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A Delay Hop Efficient Inter Cluster Routing for Wireless Sensor Network

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***Abstract*-Wireless sensor networks consists of low cost sensors, which interact with each other in a wireless manner. These networks has to be designed in such a way that they have maximum lifetime. Energy map gives the information about the amount of available energy in each part of the network and is helpful to increase the duration of the network. The main issue in the family of wireless sensor is Battery consumption which has to be resolved. In order to increase the scalability of the network, and to diminish the energy usage for overall sensor operations, we focus on clustering techniques and data aggregation in this paper and also with the limited resource of WSN the multitier technique is implemented. Main primary cluster head and secondary cluster head (SH) are the prominent entities of this algorithm as they play a vital role in receiving and transmitting the data to the base station. The benefaction of this paper is mainly on the assortment of a secondary cluster head and the routing protocol which routes data to the nearest cluster head for both tier 1 and tier 2 .The operations of the sensor network will eventually increase the endurance of the network compared to LEACH protocol, due to multi-tier clustering in sensor network.**

Keywords: Wireless Sensor networks, primary cluster head, secondary cluster head, multitier.

I. INTRODUCTION

The word "wireless" has embarked an evolutionary change to the communication world. The wireless communication was first started with the radio transceivers and then this was extended to other communication networks such as cellular and broadband Internet networks. Later this was further applied to other different fields of communication. As the technological advancement in the field of micro electro mechanical system (MEMS) took place along with the wireless communications, the use of wireless sensor networks (WSNs) as greatly increased. These wireless sensor networks consists of network nodes as their functional elements. The number of sensor nodes may range from hundreds to thousands in particular networks. The distribution may be done manually or without any particular pattern. These sensor nodes are responsible for sensing the various environmental conditions, defiance surveillance and other critical operations that may be used for preprocessing steps in some field.

The major drawback of WSNs is the stored power consumption. Once these batteries are drained out it is tedious to recharge, hence to minimize the battery usage clustering techniques was developed. LEACH was the very first method that was developed to minimize the battery usage of sensor nodes. In this method, the clustering head is responsible for transmitting the data between the base station and its member nodes and vice versa. This reduced the battery energy of each sensor nodes as the data was not sent directly to the base stations.

We propose a clustering head regression known as Multi tier Algorithm Protocol (MAP) that effectively reduces the power consumption of sensor nodes. This technique involves two clustering head for data aggregation and transmissions along with shortest path routing method between the two destinations.

II.EXISTING SYSTEM

Wireless sensor network(WSN) contains many sensor nodes equipped with sensing, computing and communication devices which are short range over wireless channels. These nodes might be scattered over the large are; for e.g, WSN can do monitoring for some point of interest areas.In such case, the priority goal of WSN is to receive data from the environment and transmit it to sink node. Since the size of the WSN is restricted, challenges for the design and management of WSN would be in the terms of memory, power and communication capacity which are restricted in WSN. Power restriction is the most important of these constraints. These areas are considered in order to improve the logitivity of nodes. The data transmission between nodes are too much expensive in terms of power supply because power supply is the critical resource. Hence, management of data transmission with restriction in power supply place a vital role of WSN protocol design.

III.CURRENT APPROACH

We have a set of routing algorithms which forms the network in such a way that it takes a group of nodes and forma a cluster and also such a network now requires two kinds of detections and sending to base station i.e Inter zone communication and Intra zone communication. In Inter Zone Communication the communication is between nodes and base station within the same zone. In Intra zone communication the communication happens between zones. For Inter Zone communication only the nodes within the zone communicate directly with each other whereas for the Intra Zone communication there is a special node which comes into picture known as cluster head which is responsible for communication between a given zone to the other zone in the network. In the current approach of algorithm an intelligent and novel approach is

chosen in which rather than having one cluster head we have two cluster heads so if one cluster head energy becomes less than the second cluster head can be chosen for communication. More ever even there are two nodes one is a relay node and it shares its data with back up node if its energy is less. Hence the proposed algorithm reduces the energy as well as the round trip time required for the communication.

IV.LITERATURE SURVEY

LEACH (Low Energy Adaptive Clustering Hierarchy) is one of popular cluster-based structures, which has been widely proposed in wireless sensor networks. LEACH uses a TDMA based MAC protocol. The idea is to form cluster of sensor nodes based on signal strength and use the cluster-head as a router to forward data of other nodes in cluster to the base station. The data processing is performed at cluster-heads. LEACH is a dynamic clustering mechanism. In this paper we analyzed the literature of LEACH related protocols using different platform like NS2, OMNET++ and then in different sections just briefing about those papers.

CAT: The New Clustering Algorithm Based On Two-Tier Network Topology For Energy Balancing In Wireless Sensor Networks [1]:

Energy balancing is essential for enhancing the network lifetime in wireless sensor network since the energy constraints is important restrictions. Hence there are many algorithms to balance the energy consumption in WSN. In this paper, a new clustering algorithm proposed on two tier network topology called CAT. CAT selects best sensor node as a cluster head. Thus simulation result shows that CAT prolongs the network lifetime by 49% and 19% compared to LEEACH.

Energy-Efficient Communication Protocol For Wireless Micro sensor Networks [2]:

This paper gives an overview of communication protocol that have significant impact on energy dissipation in WSN. LEEACH uses local cluster base station to distribute the information among the sensors in the network. Simulation shows that LEEACH can achieve better utilization compared with other routing protocols.

Energy-Efficient Data aggregation Hierarchy For wireless Sensor Networks [3]:

In WSN sensors are equipped with small batteries, so the amount of energy consumed is minimized by the appropriate number of aggregators. This paper presents energy efficient protocol for aggregator selection (EPAS) and hEPAS.

Energy-Efficient Data aggregation Hierarchy For wireless Sensor Networks [4]:

Wireless sensor network portioned into clusters to obtain efficient information. If the location of the base station is not considered in the clustering algorithm in hotspot problem in multihop WSN. With the consideration of the base station location in unequal solves this problem. This paper introduces a Fuzzy unequal clustering algorithm that aims to prolong lifetime of WSN. Simulation results show EAUCF is energy efficient clustering algorithm in real time WSN accusation.

Energy-Efficient Clustering In Sensor Networks Using Cluster Manager [5]:

To route the information from a sensor node to the remote BS in WSN, there are various techniques are available. The problem with this techniques are prolonging the life of the sensor node.This paper presents energy efficient clustering technique foe large scale sensor networks.The goal of energy efficient clustering algorithm for an efficient cluster head selection by using a cluster manager is to minimize transmission costs and energy usage.

V.PROPOSED METHODOLOGY:

Due to evolutionary developments in the micro electromechanical systems (MEMS), the application of WSNs has notably increased. These WSN contains large number of network sensor that are scattered all over the area. The introduction of the sensors over a large zone can be accomplished by either manually or without any definite pattern. These network sensors are widely used in the field of monitoring the environmental conditions, defense operations, tracking the targets and many more.For these applications there is a requirement of large power consumption which needs to be optimized and also the reliability of the network elements must be maintained.

The conventional process uses LEACH algorithm that transmits using single cluster head which is responsible for processing and data transmission, depending upon the distance between the source and the destination the number of hops are decided. Predominantly the number of hops will be more in the conventional technique, as a result it uses large amount of power as and when the data are transferred over the network. As a solution for the disadvantage encountered in the conventional method we use Multi tier algorithm protocol (MAP).

In this paper we described a new clustering head regression namely MAP, as the name indicates this protocol involves two tier network structures. The protocol employs two clustering head namely primary cluster head and secondary cluster head. The primary cluster head is elected based on the value of Kopt, which is responsible:

1. For data transmission within its cluster boundary.
2. For transferring data from member nodes to the base station and vice versa.

Whereas the secondary cluster head is responsible for the reception of data from its member nodes, processing and transmission of data to the respective primary cluster head at the tier one.

Following are the assumptions for MAP:

Assumption 1:The sensor nodes are equally scattered within tier one and tier two

Assumption 2:The nodes are immobile.

Assumption 3: The energy distributed among all nodes is initially assumed to be same.

Assumption 4:The Base station is concentric of the zone.
The MAP involves node distribution and Kopt algorithm:
I. The node distribution algorithm is used for the distribution of wireless sensor nodes into tier one and tier two based on the following:

Area of boundary (A) =$(2r)^2$ (1).

Area of tier one (T1) = r^2 (2)

Area of tier two (T2) = A – T1 = $3r^2$ (3)

From 3 we can infer that the number of nodes scattered in tier two is thrice the quantity of tier one and the base is concentric.
II. The Kopt algorithm is used to identify the primary and the secondary cluster head based on the output level as per the below mentioned formula,

$$Kopt = \frac{\sqrt{M}}{\sqrt{2\pi}}\sqrt{\frac{\xi_{ab}}{\xi_{cd}}}\frac{X}{d_{avg}}$$

$Kopt$:optimal no. of cluster,
M:no. of nodes fairly distributed in a region N×N,
$\xi_{ab}\, d^2$:amplifier energy,
$\xi_{cd}\, d^4$: amplifier energy of multi path transmission,
d_{avg} : average distance between base station and nodes,
After identification of PCH and SCH the nodes at the vicinity will combine and form the cluster based on the Euclidean formula.Finally each node will have its own clusters and each one will be assigned with a cluster head.This cluster head will be responsible for transmission of data from other nodes and the base station. For normal tier one transmission, the transmission node will transmit the data to its cluster head,which in turn pass the data to the PCH and finally the BS receives the data from the PCH. For tier two transmission, the transmission node will transmit the data to SCH within their cluster, which in turn will process the data by aggregating and compressing. Now the SCH will forwards the compressed data to the nearest PCH and the process continues until the next selection of the cluster head.

VI.RESULTS AND DISCUSSION:

The implementation was with the help of MATLAB programing. During implementation, the number of nodes considered are 20 and the iteration carried out with 25 iterations. Number of hops, Energy consumed, Number of dead nodes and the number of alive nodes are the parameters used in this experiment.

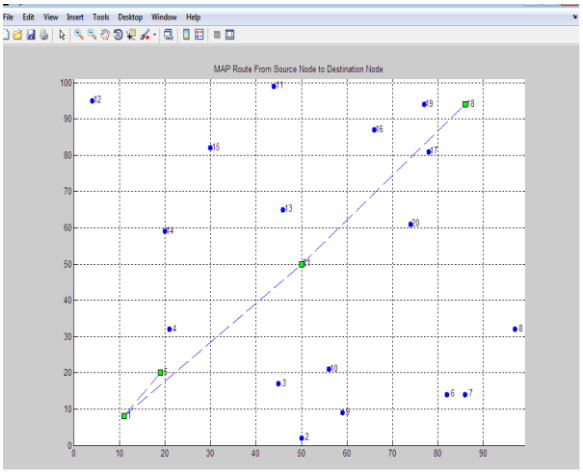

Fig. 1. Routing from source node to destination node

Fig. 1, shows data transmission from source node to PCH and from PCH to destination node between different clusters.

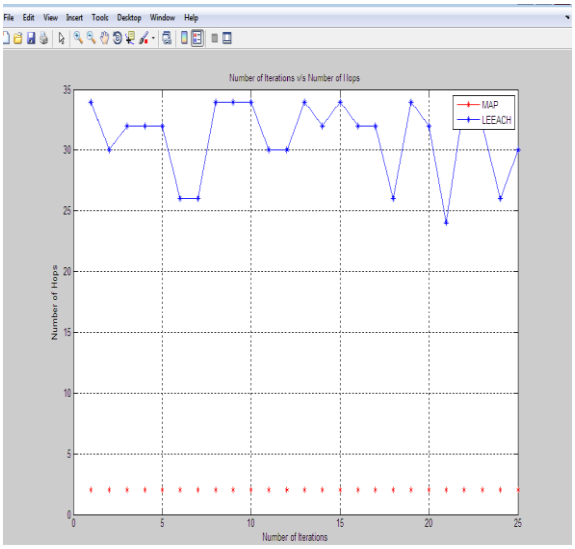

Fig. 2 Number of hops during 25 iterations

Fig. 2 shows the number of hops during the 25 iteration .The number of hops taken in MAP is just 2 in the 25 iterationsbut the number of hops taken in LEACH is 30.

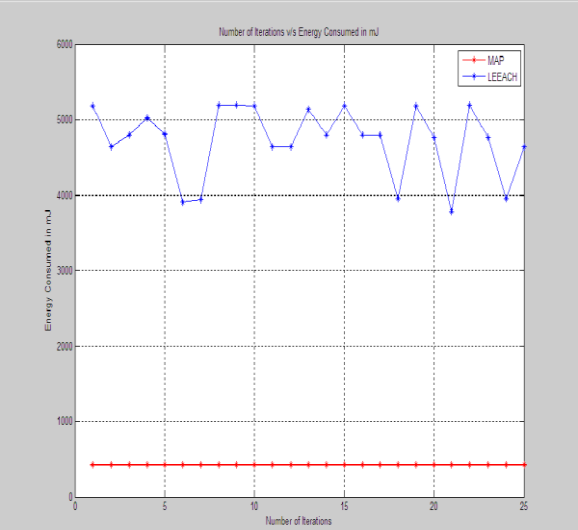

Fig. 3 Energy consumed by the nodes during 25 iterations.

In the data transmission, energy usage is the important parameter that need to be considered. The Fig. 3 shows that the energy used by the nodes during the MAP implementation is less then that of LEACH.

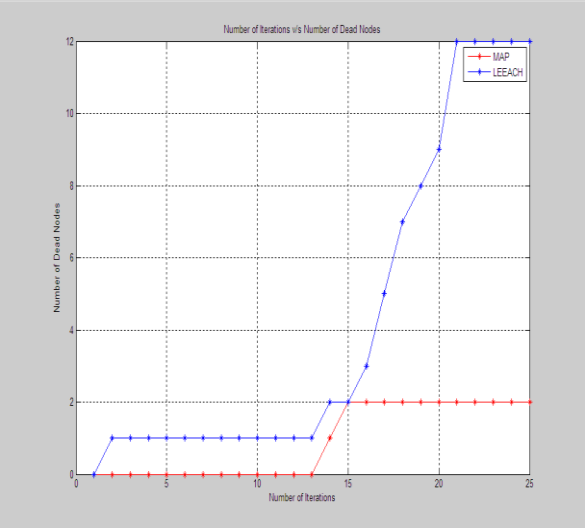

Fig. 4 Number of dead nodes during 25 iterations.

Fig. 3 show the dead nodes for MAP during 25 iterations. We can see that only 2 nodes are dead in MAP in the 25 iteration meanwhile the number of nodes that are dead in the LEACH is almost 12 which quite higher as compared to MAP.

VII.CONCLUSION

Clustering plays vital role in wireless sensor network in order to extend network lifetime. Selections of cluster head also plays important role in extending the network life time. In this experiments, selection of cluster head based on fuzzy logic occurs on secondary cluster head(SCH). Compare to LEACH, We can find 18 alive nodes in 25 iterations of MAP. This convinced that MAP extends lifetime duration of sensor network

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