A Research on Energy Efficient Cluster Routing for the Wireless Sensor Networks

Ch. Rambabu, V.V.K.D.V. Prasad, K. Satya Prasad

Abstract—Clustering with energy efficient routing is the most important technique for the wireless sensor networks. Cluster converts group of sensor nodes into small clusters and electing the cluster heads with energy efficient cluster routing for all the clusters in the Wireless sensor networks. By selecting the proper energy efficient cluster routing algorithm we can increase the life time of the wireless sensor networks. Lot of techniques are used for energy efficient cluster routing for Wireless sensor networks like Particle Swarm Optimization, Artificial Bees Colony Optimization, Crow Search Algorithm, Energy-efficient Intra-cluster Routing (EIR) algorithm and Dolphin Echolocation Algorithm (DEA). In this paper we have given the comparative analysis report of energy efficient cluster routing algorithms for the wireless sensor networks in terms of energy efficiency and sensor node lifetime of the networks.

Index Terms: Cluster, Cluster head, DEA, EIR, ABCO

I. INTRODUCTION

Compilation of Sensor nodes which are made up of hefty numbers of minute MEMS (Micro Electro Mechanical Systems) diffused over a lonesome topographical are called Wireless Sensor Networks. These networks are proficient for competent storage, processing the communication that is limited and sending communication with the help of radio channels to short distances. Regarding with connectivity as wireless networks, WSN and ad hoc networks are equivalent but, WSN are vigorously shared among the nodes and has connection with the base station directly. Peculiarity of WSNs is ease of usage, scalability in nature, resilience, energy harvesting nature and homogeneity, heterogeneity nature of nodes. In 1950's first generation of WSN is introduced by the military department of U.S in the category of surveillance in the sound system helpful for detecting and tracking of submarines. Then in 1960's-70's DARPA initialized distributed sensor networks which in 1980'S replaced as wireless sensor networks reducing the disadvantages raised in the evolution of distributed sensor networks.

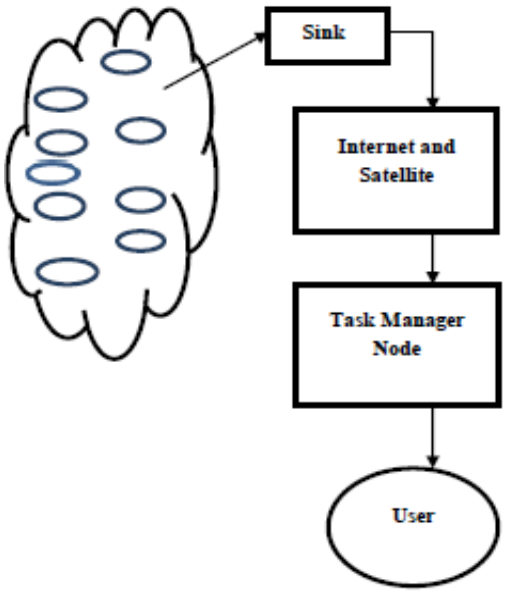

Fig 1: Wireless Sensor Network

In between the network and the users, base station or sink performs like a coalition. These networks contains numerous nodes which the nodes itself contains various chunks like a microcontroller, battery, radio transceiver embedded with and antenna internally. From a simple star network to precocious multi-hop mesh network which is wireless, WSN differs with respect to the cartography. Flooding or routing can be cogitated as the propagation technique betwixt the network hops. Environmental predicaments like temperature, pressure, sound are being audited by these wireless networks. Confiding with the environment, these networks perform according to the requirement whether must be in under water, air or land. Keeping in view all the requirements, these networks are classified into 5 modules they are underwater WSN, underground WSN, terrestrial WSN, multimedia and mobile WSN. Each module has its own peculiarity comparable to others.

Revised Manuscript Received on April 12, 2019.

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As the coin has head and tail, in the same format every technique contains pros and cons. The curbs of these WSN's are bridles protocols, deals with only very less range of communication, devours excessive power, confined life time having batteries, only few hundred kilobytes of storage capacity is accessible, Some amount of energy is required and produced by the passive devices. WSN have several applications including each and every sectors of military, industry, entertainment, ecosystem, transportation and health care monitoring applications. These network devices can be rigged with actuators to exploit upon every particular condition.

Enemy intrusion is the best military application done by the wireless sensor networks. Oil or gas pipelines containing geo-fencing comes under the civilian purpose application. Dealing with the health monitored application, wearable, implanted and environment-imbedded applications are developed.

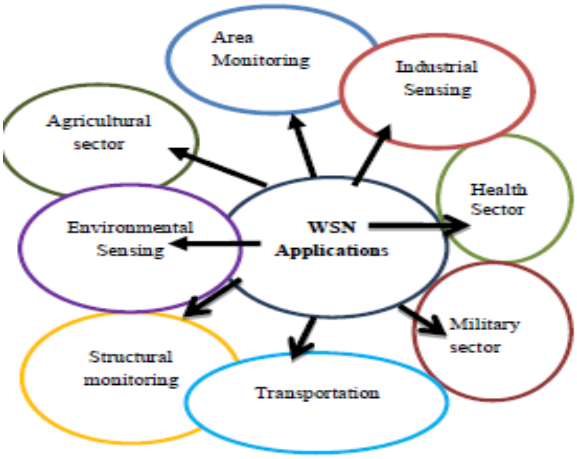

Fig 2: Applications of WSN

II. ENERGY EFFICIENT CLUSTER ROUTING OF WSN

Increasing the lifetime capability of networks one of the decisive methodologies introduced is clustering which implicates factions the nodes of sensors as clusters thereby selecting them as cluster heads. For some strategic or random methods sensor nodes are disbursed within a region by the wireless sensor networks. Decreased traffic of the network, scalability and robustness are enacted by the sensor nodes that are clustered by the applications of sensors. There are 5 types of Energy Efficient Cluster Routing techniques for wireless sensor networks and they are shown as follows:

2.1 Energy Efficient Intra-Cluster Routing Algorithm

It is a type of cluster head technique involved in the WSN which is segregated into 3 sub-parts like optimal distance calculation, exclusive sojourn position of MS and optimal sojourn position of MS (mobile sink). In the first part minimum residual energy of mobile node is produced which is nothing but a node which is taken as reference in the cluster which is defined as critical node. Finally between mobile sink and mobile node optimal distance is computed such that the consumption of energy among mobile node and mobile sink is evened. Then in exclusive sojourn position for mobile sink, for every mobile node sojourn locations are produced with respect to the mobile sink. Lastly in optimal sojourn position of mobile sink, optimal sojourn positions are obtained for mobile sink.

2.2 Particle Swarm Optimization

In this algorithm, results replicates like a particle or a bird. Elucidation generally contains an array, where the length of this output equals to the network containing the total cipher of sensor nodes. Particle position is mended considering three particulars they are particle prevailing position, betwixt of all the particles culminating position of all particles and particle position which is not veteran till now.

2.3 Artificial Bee Colony Algorithm

It is a kind of approach which optimizes the numerical problems by caricaturizing the honey bee demeanor. Its working is similar to that of the honey bee structure which similarly forms a colony containing bees of three types they are employed bees, scouts and on-lookers. First of all employed bees search for food resources i.e., for the best minimum and maximum limits of position. Once the position is identified by the employed bees, assuming all the bees having similar maximum and minimum positions fitness is calculated. This information from employed bees is generated to on-looker bees then probability is measured with the positions. If these are not efficient then the scout bees immediately produces unique vectors and the process goes on continuing till the best required result is obtained.

2.4 Dolphin Echolocation Algorithm

Identifying or locating invisible objects and also asunder objects for efficient communication is generally defined as echolocation. This entire identification is done by the dolphins in this algorithm by sending echoes when striking the obstacle or the target and this happens only when the complete searching is completed by the dolphin. Benefit with this approach is, it is more efficient and flexible.

2.5 Crow Search Algorithm

It is a kind of algorithm which is meta-heuristic meaning user friendly and also implementation is easy. In the name itself says crow, means the comportment of this algorithm resembles the demeanor of crow that stays in the flocks for its memory power in handling the food, and preventing themselves from larceny of food. In the same manner this algorithm performs fantastic memory power regarding the previous iterations and preserves caches with the help of probability.

III. COMPARATIVE ANALYSIS

Optimal excerpt of cluster heads are indulged by the particle swarm optimization algorithm, among the sporadic distribution of cluster heads heading towards the best outputs. Energy obsessed by this algorithm 0.5 J with 4000 bits of packet size and the required nodes as cluster head are 100. Search space distance from object to the target is ebbed by the dolphin echolocation algorithm. Power loss

accomplished by this algorithm is 4.3495 which is not admirable technique for cluster head. Also we have reviewed crow search algorithm which also has power loss of 50 HP with 53A current and 100HZ frequency.

In this paper we have primarily reviewed on three algorithms they are, Energy Efficient Intra-Cluster Routing Algorithm, Dolphin Echolocation Algorithm, Crow Search Algorithm. These algorithms are compared with Artificial Bee Colony Algorithm. To compare one with another model we consider two criteria called energy conservation and number of active nodes i.e.., life time of the algorithm. Algorithm having less consumption of energy and having excess number active nodes is considered as the outstanding algorithm. Energy diminution of our proposed model is very less when collated with the other three algorithms and also has nearly 50 active nodes of cluster heads which is very huge when analyzed with the other algorithms.

IV. SIMULATION RESULTS

For Experiment conduction we are using NS2 simulator with Simulation Parameters includes

Parameters	Type
Radio-propagation	Propagation
MAC	Mac 802_11
Network interface	WirelessPhy
Antenna	OmniAntenna
Packet Size	512
Rate	250kb
Initial Energy	15.1 J
X axis	1000
Y axis	60
Number of Nodes	100
Simulation Time	50

Table 1: Simulation parameters

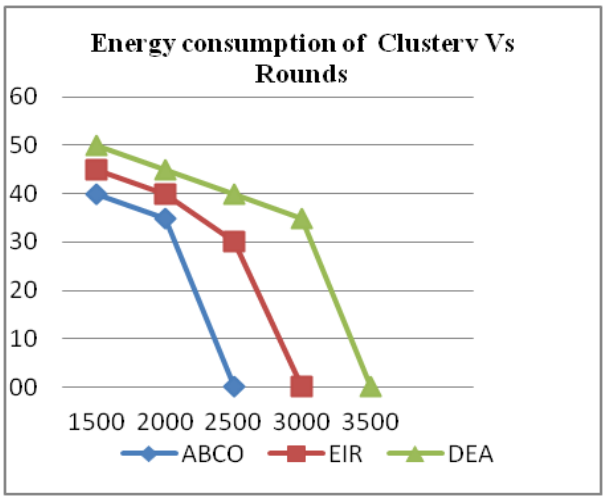

Figure 3. Energy of Cluster Vs Rounds

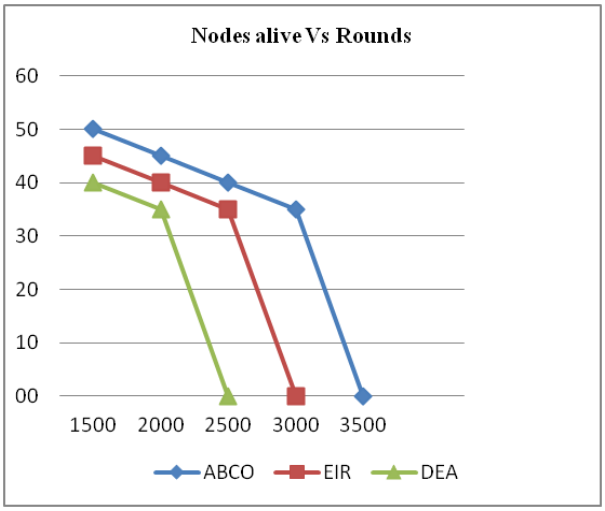

Figure 4. No of active member nodes Vs Rounds

V. CONCLUSION

Wireless Sensor Networks are widely used in the communication which undergoes several applications inbuilt with several cluster techniques which is the back bone of wireless sensor networks, with power limitations and less number of active nodes. So to enhance the lifetime of active nodes and to diminish conservation of energy, suitable clustering head technique must be chosen. Till now several techniques were introduced and they are Energy Efficient Intra-Cluster Routing Algorithm, Particle Swarm Optimization, Dolphin Echolocation Algorithm, Crow Search Algorithm and Artificial Bee Colony Algorithm. We have taken some results with respect to energy and lifetime for three algorithms and compared them with each and came to a conclusion that artificial bee colony algorithm is the best technique when pondered with the other algorithms. Vigorous research is done on this cluster head techniques to produce technique with least energy consumption and steep life time of the networks. Further research is to be done to improve the artificial bee colony algorithm with minute energy usage and increased life time of network.

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