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Comparative Analysis of SCMR, P-LEACH and V-LEACH Routing Protocols in Wireless Sensor Network

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Abstract: *The main requirement of wireless sensor network is to prolong the network life time and energy efficiency. The sensor nodes have limited energy and to minimize the energy dissipation of sensor nodes in transmission of information from cluster head to base station, multi-hop communication been used. In this paper a new energy effective algorithm has been proposed which is based on SCMR, P-LEACH and V-LEACH protocol. The parameter to be determined in this paper are energy efficiency, throughput and packet delivery ratio. The simulation result shows the comparison of SCMR, P-LEACH and V-LEACH protocol.*

Keyword: *Wireless sensor network, Multi-hop communication, Energy efficiency, SCMR, P-LEACH, V-LEACH.*

I. INTRODUCTION

Wireless Sensor Network (WSN) is an on growing research topic in the field of communication system. Usually, it consists of a number of sensor nodes which are interconnected through wireless links to monitor physical or environmental conditions, like sound, temperature, and motion. The main advantage of the sensor technology is extremely small, low powered sensing devices equipped with programmable computing, multiple parameter sensing and wireless communication capability. Also, less cost makes this possible to have a network of thousands of sensors, thereby enhance the reliability and accuracy of data and the area coverage. But the drawbacks of the WSN are that it has limited battery power, limited storage and computation capabilities, prone to the security attacks and have limited bandwidth to communicate. So, many of the researches proposed the Cluster based Wireless Sensor network that is used to reduce the network energy consumption and also increase energy efficiency. Clustering in WS Network is performed to minimize the energy consumption and also to reduce the data transmission over the network that is required to transmit the message to the BS, as the CH becomes responsible for communication, which results into prolonged network lifetime. a Clustering Wireless Sensor network every cluster has a leader sensor node, called as Cluster-Head (CH) and is selected based on the probability. A CH aggregates the data collected by the leaf nodes (non- CH sensor nodes) in its cluster, and sends the aggregation to the base station (BS), this technique is known as Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol. LEACH protocol effectively increases the network lifetime but greatly reduces the total energy consumption, since they consume more energy in the cluster head node and once the CH dies all other node associated with it becomes isolated. An enhancement over the LEACH protocol was proposed. The protocol called Power-Efficient Gathering in Sensor Information Systems (PEGASIS), is a near optimal chain based protocol. The key idea in PEGASIS is to form a chain among the sensor nodes so that each node will receive from and transmit to a close neighbour. Gathered data moves from node to node, get fused, and eventually a designated node transmits to the BS. Nodes take turns transmitting to the BS so that the average energy spent by each node per round is reduced. . The main purpose of the WSN is collection of information about the environment, It is designed to use the energy efficiently. The transmission of information in these networks is very important because incorrect routing will result in imbalance energy consumption. To avoid this condition routing algorithm is proposed. In this paper, a new energy effective routing algorithm is presented which is based on SCMR, P-LEACH and V-LEACH protocol. The remainder of the paper is organized as follows: Section II explains the progress in the field of WSNs; Section III presents the proposed concept; Section IV shows the design implementation; Section V shows the simulation result; Section VI concludes the paper.

II. RELATED WORK

Many energy efficient techniques were employed. L. Bhasker[6] has introduced a genetically derived secure cluster-based data aggregation in WSN. In that initially the cluster heads are selected based on the node connectivity, which acts as a data aggregator.

Then, the clustering process is executed using the genetic algorithm. When a cluster member wants to transmit the data to aggregators, a data encryption technique is used that offers authenticity, confidentiality and integrity. Thakkar.A[6] proposes a coverage based energy efficient algorithm. In this paper, the multi-hop short range communication among the sensor nodes were more energy efficient than single-hop long range communication comparatively. Moreover, the paper was involved in making uniform distribution of CHs using non overlapped cluster areas. The main purpose was to achieve higher packet reception rate irrespective to network longevity. Amit grover[4] proposes the LEACH and extended LEACH protocols in WSNs. It explains the TL-LEACH protocol. In TL-LEACH within its cluster CHs gather data from its cluster members and transmit data to another cluster head (CH) which lies between cluster head and Base station. TL-LEACH reduces more energy consumption than original LEACH and also reduces number of nodes to transmit data to Base station.

III. PROPOSED CONCEPT

In proposed concept, we explain the SCMR, P-LEACH and V-LEACH routing protocol.

A. SCMR

SCMR is a static clustering based multi-hop routing. It omits the overhead of dynamic clustering and reduce the energy consumption and as a result prolongs the network lifetime. In this method, the field is divided into three nested concentric circles where the sink node is in the center of these circles. With such a partitioning three main groups are formed. Each main group is divided into four sub-groups. Each partition obtained from the last division is considered as a cluster. This model uses multi-hop data transmission. Each cluster head collects data from the normal nodes of the same cluster and sends it to the next cluster head. Here next cluster means the cluster in the closer inner group with the same sub-group number. This work continues until the node in the innermost main group receives information and sends it to the sink. To select the cluster heads in each round, the node with the greatest amount of energy will be selected as the cluster heads.

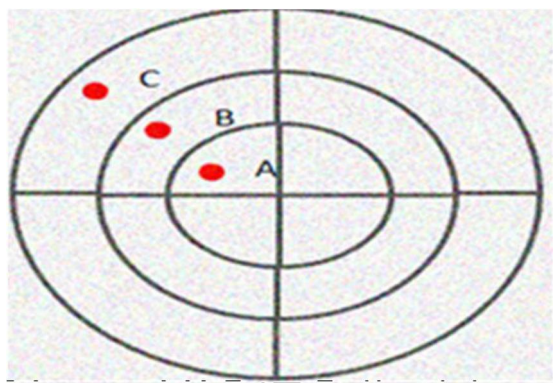


Fig.1 SCMR MODEL

This is an example of SCMR protocol. Here node A,B,C is considered as CH. The node C which is located in main group 3 and sub group 2 collects the data from the member nodes of its own cluster and send it to the node B. Node B which is located in the main group 2 and sub group 2 collects the data from its own cluster and aggregate that data with the data collected from node C and send to the node A. Node A which is located in main group 1 and sub group 2 collects the data from its cluster and aggregate this with the data collected form node B and send it to the sink node.

Dividing environment into two types of main groups and sub groups has two advantages: The main groups closer to the sink are spatially smaller than the farther groups . Therefore the clusters formed near the sink are smaller than the farther clusters. Thus, cluster heads closer to the BS can spend more energy to transmit data between clusters and the advantage of dividing each main group into four sub-groups will reduce the data transmission distance.

B. P-LEACH

P-LEACH is the combination of PEGASIS (Power Efficient Gathering in a Sensor Information System) and LEACH (Low Energy Adaptive Clustering Hierarchy) protocol. It overcomes the drawback of these two protocol i.e LEACH consider the dynamic cluster approach and energy efficiency during wireless transmission, while PEGASIS consider the power consumption, reduced traffic overload and cost efficiency, but doesn't take into account a dynamicity. The combination of the two protocols is to design an ideal

routing protocol for wireless transmission and networking. The cluster head set is responsible for data forwarding in LEACH, while in PEGASIS, hierarchical chain formation is implemented through an energy efficient algorithm. So P-LEACH combines the chain formation technique within the clusters for data forwarding.

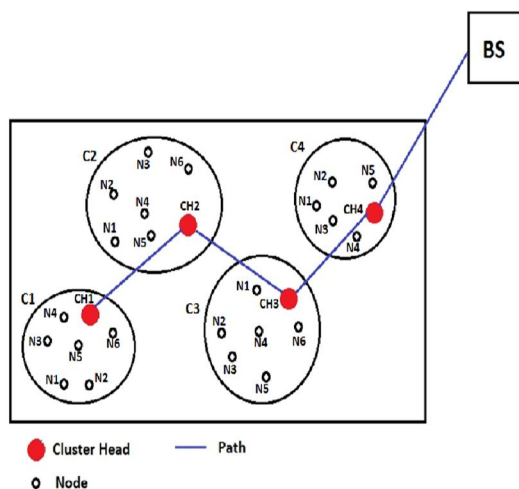


Fig.2 Architecture of P-LEACH

The fig.2 is an example of P-LEACH protocol. The hollow circle represents the nodes and the red spot represents the CH. The line represents the path from nodes to base station. The cluster head communicates with the next cluster head and form a chain to base station. The cluster head having the least distance to the base station is considered as a leader node of the chain. The role of leader node is to collect the data from neighbour nodes and aggregate that data and send to the base station directly.

C. V-LEACH

In LEACH protocol, the cluster contains member nodes and Cluster Head. Suppose the cluster head does not have sufficient energy to transmit the received data to the base station, the cluster head dies. In this case the data of the particular cluster will not reach to BS. To overcome this problem V-LEACH is introduced. It includes CH, a vice-CH. The head cluster node receives the sent data by other nodes of the cluster and transmits it in the form of packet to the base station. The cluster head simultaneously received the data from different nodes. So it lose its energy. Ones cluster head loses its energy, the transmission from cluster head to base station stops. To avoid this condition and to increase the lifetime of network even after when the cluster head is dead, vice cluster head is also selected. The role of vice cluster head is to collect the data from its cluster and then send to another CH i.e vice cluster head in each cluster become cluster head when cluster head dies. So this protocol overcomes the work of selecting the new cluster head every time when the CH dies and the data will reach the base station continually. This will increases the network lifetime and to reduce the energy consumption multi-hop communication is used.

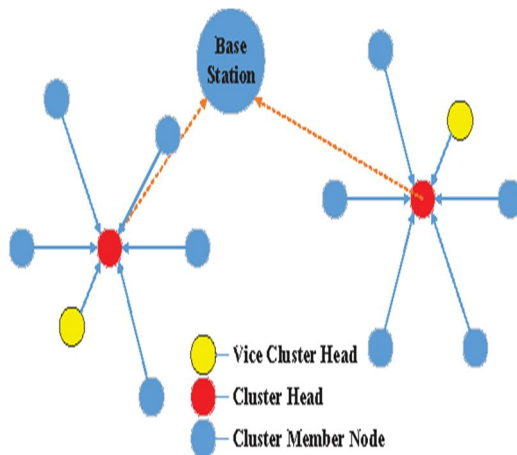


Fig.3 V-LEACH MODEL

IV. DESIGN IMPLEMENTATION

A. Design Implementation Consist Of Four Steps

- 1) Node deployment
- 2) Cluster formation
- 3) Cluster head selection
- 4) Data transmission

B. Node Deployment

Nodes are deployed in the network region. Each node should send hello packets to its neighbour node which are in its communication range to update their topology and neighbours.

C. Cluster Formation

The cluster formation process eventually leads to a two-level hierarchy in grid cells where the CH nodes form the higher level and the cluster-member nodes form the lower level.

D. Cluster Head Selection

CH is selected based on the energy consideration. After the node is selected as CH, it send the advertisement message to the member nodes of its own cluster.

E. Data Transmission

CH nodes aggregate the data (thus decreasing the total number of relayed packets) and transmit them to the base station (BS).The source cluster head node will send the data to the sink through intermediate cluster head.

V. SIMULATION RESULT

Ns2 has been used as simulation platform to evaluate the performance of the new algorithm V-LEACH and compare it with P-LEACH and SCMR protocol.

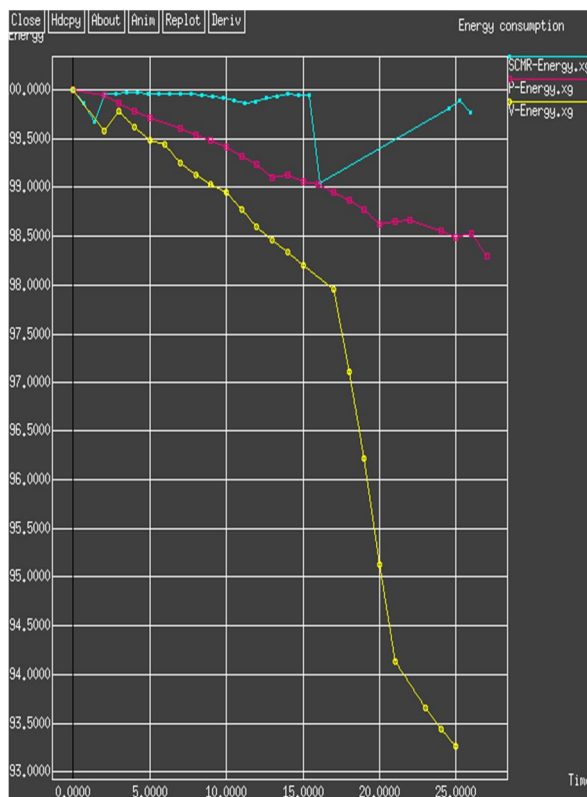


Fig.4 Comparison graph for Energy Consumption

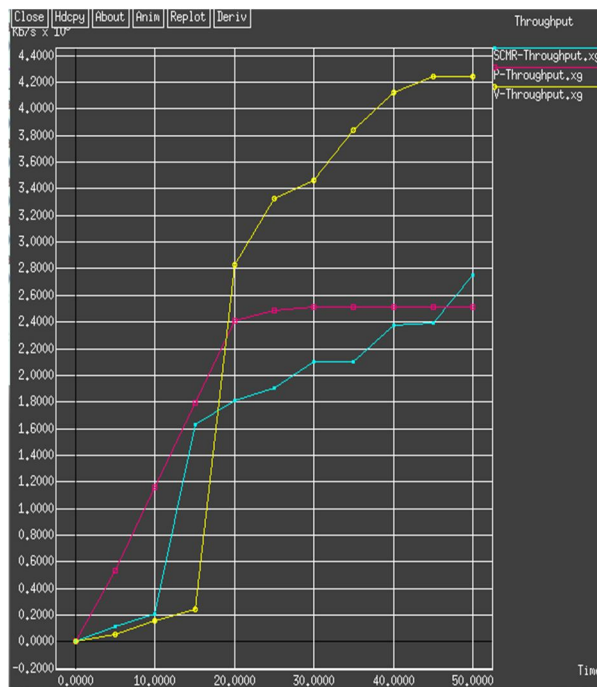


Fig.5 Comparison graph for Throughput

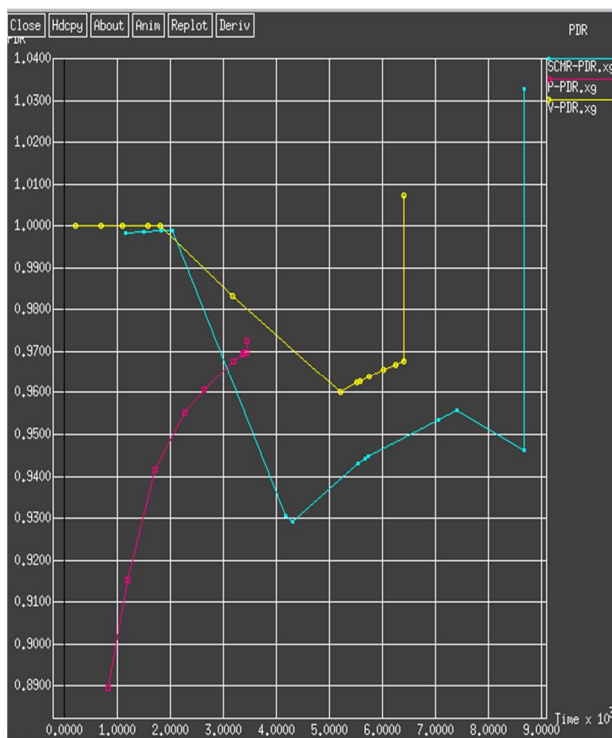


Fig.6 Comparison graph for Packet Delivery Ratio

VI. CONCLUSION

In this paper, we proposed the SCMR, P-LEACH, V-LEACH routing protocol for improving the energy efficiency in wireless sensor networks. The performance of V-LEACH protocol is compared with the P-LEACH and SCMR protocols. With simulation, we observed that V-LEACH is much better than other two protocols in terms of energy efficiency, throughput and packet delivery ratio. Ns2 is used for evaluating the performance of the protocol.



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