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ENERGY-EFFICIENT LIFETIME MAXIMIZATION CLUSTERING APPROACH FOR WIRELESS SENSOR NETWORKS FOR AN IOT APPLICATION

Dr.Rahul Pethe
Electronics and Telecommunication Engineering, S.B. Jain Institute of Technology, Management and Research, Nagpur, India, rahul2480@gmail.com

Namrata Mahakalkar
Computer Science and Engineering, Priyadarshinin College of Engineering, Nagpur, India
namratamahakalkar@gmail.com

Dr.Anamika Kumari
Assistant Professor, Dr. D. Y. Patil College Computer and Studies, Pune
Anakumari75@gmail.com

Abstract— WSNs are autonomous sensors that are distributed spatially than can supervise conditions that can be physical or environmental, such as temperature, sound, pressure, etc., and to transfer their data to a main location cooperatively through the network. Events are detected by Nodes and then sent to the Base Station(BS) relevant data. Replacing batteries quite often in remote locations is not feasible. Using the clustering approach, the energy consumption of such networks is minimized. One of the important methods to extend the life of the network in wireless sensor networks (WSNs) is clustering. For all the clusters, it involves grouping sensor nodes into clusters and choosing cluster heads (CHs). Cluster heads are subject to excessive battery drain in those near the BS. In this paper, therefore, approaches are discussed for increasing energy efficiency and network lifetime.
Keywords: "Sensor, Energy efficiency, routing, clustering, lifetime, wireless sensor network"

I. INTRODUCTION

Wireless sensor networks are used to monitor the different issues related to environment has advantage of imposing no constraints due to cabling for data transmission. Wireless sensor network in mesh combines multiple transceivers to cooperatively transmit and released their data so as to increase the area of communication. The wireless sensor network which is the only area which will response for the above characteristics which can be utilized for faithful monitoring of environment for large area. Hence it requires multiple wireless sensor nodes.

The researchers from environmental study take the advantage of WSN for monitoring Agriculture irrigation [1], environmental pollution [2],monitoring structural health[3] wireless mesh networking of wireless sensor network is a key feature off zigBee protocol[4].an open source wireless mesh networking module for environmental monitoring[5]. The design which is supporting the wireless mesh network which is based on IEEE802.15.4 slandered [6]. Planning of energy efficient clustering for wireless sensor network[7]. Therefore some researcher can irrigate an off the shelf ZigBee module that is XBee design[8].many researcher work on environmental application and communication range but some problem are remains

unsolved that is the lifetime of the wireless sensor node and energy which is unused during the searching of incident. Hence network design, head selection and routing will play an important role to improve the life time of mesh network.

Because of its potentially large application area, the WSN is rising as a main research subject. The WSN consists of nodes, from a few hundred to even thousands, in which each node is constructed. It has one (or sometimes several) sensors connected to it. Every node has restricted capabilities but a useful network catering to disaster applications can be created collectively. Management, detection of forest fires, tracking of vehicles, habitat monitoring, etc. Deployments in real life are mostly done with 30-40 nodes due to scalability, energy, and energy issues. Conservation, reliability [1] In order to deal with issues such as network lifetime and energy, clustering over a distributed method is progressing. "Communication connectivity" in a clustered WSN, various nodes are shown in Figure 1. There is one or more Cluster Heads (CHs) in every cluster. Near a sink node, sensor nodes suffer from the heavy traffic load imposed on them and their energy is strongly depleted. The energy hole problem is called this phenomenon. One way of reducing energy depletion is by aggregating data. To solve many problems such as scalability, energy and lifetime problems of sensor networks, clustering into sensor nodes is very important [2].

The objective of this algorithm for clustering is to partition the network into several clusters. The benefits of an algorithm for clustering are:

• "reducing routing table size,
• reducing the redundancy of exchanged messages,
• reducing the energy consumption, and
• extending the networks lifetime."

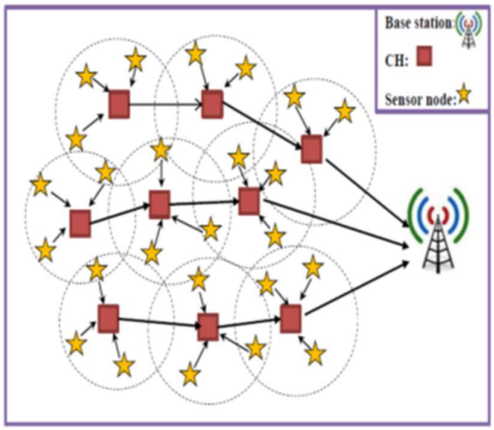

Fig 1: A clustered WSN

II. RELATED WORK

To Achieving some useful objective the IoT devices are integrated with some of processing, sensing and networking capabilities.[3] The IoT devices are establish connection to the other devices to transmit information using an intertransverse protocol. In IoT, devices consist

Bluetooth, WLAN (Wireless LAN), Different types of sensors, RFID (Radio Frequency Identification), GPS (Global Positioning System), infrared etc. [4]. To capture more amount of data from different areas, we need this type of connectivity. IoT is a intermediate between device, sensors and the data networks. Issue in IoT devices is interoperability among communication devices and services. The communication devices should be flexible in adopting the situation in carrying information with less human involvement [5]. A wireless Sensors Network (WSN) consists of many sensors which consume low power and multi-functional operating in an unreachable environment, and having capabilities of sensing, computation and Communication. CPU (Central Processing Unit), ADC (Analog to Digital Converter), sensor unit, power unit and a communication unit are the basic component of a nodes.[6] By the recent advance in MSME is Micro Electro Mechanical Systems technology. MSME ramping up of sensors has been made potential. A unit of processing, limited memory, battery inform source of information about the limited computational and sensors are the components of sensor nodes. WSN is used to gathering data with the help sensor nodes. Sensor nodes are MEMS (micro–electro–mechanical systems). [7] Physical condition like environmental temperature and environmental pressure in measurable by MEMS. Physical data measure by using sensor nodes to be monitored. The sensors sensed analog signal and analog-to-digital converter digitized signal sent to controller for further use. Size of sensor node are very small, extremely low energy consumed, operated in high volume density and can be adaptive and autonomous to the environment. Sensor nodes(SN) is low power device consists by WSN. Sensor nodes are divided over the area to be measure the atmospheric variations. SN communicate with each other and form a network.One or more number of SNs among network will act as the sink that will bring the direct communication with users. Sensor is the important component of WSN that helps to collect the environmental conditions in different areas. Data processing, communication, leveraging the network with more SNs are the important functionalities of SN.

A wireless sensor network (WSN) consists of large number of low powers, low cost, and tiny communication devices, called sensors. Like nodes (i.e., computers, laptops, etc.) in traditional wireless networks such as mobile ad hoc networks, sensors have energy, storage, processing, and communication capabilities. Also, sensors have a sensing capability by which they sense phenomena and perform in-network processing on the sensed data before sending their results to a central gathering node, called the sink. WSNs can be used in a variety of monitoring, control, and surveillance applications [22].

Particularly, the sensors possess several scarce resources, with battery power (or energy) being the most critical one. One way to extend the lifetime of a WSN is through load balancing so that all the sensors deplete their energy as slowly and uniformly as possible. Also, the behavior of the sink has an impact on the network lifetime. Indeed, sensors in the proximity of a static sink act as the traffic hot spots and have significantly reduced lifetime than all other sensors in the network. Those sensors nearer a static sink would suffer from a severe depletion of their battery power, which may result in possible network disconnection and disruption of the data from reaching the sink.

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In Internet of Thing (IoT) are mainly communicating from source to target devices which helps to process, store and analysis the information. Efficient protocols must support for data communication between the low energy consumption devices.[9]

III. ISSUES IN PREVIOUS WORK

We have investigated various clustering algorithms. and Find that certain energy-efficient algorithms improve network existence and consume routing energy as well While every attempt is made to include a full and reliable state-of-the-art survey of energy-efficient clustering algorithms with LEACH and its advanced protocol, as relevant to WSNs. Some applicable algorithms for homogeneous WSNs. Bad performance (due to the problem of link breakage) when the nodes are mobile. On the base station, more overhead, so it's not suitable for large networks. On the base station, more overhead, so it's not suitable for large networks. Decreased level of energy. Sometimes, loss of data, such as when some CH hop dies. Inefficient consumption of energy. Inefficient data rate of delivery. Packet Loss when CH moves. It increases the use of energy, particularly when transmitting data to the base station. Provides the base station with increased overhead.

Fig 2, Fig 3, Table 1. Represents the correlative work of every considered algos with regard to various cluster parameters

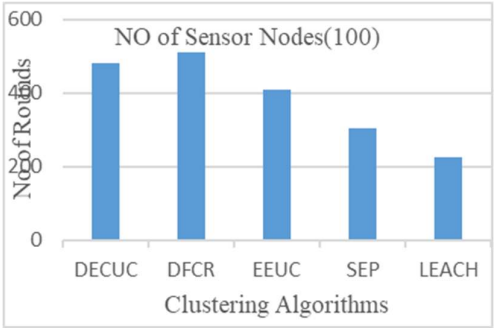

Fig 2: No of alive nodes per round

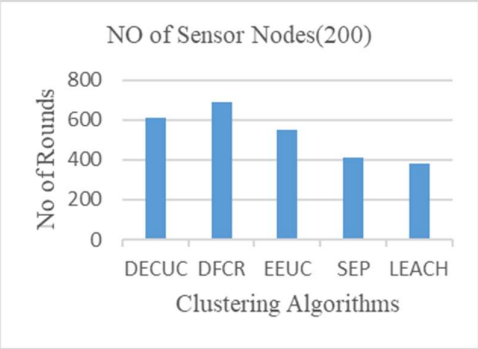

Fig 3: No of alive nodes per round

IV. PROPOSED WORK

Algorithm tends to balance energy in a cluster through energy efficient reliable cluster head selection. The objective of proposed algorithm is to improve the cluster head selection mechanism of protocol. The operation of proposed protocol is divided into rounds. Each round consists of a setup phase and steady -state phase. In setup phase, coordinator node selects the cluster head for each cluster. In steady -state phase, sensor nodes sense the environment and transmit the sensed data to the corresponding CH for further onward transmission to the CN& BS.

SETUP PHASE

It is assumed that clusters are already formed in setup phase and coordinator node is aware of the cluster formation and information. An algorithm for cluster head selection consists of following steps:

Step-I: The CN set the value of k for the current round for each cluster based on density of nodes in a cluster. It broadcast the value of k to each corresponding cluster i.e. k i. The value of k determines the k number of nearest neighbor nodes.

Step-II: All the sensor nodes send their k number of nearest neighbors (based on distance) to the CN. The distance to the node can be calculated based on received signal strength indicator (RSSI).

Step-III: The coordinator node select candidate set of cluster heads i.e. C i for each cluster through K-theorem. The value of ki is always equal to the number of candidate cluster heads in a cluster i.e. C i.

Step-IV: The CN request candidate set of cluster heads in each cluster to send their combined rating (CR).

Step-V: Each candidate cluster head node calculate it's own CR based on residual energy (RE), distance to coordinator node, node reliability (R) and degree of mobility (M) and send it to CN.

Step-VI: The coordinator node selects a node as cluster head among candidate set of cluster heads for each cluster based on CR. The higher the CR a node has; greater the chances of being cluster head. The CN confirms each cluster about their CH. After the CH selection, routing paths are established that is beyond the scope of this research except our research prefers multihop routing. Each CH creates a TDMA (Time Division Multiple Access) schedule for

intra –cluster communication. In TDMA, one -time slot is reserved for each cluster member to send or receive its data to/from the CH.

STEADY PHASE

In steady phase, each sensor node wake up in its allo cated time slot and send or receive data to/from the CH. The corresponding CH aggregates the collected data from its cluster and forwards it to the CN. The CN may apply some compression algorithm on received data from all the CHs and transmit it to the bas e station either directly or through multihop transmission. At the end of each round, each CH check its residual energy and energy dissipated in previous round. The decision for reselection of cluster head is based on residual energy and energy dissipated by the cluster head in previous round. If the residual energy is twice the energy dissipated in previous round, the CH would continue for the next round. On the other hand if residual energy is twice the energy dissipated in previous round and there are significant number of nodes alive in a cluster (may be equal to value of k i). It would consult to CN for CH reselection. A node can only serve as CH twice consecutively. The purpose is to avoid CH reselection after each round because the process itself requires significant amount of energy. The nodes can exchange network setup and maintenance messages instead setup phase (if there is no need to reselect cluster head). Information about topological changes (due to dead nodes or node mobility) can be exchange during this phase [43].

This research study plan is to evaluate performances of different existing or new algorithms. NS2 can be used as a simulation environment. AODV protocol would be implementing and analyze for the comparison. Fedora being chosen for implementation, providing stable and robust platforms. NS2 being used for Network Simulation using scripting & Gnuplot for plotting of graphs. NamFile would be showing Communication Process of WSN Network indicating Communication between the nodes. Process finds QoS Parameter Delay, Jitter, Throughput, Energy and ratio of Packet Delivery. Share of Bandwidth by application network i.e. Throughput is calculated. Bandwidth being the available network path for a particular Communication would be shown. Time required by a packet to reach from source to destination, if packet is delayed then computation of average delay would be carried out in the implementation process. The process defines the number of data packets delivered giving the Packet Delivery Ratio. The implementation part will be showing the packets too that are dropped in other links.

By forming a wireless sensor network, a good monitoring system can be developed. Three to four routing protocols would be compared on different performance parameters at different number of nodes and at different distances. Performance analysis and lifetime improvisation of WMN would be done application wise

V. SIMULATION RESULTS

In the presented work, we have considered 49 nodes. The simulation is performed by using NS2 for the evaluation of the performance of algorithms. In NS2 AODV protocol are available in the default installation and the require necessary improvements as well as modifications are implemented to make it as the our proposed AODV_HPR protocol. Hence the les (source code) of the wireless physical layer and AODV routing agent will going to formulate for the further applications of AODV_HPR.We are going to consider the above parameters in the ad hoc wireless network with the AODV HPR protocol. The following metrics has been selected

in order to evaluate the effect of AODV HPR protocol for reducing the routing overhead and less energy consumption. MobileSink in order to improve the lifetime of the sensor network and reduce the congestion

Table 2: Simulation Parameters for the presented work

Parameter	Value
Terrain Size	1200-1100 sq.m.
Simulation Time	30000 msec
Number of Nodes	49
Node Placement	Uniform
Transmission Range	280 m
Bandwidth	2 MHz
Propogation Model	Two Ray Ground
Minimum Speed	0 sec
Maximum Speed	0,10,20,30
MAC Protocol	802.11
Network Protocol	IP
Routing Protocol	AODV, AODV HPR
Transport Protocol	TCP
Application	CBR

The simulation environment which contains total 49 nodes. It will evaluate the result for average energy consumption, packet drop, packet Delivery ratio, throughput.

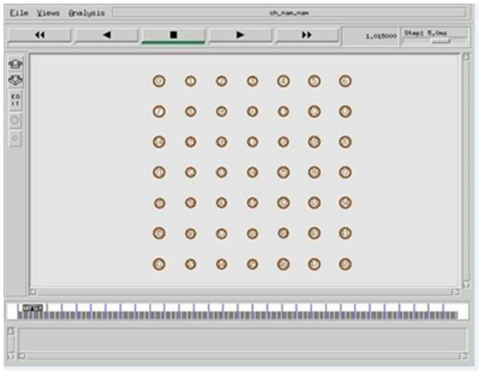

Figure 4: Simulation Scenario in NS 2

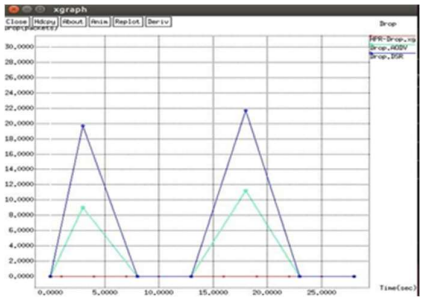

Figure 5: Graph of Time Vs Packet Drop

Figure 6: Graph of Time Vs Packets Delivered Successfully

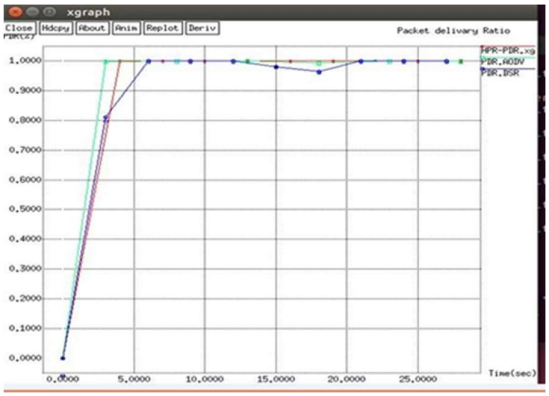

Figure 7: Graph of Time Vs Packets Delivery Ratio

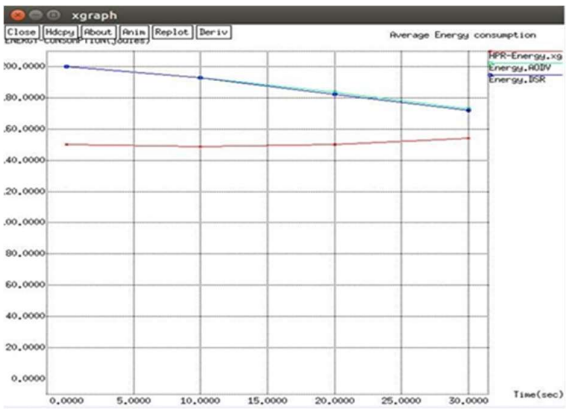

Figure 8: Graph of Time Vs Average Energy Consumption

VI. CONCLUSION

The above-mentioned clustering approaches fused with multi-hop routing in energy inhibited WSN possess remarkably decreased the use of energy. However, the network lifetime of such protocols is deteriorating due to the hotspot problem. The reshaping of the perspective of unequal clustering showed a significant refinement in network life. The multifaceted procedure of the fuzzy logic construct has shown the significance of numerous frameworks such as node degree, density, cluster formation energy and cluster range estimation. Considering various clustering parameters, all the algorithms discussed are explored and a simulated inspection is

still carried out for few selected ones. A routing protocol approach combined with a clustering protocol for a network to be energy efficient for QoS is suggested by the ongoing proposed work. Proposed model for AODV-HPR performance much more improved with the parameters e.g. throughput, packet delivery ratio, energy consumption, packet drop by identifying particular nodes say HPR node. These nodes will improve the performance of existing AODV protocol. HPR node will get involved in the process of routing and remaining nodes will receives the packets. And it will not allow processing that kind of request which is acting as simple neighboring nodes. Hence we conclude the consumption of energy by the nodes in AODV-HPR protocol is less in comparison with AODV and DSR; this is very much important factor which will affect the performance of the network. By using AODV-HPR protocol lifetime and performance of network is improved. Thus, we conclude that wireless network with AODV HPR protocol is capable of reducing routing overhead and consumption of energy is less in the designed network. Hence lifetime of the network will be increased.

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Table 1: COMPARISON OF DIFFERENT CLUSTERING AND ROUTING ALGORITHM

Protocol	Cluster properties						
	Distributed/ Centralized	CH selection	Unequal cluster size	Intra-cluster single hop	Inter-cluster multi-hop	Coverage aware	Fault tolerant
LEACH [3]	Distributed	Random	N	Y	N	N	N
SEP [4]	Distributed	Hybrid	N	N	Y	N	N
EDUC [5]	Distributed	Random	Y	Y	Y	N	N
EEUC [6]	Distributed	Hybrid	Y	Y	Y	N	N
ERA [7]	Distributed	Weight	N	Y	Y	N	N
DFCR [8]	Distributed	Fuzzy	Y	Y	Y	N	N
DECUC[9]	Distributed	Fuzzy	Y	Y	Y	Y	N