Energy Efficient Data Aggregation Technique for Wireless Sensor Networks

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Abstract- Wireless sensor network is similar to adhoc networks, which is senses the information and reply back to their base stations. Wireless sensor networks are used to collect the information from physically and environmental conditions. WSN is decentralized network, which is deployed far places due to this sensor nodes have small size, that's why here energy consumption of the sensor nodes is major issue. In this research work, clustering approach is used to grow the energy level of sensor nodes. For data aggregation the cluster heads are selected in this approach. To grow up the energy level of sensor nodes the fuzzy logic rules are derived that on based upon some parameters in the network like, node energy, distance from base station, and selection of cluster heads. Cache node is introduced in this research work for reduction of energy consumption in WSN. In proposed scenario, cache node is used to forward the data to base station that data is collected from cluster heads. To implement this proposed scheme some parameters are used like, number of transmitted packets, number of dead senor nodes, throughput of the network and remaining energy. This whole scenario is implements in MATLAB.

Keywords- Fuzzy, Energy Efficient, LEACH, Gateway

I. INTRODUCTION

A set of tiny devices known as nodes that help in monitoring the surrounding area collectively generate a wireless sensor network (WSN). The various physical attributes of the surrounding area are measured with the help of the sensor nodes deployed within those regions that are required to be monitored. There are around thousands of sensor nodes present within these networks that use wireless mode for communicating amongst each other. In order to connect the sensor network with the external environment, a special node which is known as base station or the sink node is available within the network. WSNs have numerous characteristic features which make them unique from rest of the networks. Some of such important characteristics are explained further. There are highly limited numbers of sensor nodes present within these networks. It is important to ensure that the sensor nodes that are to be deployed over large areas are very less costly due to which the components included within them are also of minimal cost. Therefore, least costs of components are used to generate the sensor nodes such that the structure of these nodes is very similar to that of the modern devices. There is minimal hardware design involved in these networks which results in generating such unique properties as well as limitations to these networks. The sensor nodes present in the network include batteries within them with the help of which various operations are performed. Thus, the overall lifetime of the wireless sensor networks is determined by the factor known as energy consumption. In these networks, the complications of energy optimization are higher since there is a need to increase the lifetime of the network along with the minimization of amount of energy being consumed. Within multi-hop scenarios, it is important to provide routing path for transmitting the gathered data towards the base station using multi-hop. There are large numbers of routing protocols proposed such that a routing path can be defined from source node to the base station. A flat network-architecture is adapted by the initial class of routing protocols. Here all nodes that exist within the network are known as peers. For providing an efficient, stable and scalable amount of energy within the networks, the structure is provided by the second class of routing protocols. For disseminating the interest of the network, a data-centric approach is utilized by the third class of routing protocols. The attribute-based naming is utilized in this approach through which an attribute is queried by the source node for the phenomenon instead of including an individual node from the network. Some of the major routing protocols as well as algorithms are presented in the further sections that control the energy conservation related problems of WSNs. A mechanism through which the path can be discovered and information can be disseminated from the wired as well as wireless ad hoc networks is known as flooding. The maintenance of costly network topology and complex route discovery algorithms are not the factors to be considered here as it is very simple to be executed. Gossiping is the derivative approach that is applied for addressing the disadvantages of flooding. A simple forwarding rule is utilized by gossiping which is very similar to flooding. However, there is no need of costly topology maintenance or complex route discovery of the algorithms in this approach. A data-centric negotiation-based family of the information dissemination protocols is known as SPIN. The efficient dissemination of observations that the individual sensor nodes collect from all other sensor nodes in an efficient manner is the prior objective of these protocols [7]. A hierarchical

technique is used by LEACH such that a set of clusters is generated through which the network is organized. A cluster head is chosen for managing each cluster. Multiple tasks are performed for assuming cluster heads. From the members of the cluster, the data is collected periodically in the initial task.

II. LITERATURE REVIEW

Ram Murthy Garimella, et.al (2018) presented an essential role is played by the energy efficiency in the wireless sensor network. Authors proposed a system and method in this paper in order to fill the research gap. In order to utilize the efficient energy techniques in the wireless sensor networks for the process of data gathering and routing, they utilized the concept of the Hessian matrix in this paper [8]. These wirelesses sensor nodes are distributed in the multidimensional space is the assumption on which it is based. On the basis of performed experiment, it is illustrated that proposed method can be utilized in any clustering approach using its mathematical design and provides the low-energy communication structure.

Deepa PUNEETH, et.al (2018) presented there are some criterion such as energy efficiency, data reliability, and security that must be fulfilled in the wireless sensor networks [9]. They proposed a scheme in this paper which provides the security against CN attacks along with data reliability, efficient energy. The combination of SRSS and a round-reduced AES cipher was there main objective which collectively called as "split hop AES (SHAES)". For the validation of the method near-sink CN attack, they performed various analyses and used simulation results and concluded proposed method superior to other methods.

Peijun Zhong, et.al, (2018) presented with the emerging technology and fast development in the wireless sensor networks applications leads to proposed more energy efficient routing algorithms. They discussed the major challenge in this paper that of how to overcome the hot spot problem since nodes close to base station tend to die earlier than other sensors. Therefore, this issue is alleviated effectively after introducing the concept of mobile sink node [10]. As these sink node can move along certain trajectories due to which nodes of hot spot can be distributed evenly in all direction. They studied the energy efficient routing method in detailed in this paper supported by the multiple mobile sinks. They performed various experiments for which they divided the whole network into several clusters after which investigated the effects of mobile sink on the network lifetime.

Fawaz Alassery, et.al (2017) has presented the sensing nodes are deployed in the form of network that is wireless sensor network, which is used for various applications [11]. In this approach the data is transmitted through two circumstances. In the first case, the source node received data from one rechargeable relay node that is deployed in the centre of sensing nodes and then these packets are forward to destination node. In second case, the whole sensing nodes are divided into clusters and in each cluster have its own rechargeable relay node is used to forward the data to destination node. The experiments are done by them on both cases, but the second case gave the better results because in this technique the clusters used. In this technique there is direct data transmission in each cluster due to clustering technique and the central relay nodes.

Mehdi Kalantari, et.al (2017) presented routing in the wireless sensor networks are very necessary due to which they proposed a new scheme in this paper [12]. By using these equations in the networks the best routes are find out which gives the energy efficiency**.** They approximated the identified paths using a sequence of wireless links each between a pair of sensors in order to find the actual routes. As per done simulation and obtained results, it is demonstrated that there is improvement in the network lifetime as compared to other traditional shortest path approach.

M. D. Umale1, et.al (2015) presented there are various issues in the wireless sensor network (WSN) among those energy consumption is considered as the major issue [13]. There are various approaches such as cross layer energy efficient model with two modulation scheme Frequency shift keying (FSK) and Pulse Position modulation (PPM) using which issue of energy consumption can be solved. Using this method nodes are deployed randomly in small scale WSN. They compared the working of both modulation in this paper for both general and dense WSN and concluded that better energy optimization is provided by the PPM modulation scheme as compared to FSK modulation. Therefore, the target tracking, the grid exclusion and Dijkstra algorithm used for coverage metric and energy metric respectively.

III. RESEARCH METHODOLOGY

The proposed methodology is based on the selection of cluster head for the data transmission, for the selection of cache nodes which aggregate data to the base station.

Step 1: Cluster head selection: One of the requirements of clustered WSNs application is the monotony distribution of nodes. Balanced cluster heads are generated here that have several benefits of their own due to the suitable distribution conducted here. The disposability of fertility balance of cluster heads is avoided due to energy. Long distance communications amongst cluster head and nodes below it is also avoided here. The nodes that are not perfectly suitable as cluster heads are not chosen by the intended standards.

Step 2: Cache node selection: There are certain factors on which the intra-cluster communication within an energy cluster depends. The cluster size is one of these factors. There will be more expensive communications within the cluster when the size of cluster is large due to the relation between the energy consumption within the node radio with the distance. Thus, there is increment in intra-cluster energy.

Another factor which is important is the centrality. There is decrement of second power average distance when the receiver node gets closer to central cluster. Thus, there is reduction in intra-cluster energy [13]. Also, several other factors such as density of node also affect the energy of intra-clusters. The nodes that are within the unsuitable conditions as cache nodes are not chosen by the intended standards.

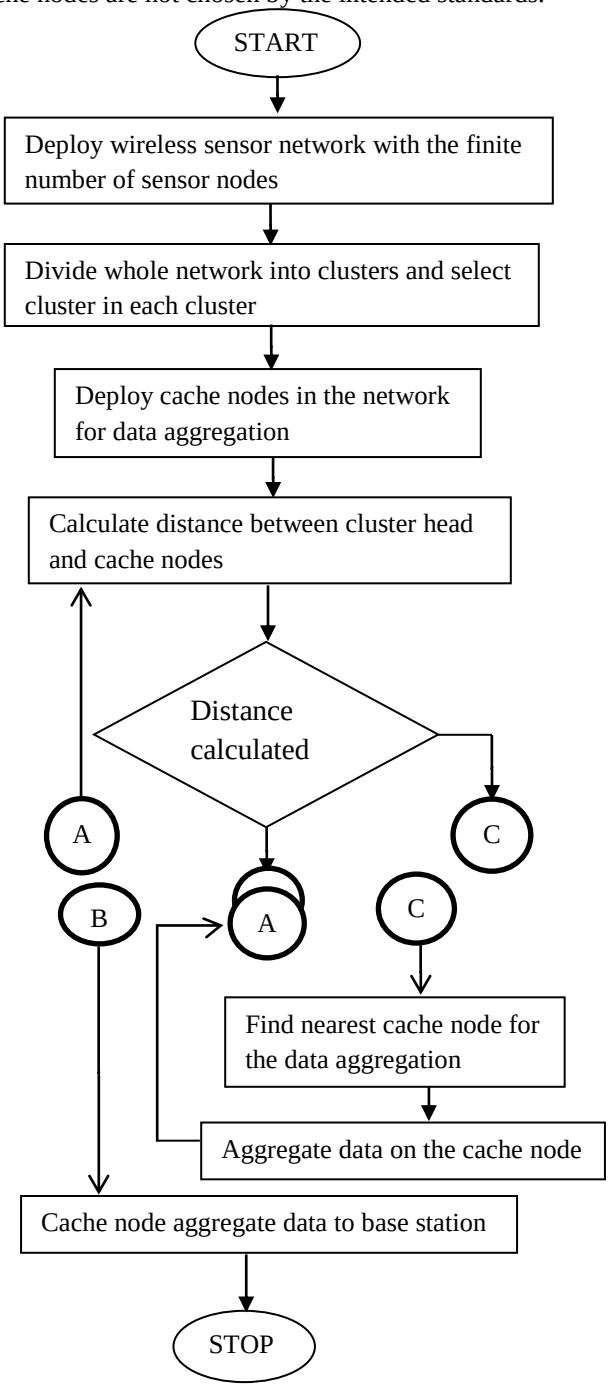

Fig.1: Proposed Flowchart

IV. EXPERIMENTAL RESULTS

The proposed work has been implemented in MATLAB and the results have been evaluated by comparing the proposed and existing techniques in terms of different parameters.

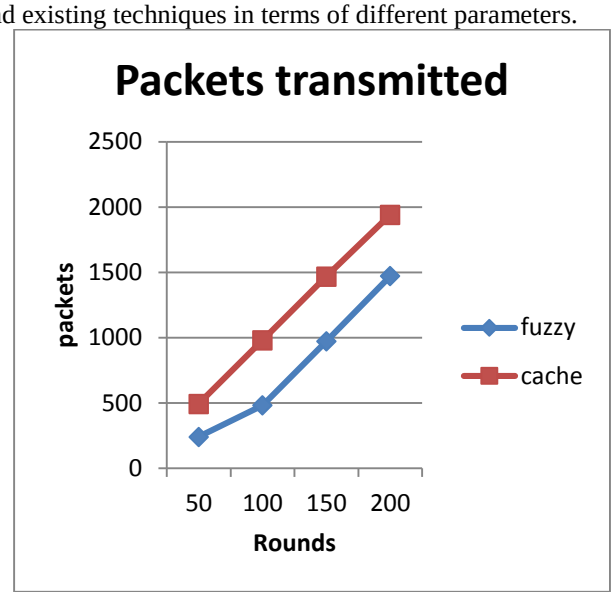

Fig.2: Number of packets Transmitted

As shown in figure 2, the fuzzy and WSN with cache nodes are compared in terms of number of packets transmitted to base station. It is analyzed that more number of packets are transmitted in the proposed technique as compared to existing technique

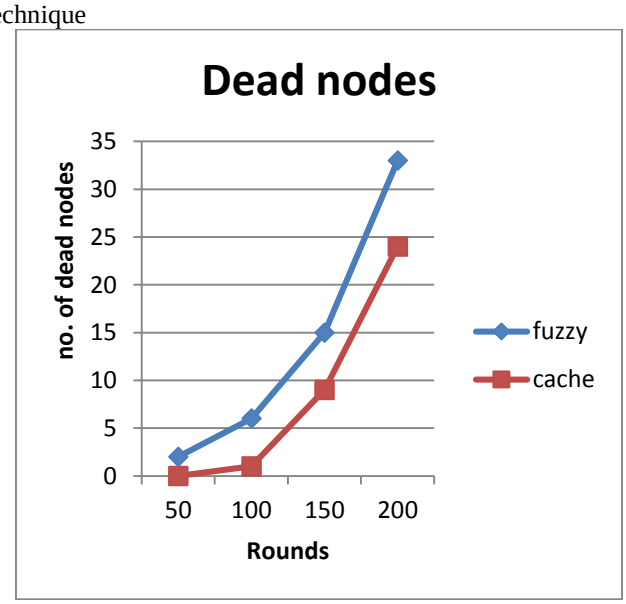

Fig.3: Last Node Dead Comparisons

As shown in figure 3, the Fuzzy and WSN with Cache is compared in terms of last node dead. The x-axis represents the number of rounds. The y-axis shows that number of rounds on

which all sense nodes die. The comparison shows that in the proposed technique number of sensor nodes alive for more number of rounds.

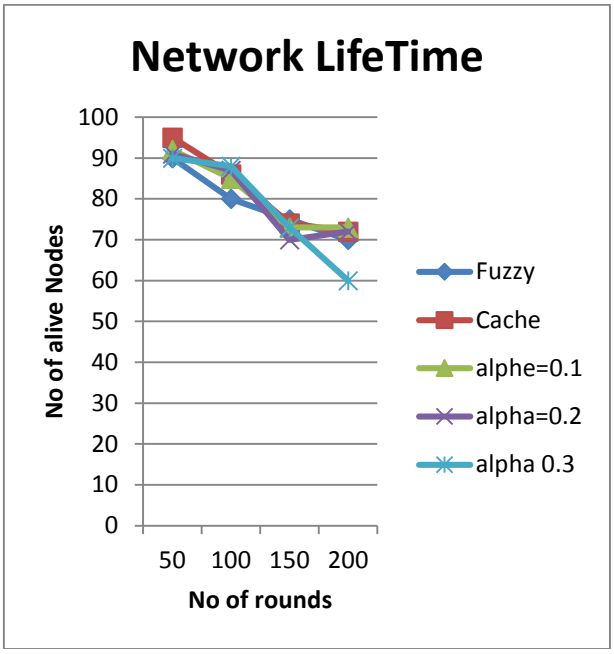

Fig.4: Network Lifetime

As shown in figure 4, the network lifetime of proposed algorithm is compared with existing fuzzy technique. It is analyzed that lifetime of cache technique is more than that of fuzzy WSN after 200 rounds.

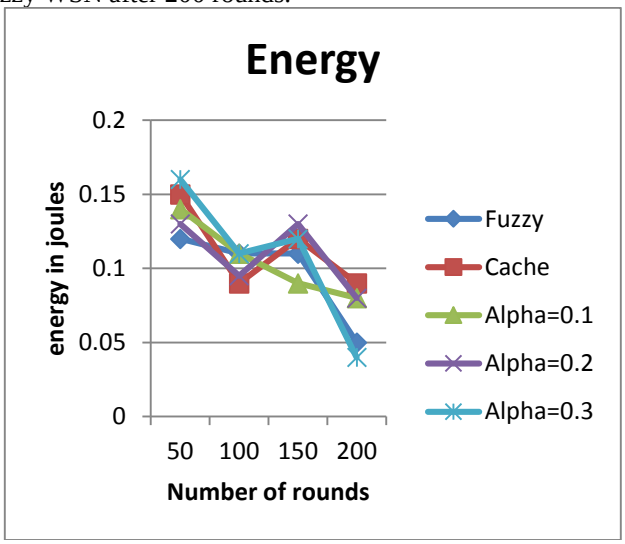

Fig.5: Energy Comparison

As shown in figure 5, the energy consumption of fuzzy and cache technique is compared. It is analyzed that energy consumption of cache technique is less as compared to fuzzy technique

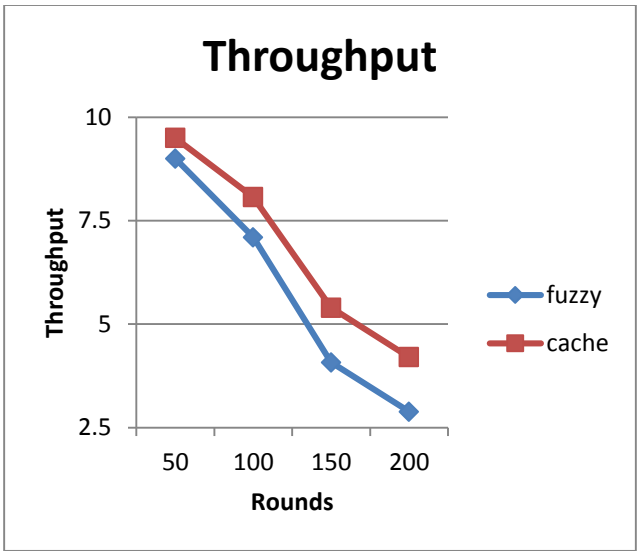

Fig.6: Throughput Comparison

As shown in figure 7, the network throughput of proposed algorithm is compared with existing fuzzy technique. It is analyzed that throughput of cache technique is increased at steady rate.

V. CONCLUSION

There is an increase in demand of wireless sensor networks today. There are different types of sensor nodes present within the networks. The applications are completely based on the several types of sensors involved within them. The surrounding environments of applications are monitored within these networks such that any kinds of activities being performed can be brought to notice of the concerned authorities. In the research work, the cache nodes are deployed in the network. The cluster heads aggregate data to cache nodes. The cache nodes will transmit data to base station. The cache nodes maintain the flash memory which improve lifetime of sensor networks. The simulation of proposed model is performed in MATLAB and result shows that proposed technique performs well in terms of packet transmission and number of dead nodes, network lifetime, throughput and remaining energy as compared to existing technique.

VI. REFERENCES

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