few decades. In order to monitors the condition of an environment. A large of Sensors can be deployed which sensed data from the area such as Temperature, Pressure, Air flow, Speed etc. WSN contains thousands of tiny sensor nodes. The communication among these sensor networks is low powered. These nodes communicate with each other or directly by Base-Station node called as Base Station. Sensor network has very high density of sensor nodes in a large geographical area. The accuracy of information provided by these sensor networks is very high. The Base station may be a stationary or mobile and they are capable of connecting the sensor network to outside world using an existing communication Internet, where users can have access to the reported data [1].WSN is an small or big device having capabilities of detection and measuring physical parameters. The key challenge a Wireless sensor Networks (WSN) [1], [2], [3], [4] and [5] routing must cope with is that the energy efficiency and prolonging network lifespan. A WSN have following characteristics:

- *Application-oriented*
- *Less Infrastructure*
- *No public address*
- *Supported communication models: hierarchical/distributed WSNs; or homogenous/heterogeneous WSNs;*
- *Limited resources of sensors (radio range, bandwidth, energy, memory and processing capabilities);[2]*

Some of most important characteristics of these networks are:

- *Wireless communications and connections*
- *Low reliability and failure capability in sensor nodes;*
- *Dynamic topology and self-organization;*
- *Hop-by-hop communications (multi-hop routing);*
- *Cooperation of sensor nodes and other WSNs' devices to each other's;*
- *Inter-nodes broadcast-nature communications;*
- *Ease of extendibility and configuration Scalability;*
- *Direct communication, contact and interaction with physical environment;*
- *Usually single-purpose and application oriented networks;*
- *Putting down and consistency capabilities of sensor nodes on different operational environments;*
- *Automatically and non-interrupted operation;*
- *Communication management capability between mobile nodes;*
- *Hardware limitations of sensor nodes;*

These data are collected and transmitted to the sink through Network. These Sensors can be deployed in such a place where Human presence is Risky. In such places Recharging batteries or replaces them is very difficult or in some cases impossible. Hence there is a requirement for enhancing the battery power so as to increase the Lifetime of the sensor network. Studies conducted by Researchers show that Energy consumption for WSN is due to the communication among sensors in short known as Routing. The important method of saving energy is the clustering. Hence clustering sensors into small groups saves energy and increases network lifetime. In clustering each cluster has a cluster Head and others are cluster members. Sensor members send data using low power to CH (Cluster Head) while CH sends these data to sink using high power communication.

The clustering of the sensors must be proper so that a trade-off should be made between two conditions:

- *If number of cluster is present than large number of cluster Head have to communicate with the Sink results High power Consumption.*

•If numbers of clusters are low than diameter of cluster increased hence more energy is needed for CM (Cluster member) to communicate with the CH.
In this paper, the discussion is about OLE (Optimized Lifetime Enhancement) in WSN, a protocol which achieves good performance in terms of Lifetime. Hence a simulation is done on OLE in terms of QOS parameter such as Lifetime, end to end Delay, Packet loss Ratio, Throughput. Simulation shows that OLE performance is better in terms of Delay and throughput.

II. RELETED WORK

Various Protocols within WSN are proposed to increase the performance of WSN but these protocols differ in many ways such as Selection of CH and Cluster formation method. Those can be given as below:

- *LOW ENRGY ADAPTATION CLUSTERING HIERARCHY(LEACH)*:

In this the selection of CH in cluster is Random which are predefined which is having probability of 0% to become CH up to certain number of Rounds. Each node has to select a CH close to it and send data to it using TDMA. Hence this results an inaccurate selection of CH, Size and number of cluster. Finally the load on each increases and long TDMA increases the latency in data Gathering. The objective of LEACH is to decrease the energy consumption required to make and maintain the clusters to improve the Lifetime of WSN. This is a HIERARCHICAL protocol in which nodes transmit data to the cluster Head and Cluster Head in turn sends data to the Sink. In each Round a cluster member is selected as the cluster Head according to its energy level. In this protocol each node has a radio power to transmit to other nodes or cluster head but by using that radio in full power waste the energy.

- *LEACH-centralized (LEACH-C):*

This is the improved and centralized version of LEACH. In which each node sends information about location and energy level to the BS (Base Station). BS utilizes the overall network information that improves performance of network. Primary hole in this method is that a GPS or other LTM is used to track the location and in condition of node failure this has no method to overcome that failure.

- *Hybrid, Energy-Efficient, Distributed clustering approach(HEED):*

This Protocol is mainly based on residual energy of the nodes. To increase the lifetime and efficiency a parameter is used which is known as communication cost. This shows the Density in the Cluster. HEED needs multiple broadcasts for cluster formation hence consumes more Energy.

- *Proxy-Enable Adaptive Clustering Hierarchy (PEACH):*

This protocol is improves version of LEACH in terms of Lifetime. In this a proxy node is selected which can take roll of a current CH of low power during a single round. The advantage of this protocol is to detect and manipulate the cluster head failure, Hence Lower the overhead of clustering again. This protocol can increase Lifetime and reliability of WSN. In this protocol a proxy node is selected as the Cluster head and during one round of communication. This protocol can increase the lifetime by 15% as compared to the LEACH protocol.

- *Power-Efficient and Adaptive Clustering Hierarchy(PEACH):*
  The main objective of this method is to maximize the lifetime. This protocol uses multilevel clustering.

III. NETWORK MODEL

In the Simulation it is assumed that there are n numbers of sensors nodes are present and within the area of the rectangle A. To assess the performance of the protocols, a collection of simulation runs were meted out. The simulation runs were conducted using the distinct event machine OMNeT++ [16] because the simulation platform to get a network in a hundred × a hundred space during which sensing element nodes are distributed statically and uniformly. The sink node is found at point (50,200) and it is assumed that it's having infinite power and different resources. the protocols can also be appropriate for the other WSN application that needs information gathering like preciseness agriculture, product quality and surroundings observation.

The scenario is having following property:
- *One sink is present outside the area*
- *The sensor nodes are non-rechargeable*
- *They can change the power level according to the distance of the data being send to receivers*
- *The signal collision and interface among the signal in WSN is assumed to be none.*
- *Only packet loss due to node failure is considered.*

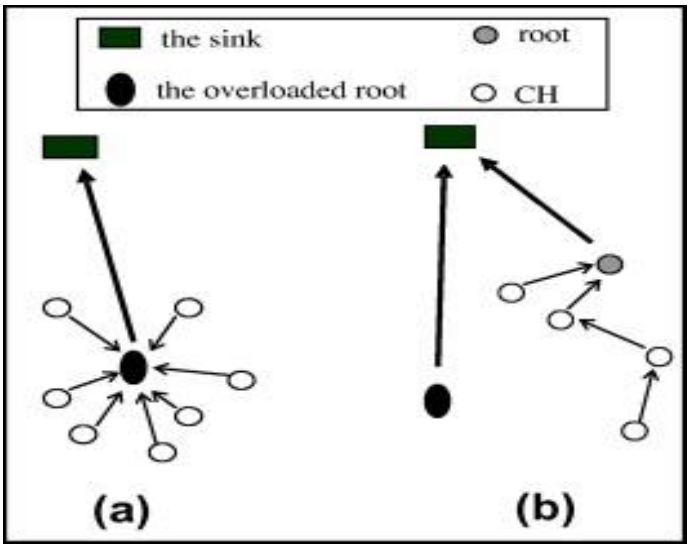

Figure: 1 Model of OLE

IV. NETWORK SIMULATION

Network Simulation is a technique of modelling the network behaviour by observing in a test lab. To check the changing behavior in different conditions, the attributes of the environment can be modified as well. There are different types of simulators available to simulate the ad hoc network and NS (Network Simulator) is one of the most popular simulators among those. It is a series of discrete event simulators which specially includes NS-2 and NS-3.Both are targeted for networking research especially for TCP, routing protocols, multicast protocols etc over wired and wireless networks. Among two, NS-2 has been used and widely accepted by a larger community. The components of NS-2 are written in OTcl and C++ both. Like NS-2, NS-3 is also an open source tool but with modular design. All the components are completely written in C++. It provides a set of simulation models implemented as C++ objects emphasising more on emulation.Python can also be used as the programming language in NS-3. In this section, the simulations that were allotted to check the performance of the protocols are rumored.

To study the performance of OLE as compared to the other Protocol. Various parameters are defined in terms of QOS parameter.
In the simulation raw packets are used instead of aggregated data packets:

- *PACKET LOSS PERCENTAGE :*

This is the ratio between the packet loss and the total number of transmitted data path packets loss is the difference between the number of packet sent and number of data packet received. Graph shows that as comparison to the LEACH and C-LEACH the packet loss percentage is low.

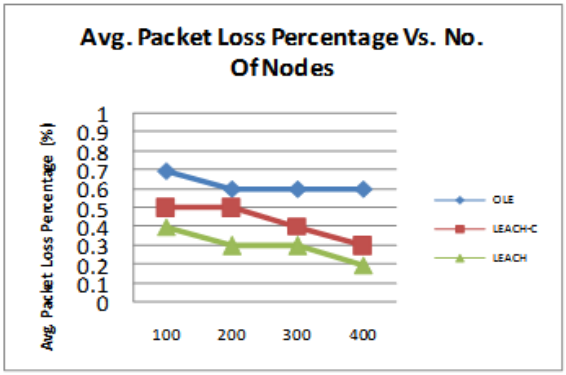

Figure: 2 Network lifetimes vs. number of nodes

- *THROUGHPUT:*

This is the ratio between numbers of bits received at sink during lifetime to the network Lifetime.

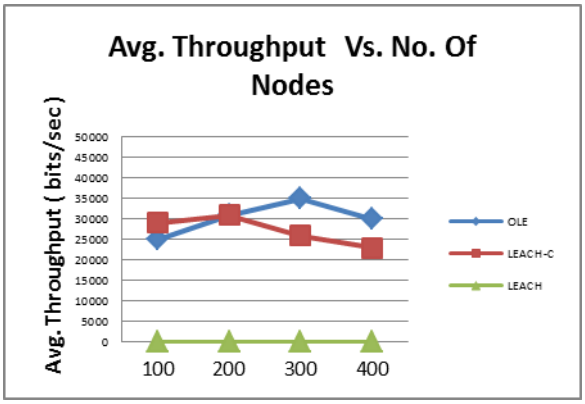

Figure 3 Average Throughput vs. number of nodes

- *END TO END DELAY*

This is the actual delay between the raw data packet sent to the raw data packet received.

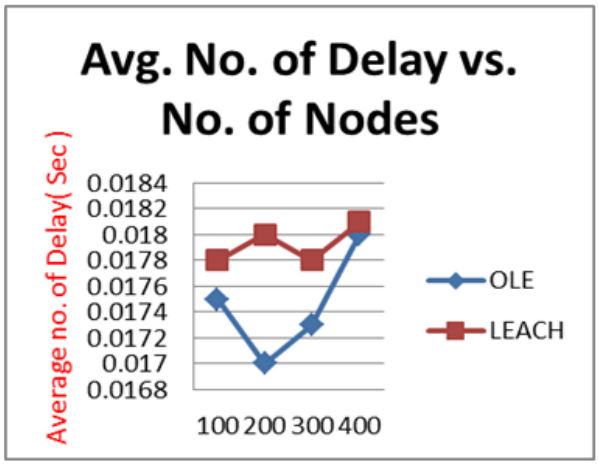

Figure 4.Average end to end delay vs. number of nodes

- *LIFETIME:*

This is the number of counting of rounds of the nodes before the dies.

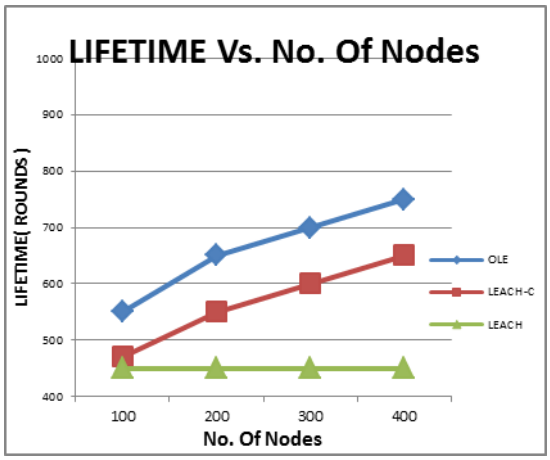

Figure 5 Network lifetime vs. number of nodes

V .NETWORK SIMULATION

For Our Simulation we are using NS3 as the simulator mainly because NS-3 provides greater scalability and better performance in comparison to NS-2.Number of nodes is varied from 20 to 100 in this work. Mobility model used is Random waypoint Mobility Model (RWP). Mobility model for VANET behave very different in nature than MANET. So, we need to implement our protocol on specific VANET models, but to start with basics, in this paper we are just comparing the effect of RWP on existing VANET routing protocols. Readings are taken from 0 second to 10 seconds. Good put, MAC/PHY overhead and delay are recorded for concluding the efficient routing protocol. 10 sink nodes are taken in case of 20 nodes, 20 sink nodes are taken in case of 50 and 100 nodes.

VI .CONCLUSION

This paper provides about the optimization lifetime enhancement in wireless sensor network and this technique is successful at various stages during the simulation in terms of QOS. Simulation results show that OLE offers improvement over LEAP, LEAP-C, and HEED in terms of loss percentage, throughput, delay by on average 90.3 %, 8.9%, 1% respectively and lifetime is reduced by 6%.

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