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AN ENHANCED TECHNIQUE FOR DISTRIBUTED LOAD BALANCED DEPUTY CLUSTERING AND DUAL DATA UPLOADING IN WSN

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Abstract- *Wireless sensor networks (WSNs) are resource controlled network in which energy is one of the mainly significant resources in such kind of networks. Due to scarce computational power and energy resources, aggregation of data from multiple sensor nodes done at the aggregating node is generally skilled by straightforward methods such as averaging. Therefore, optimal use of energy is necessary. In this paper, we described a energy-efficient routing protocol which is a novel approach for Multi-user Multiple-input and Multiple-output (MU-MIMO) for WSNs. The protocol is consistent in terms of data release at the base station (BS).This protocol organizes the data gathering and data aggregation on three different layers such as sensor layer, cluster head layer or deputy cluster head level and mobile collector. The proposed protocol employee distributed load balanced clustering and dual data uploading (LBC-DDU) at first layer which is suggested for sensors to categorize independently into clusters. At the second layer called cluster head layer or deputy cluster head level which chooses based on node status and load to form a inter-cluster transmission to connect the clusters. The third layer is the last layer called mobile collector layer provides two antennas which allows two cluster heads to upload the data concurrently every time.*

Keywords- *WSN, load balancing, Data Gathering, multi-user multiple-input and multiple-output (MU-MIMO), Clustering.*

I. INTRODUCTION

WSNs are unrecognized conversation structure that makes use of a massive range of self successful gadgets, sensor nodes, to shape a network. Each node in a WSN is able to sensing the environment, processing regionally the statistics and sending it to 1 or more range of locations via a wireless link. Wireless sensor nodes or sensors are hardware gadgets which might be small in duration, use low energy, function in excessive densities, are autonomous and carry out unattended, and are adaptive to the surroundings. The chronic analog sign received from the sensors is transformed through an analog-to-virtual converter into digitized signal and dispatched to controllers for in addition processing. Sensors can be passive Omni-directional, passive slender-beam or energetic sensors. Sensors that sense the facts and do no longer method them are known as passive sensors. The energy needed to magnify the analog sign is self generated. Sensors which can give the path of size are labeled into narrow-beam sensors. Omni-directional sensors do no longer specify the involved path in measurements. However, active sensors dynamically probe the environment and uninterrupted deliver of energy is wanted [1].

II. CLUSTERING

Clustering is one of the strategies that can be used to meet the challenges in WSN. In clustering, sensor nodes are portioned into smaller corporations called clusters. In each cluster a Cluster Head (CH) is elected. The data from the sensor node is passed to the CH in every cluster; the CH forwards it to the base station or sink.

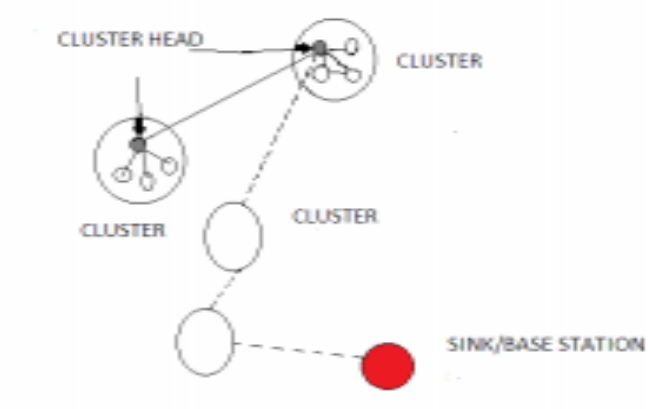

Fig.1 WSN

The cluster based corporation of the sensor nodes leads to a degree hierarchy, where CH is the higher stage and the sensor node the low stage. As noted the sensor nodes transmit the data to the CH. The CH aggregates the data directly or through speaking with neighboring CHs and forwards it to sink/base station. The base station is the data processing centre where the cease user get admission to data. Clustering presents basic system scalability, increase network lifetime and energy efficiency. In addition in the cluster the path setup is localized, network topology is stabilized and the CH can schedule activities inside the cluster [2].

III. CLASSIFICATION OF CLUSTERING PROTOCOLS

In this area we talk about the arrangement of attributes can be utilized to separate clustering protocols for WSNs [3, 4].

a) Clustering Method The two simple approaches for the co-ordination of complete clustering system are allotted and centralized. In distributed clustering, where every sensor node can run their personal set of rules and takes the selection of becoming CH. In centralized clustering, a centralized authority groups the nodes to form clusters and CHs. Sometimes hybrid scheme can also be carried out.

b) Cluster Properties In clustering procedures, there are a few traits for the cluster formation. The following are characteristics which are related to the inner structure of the cluster.

- Cluster count Cluster be counted is the number of clusters shaped in a round. More range of cluster lead to small length cluster distribution, which is higher in time period of power intake. In a few clustering processes, the choice of CHs are pre assigned from the deployed sensor nodes for constant clusters or CHs may be selected randomly results in variable quantity of clusters.
- Cluster size Cluster size is the maximum route size among the many member nodes from CH. Small sized cluster is best in time period of energy consumption on the grounds that it minimizes transmission distance and cargo of CH. In some clustering approaches, cluster size is fixed when cluster are fixed for the duration of the lifestyles time, or else it's variable for each cluster.
- Cluster Density Cluster density is outlined as share of the quantity of cluster member in the cluster and cluster area. There's big project to cut back the power consumption of CHs in dense clusters. One of the most clustering technique use fixed clustering invariably has sparse density of cluster, however in dynamic clustering systems cluster density variable.
- Message rely Message count is the number of message transmission is requiring for CH decision. More number of message transmission lead to gigantic amount of power consumption for CH selection system. There are a lot of algorithms which is no probabilistic, require the message transmission for CH selection.
- Stability If the members of a cluster should not constant the clustering schemes are said to be adaptive. Otherwise we are able to do not forget as fixed due to the fact that the cluster rely usually are not assorted for the period of the clustering process. The fixed cluster count increases the steadiness of a sensor network.
- Intra-cluster topology it indicates the communication inside the cluster as direct or multihop. It is usually single hop or multihop from sensor node to sensor node or sensor node to CH. Nevertheless this conversation also will depend on the sensors variety. This constrained range bounded the CH count.
- Inter-CH connectivity It suggests the capabilities of sensor nodes /CHs conversation to base station. If the CHs will not be having long haul communique capabilities, clustering schemes has to be certain some intermediate provision of routing to base station.

c) Cluster-Head Capabilities The capabilities of CHs in clustering schemes affect the overall clustering method in phrases of balance and lifelong of sensor community. The next are some attributes for differentiating the clustering schemes.

- Node Type At the time of deployment some of the sensor nodes are pre assigned as CHs on the concept of extra energy, verbal exchange and computation sources.
- Mobility The mobility of CHs in sensor networks can be assigned on the basis of targets described in clustering schemes. If the CHs are mobile, we are able to use this to make balanced cluster for higher network performance. Mobile CHs also can be reloadable if there is any want within the sensor network.
- Role The role of CHs within the sensor networks can act as a relay for the statistics generated by using the cluster members or carry out the assignment of aggregation or fusion of data.

d) CH Selection CHs can also be pre-assigned or picked randomly from the deployed set of nodes [3].

- Probability In probability centered clustering algorithms, each and every sensor node makes use of pre assigned likelihood to determine the initial CHs.
- Non Probability centered In no probability based clustering algorithms extra certain criteria for CH selection and cluster formation are specifically regarded that are generally established on the sensor nodes proximity, connectivity and degree and so forth.

e) Cluster Formation in cluster formation process the CHs will broadcast request packet to the sensor nodes come in radio variety to type cluster. In single hop nodes transmits to the CH straight and in multi hop all sensor node

will ship their knowledge by way of neighbor node. Fig. 1 summarizes the classification of one-of-a-kind attributes of clustering in WSNs

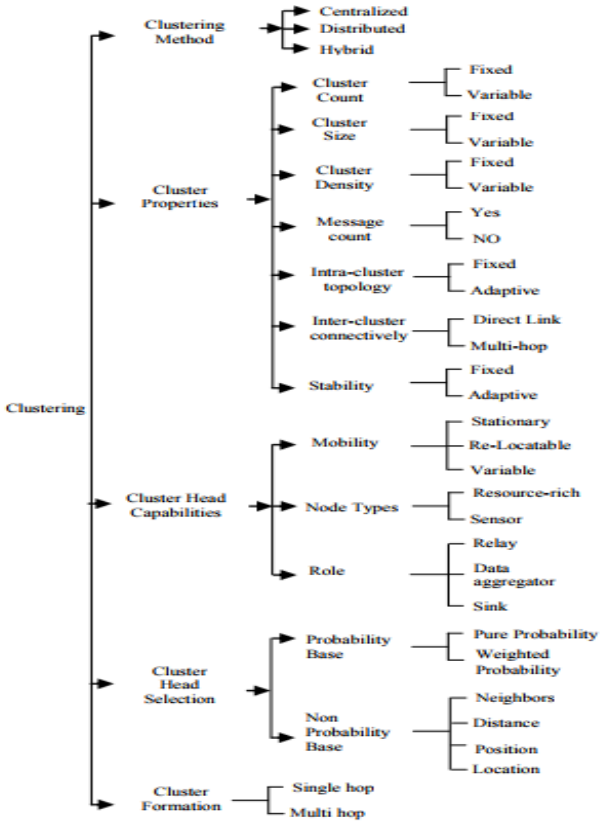

Fig.2 Classification of the different attributes of clustering in WSNs [5].

IV. LITERATURE SURVEY

Susila Sakthy et al. [2017] in this paper, Wireless sensor network consists of independent device spatially distributed in the wireless network with sensor that observes the environment conditions. The cluster based transaction is the gateway of wireless medium and distributed nodes has limitations in power supply. Packet scheduling is the mandatory process in wireless networks to balance the network and minimize the end delay. In energy efficient clustering approach the SNR based node selection is the recent development. As in the proposed process, the overall packet data scheduled according to the High Powered Multilevel priority scheduling, the scheduled data transmitted between the clusters and the base station consists of transmission node in between them. The transmission node is been selected according to the SNR value between the CH and the base station [6].

Karthika Sundaran et al. [2017] in this paper ,our propose an algorithm namely as ECUCF (Energy Conserved Unequal Clusters with Fuzzy logic).. Based on the distances of the nodes from the BS, the network is divided into three unique sectors. For designing unequal clusters in each sector, a fuzzy logic approach is followed. The CHs that are nearer to the base station are designed to be of smaller sizes whereas the CHs that are situated farther away from the sink to have higher cluster sizes. The proposed algorithm ECUCF is simulated using MATLAB environment. The performances obtained are compared with the performances of other clustering schemes like LEACH (equal clustering algorithm) and FBUC (unequal clustering algorithm). From the simulated results, it is found that the performances of ECUCF are much improved as compared to LEACH and FBUC in maximizing the number of clusters, increasing the number of live nodes in the network and extending the lifetime of nodes on each round of operation [7].

Saad Talib Hasson et al. [2017] In this have a look at all the cluster nodes ought to sensing positive data and transmit it to its CH. This knowledge shall be accumulated at distinct nodes referred to as CHs that is earlier assigned for every cluster. The CH aggregates the info and forwards it to the BS or a node sink. In this study two developed clustering approaches are suggested and created using Net Logo (5.2.1 version 2015). These approaches are Extreme node and double Extreme nodes. In addition to these two approaches, the DB-Scan clustering approach is also suggested to be used as a reference to compare its results with these two suggested algorithms. Results show certain improvement in these suggested algorithms. Many performance metrics can be used to Measure the performance of the suggested WSN such as NRL, PDF, End-to-end and throughput [8].

Harsha.P.M, et al. [2016] This paper presents a process for clustering and CH election system making use of mobile centered LEACH-ERE in WSN atmosphere to expand efficiency of energy. It provides relation amongst ways situated on lifetime of the network. On the basis of lifetime of network, it makes judgment amongst various approaches. Packet delivery ratio get consider the fix and mobile nodes in each responsible node [9].

Praveen Kumar K.V et al. [2016] In this paper, our method the CH selection technique includes an effective method of CH selection. Our algorithm reduces the communication overhead, energy consumption and increases the network lifetime when compare to earlier state of art works [10].

Li Shi, Liu Mengyao et al. [2015] In this paper, a novel approach of neural network and wireless sensor network combination for the inner data integration is adopted in order to effectively improve data transmission efficiency, reduce network energy consumption.

Firstly, a type of clustering protocol referred to as CNN-LEACH primarily based on Hamming network and a sort of optimization algorithm known as SMPSO-BP primarily based on neural community are proposed. Then, the CNN-LEACH clustering routing protocol included with SMPSO-BP optimization algorithm is implemented within the WSN data fusion procedure. The above-cited protocol and algorithm under special situations are simulated and as compared at the NS2 platform. The result show that, SMPSO-BP algorithm has improvement in convergence and CNN-LEACH protocol truly stability the power consumption of the network load to some extent. Finally, Their aggregate reduce the redundant data in WSN and the energy consumption of senor node and prolong the network lifetime [11].

Karishma Desai et al. [2015] in this paper, our proposed algorithm CH (CH) selection is carried out using distance between nodes and energy of the nodes. They are selected in any such way that, the distance between them is highest and vigour of the chosen CH is extra. All the CHs send data to the CH placed toward the BS and in turn, it aggregates and transmits records to the BS [12].

V. LBC-DDU ALGORITHM

LBC-DDU algorithm is the distributed load balancing clustering dual data uploading which is applicable at the layer which is known as sensor. In the clustering approach, cluster head election is the vital part. For the network performance and lifetime, cluster head should be selected with the highest remaining energy. At the initial level, we consider a group of sensors and stand for S = {SN}. All the sensor nodes are identical and they perform the decision personally.
Every cluster has maximum N cluster heads which should be greater than 1 and this assure that every sensor is enclosed by minimum one cluster head within a cluster. There are four steps in the LBC process which are initialization, claim of status, formation of cluster and synchronization of cluster head.
At the initialization step, every sensor communicates with the neighbor nodes that come in the range of them. If a sensor is a remote node it maintains itself to be a cluster head and there is only one node which is that sensor node itself. Otherwise, a sensor si, first sets its status as “tentative” and its initial priority by the percentage of residual energy. After that, si arrange its adjacent nodes by their primary priorities and choose M − 1 adjacent nodes with the maximum primary priorities, which are momentarily treated as its peers of candidate.
The second step is the creation of cluster that determines which cluster head a sensor must be connected with. The measure can be illustrated as follows: for a sensor with uncertain status or being a cluster member, it would indiscriminately associate itself with a cluster head along with its peers of candidate for balancing the load principle. In case a cluster head is having a low energy on battery then there is a need of re-clustering. This procedure can be finished by distributing a re-clustering message to all the members of cluster. Cluster members that obtain this message and swap to the initialization step to complete a new iteration of clustering.

A. Cluster Formation and Cluster Head Selection

1. Cluster Formation

This section describes about cluster formation. A network area $G(N, Z)$ divided into multiple zones Z with a maximum coverage range. A cluster is formed with fixed radius by choosing (nexthop candidates of nodes or with highest cooperating neighbor density within range of 2 hop distance) a node as center and randomly small distance as radius and along with cost. Center of the new circle is calculated as mean of the points within the circle whereas the radius is increased by the distance of two successive centers. This way the clusters are generated when the nodes acknowledged which is given away in Fig (2).
It contains the subsequent parameters:

- A set of node B
- A matrix of node (n_i and n_j)
- Random length r

The formation of cluster is explained as below:
Step 1: First select a node b_i which is 2 hop distance apart from other participating node with a random length r_1.
Step 2: Perform the cluster formation technique

Do
B=b_i, r=r_1;
Draw a circle with b_i as center and r as radius
Compute new radius $r_1 = r + | b_i - b_j |$
While $b_i \neq b_j$
Cluster-1 is formed with every collaborating node available within the circles.

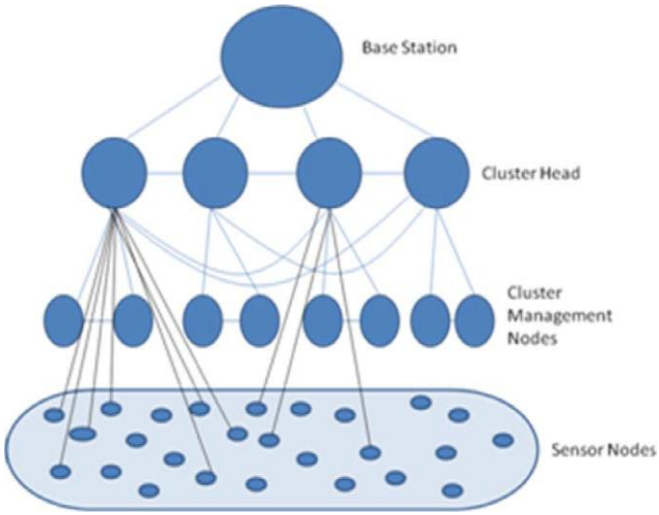

Fig 3: Cluster formation in WSN

2. Cluster Head Selection

This part illustrates about the selection of Cluster Head (CH) in a MANET based on node fitness, node degree, node mobility, residual energy level and trust-value. For this purpose, initialize the initial trust rate value as(1), energy rate(10J), and mobility rate. Compute node fitness, the node fitness function derives based on sum of node energy level and node trust level. The node degree represents how many number of neighbor nodes for each node in a network. The following procedure determines the election of efficient and trusted CH.
Step 1: Calculate the percentile of node degree as PN_d
$PN_d \leftarrow \left\{Number\ of\ 1-hop\ nodes\ inside\ the \frac{cluster}{N}\right\} * 100$ where N is number of nodes
Step 2: Calculate the percentile of node energy level.

$$PN_E = \left\{\frac{RE_n}{T}\right\} * 100$$

Step 3: Calculate the percentile of node mobility

$$P_m = \{Avg(MS)/T \times 100\}$$

Step 4: Compute the percentile of node trust

$$P_{TV} = w1.PN_d + w2.PN_E + w3.P_m$$

where w1, w2, and w3 are weight factors given to different parameters such as node degree, energy, and mobility.

$$w1 + w2 + w3 = 1$$

Based on section 3.1 and Table 1 and 2, the Cost (WN_i, t) and the past verification for the delivery of Packet to the Destination Node $t(H_t, N_i)$. The node TV is determined as

$$TV_{i,j} = \sum_{\substack{0 \le i \le m \\ 0 < j < n}} \frac{P_{TV}(i,j)}{cost(WN_i, t)}$$

Where $i, j \in nodes$, $TV_{i,j}$ represents node i's TRUST_VALUE for node j.
The CH selection technique can be explained as below:
Step 1: First, Initialize the parameters to 0 or null.

$CH_{cur} \leftarrow 0$
$CH_{prev} \leftarrow 0$
$Time_{prev}$ 0$\leftarrow$
Curr () $\leftarrow$0

Step 2: Calculate the TV of each node from the equation ()

$$TV_{i,j} = \sum_{\substack{0 \le i \le m \\ 0 < j < n}} \frac{P_{TV}(i,j)}{cost(WN_i,t)}$$

Step 3: Compare the given condition to select CH

While ($Time_{prev}$_Curr () or TRUST_VALUE (CH_{prev}) ≤ 1=true) do

CH_{prev} remains as Cluster Head

End while

Step 4: Compare Trust Value of previous and current Cluster Head

If Trust_Value(CH_{prev})=Trust_Value(CH_{cur}) and Cost(CH_{prev})=Cost(CH_{cur}) then

both CH_{prev} and CH_{cur} remains as cluster heads

Else

select new Cluster Head

Select new cluster head(s)

end if

VI. Simulation Results

In our proposed work, we used Network Simulator Version-2 (NS2) for the simulation. The channel capability of mobile hosts is fixed to the similar rate: 2 Mbps. In this work, Wireless LAN in which the distributed coordination function (DCF) used as the MAC layer protocol. It has the functionality to inform the network layer about breakage of link.

In our simulation, the area for the movement of nodes is 1000 meter x 1000 meter and the simulation time is for 10 seconds. All nodes have the identical transmission range of 250 meters with Constant Bit Rate (CBR) traffic. In the table below, there are various parameters:

No. of Nodes	50,100,150 and 200.
Size of Area	1000 X 1000
Medium Access Control	802.11
Transmission range	250m
Simulation Time	10 sec
Traffic Source	CBR
Initial Energy	10.3 J
Receiving Power	0.395
Sending power	0.660
Idle Power	0.035
Rate	40 Kbp

Table 1: Simulation parameters

A Performance Metrics

We estimate mainly the implementation according to the following metrics.

Average Packet Delivery Ratio: It is the proportion of the quantity .of packets established effectively and the sum quantity of packets transmitted.

Average Packet Drop: It is the regular quantity of packets dropped by the mischievous nodes.

Delay: It is the time taken by the packets to arrive at the receiver.

Energy Consumption: It is the quantity of energy inspired by the nodes for the data communication.

We compare our Dynamic Energy Efficient Routing Protocol with the M-LEACH technique.

B Results

A. Based on Nodes

In our first experimentation we used different number of nodes as 50,100,150 and 200.

A. Performance Metrics:

Some of the metrics are as follows which are used for understanding the performance of routing approach and for comparing it with M-LEACH.

Average Communication Energy: It is defined as the average of total energy consumed during network communication. Suppose, E is the total energy consumed during the communication and n is the number of nodes in the system. Therefore, E/N is the average communication energy. A protocol with lower average communication energy is desirable.

Throughput: It is defined as the ratio between the actual numbers of packets transferred by the nodes to the numbers in the system which are successfully delivered at the BS (base station**)**. It reflects the percentage of packets lost during transmission. A protocol with higher throughput is desirable.

Lifetime: It is defined as the time taken considering the start of the network for the first node to die during the simulation. A protocol with larger lifetime is desirable.

Node Death Rate: It is used to measure the number of nodes that died over a time period during the start of the simulation.

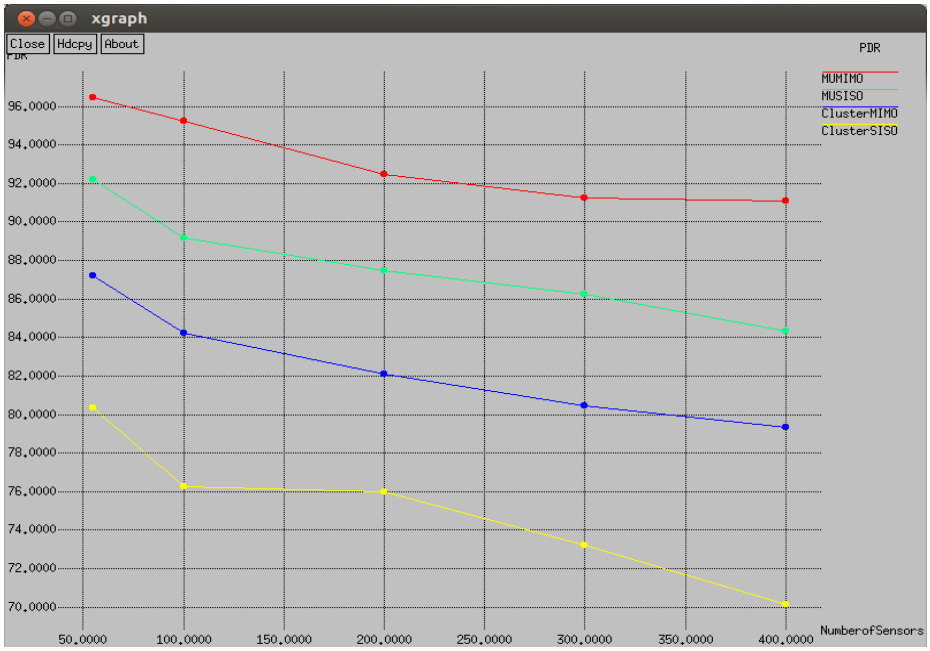

Fig 4 : PDR: Nodes vs PDR

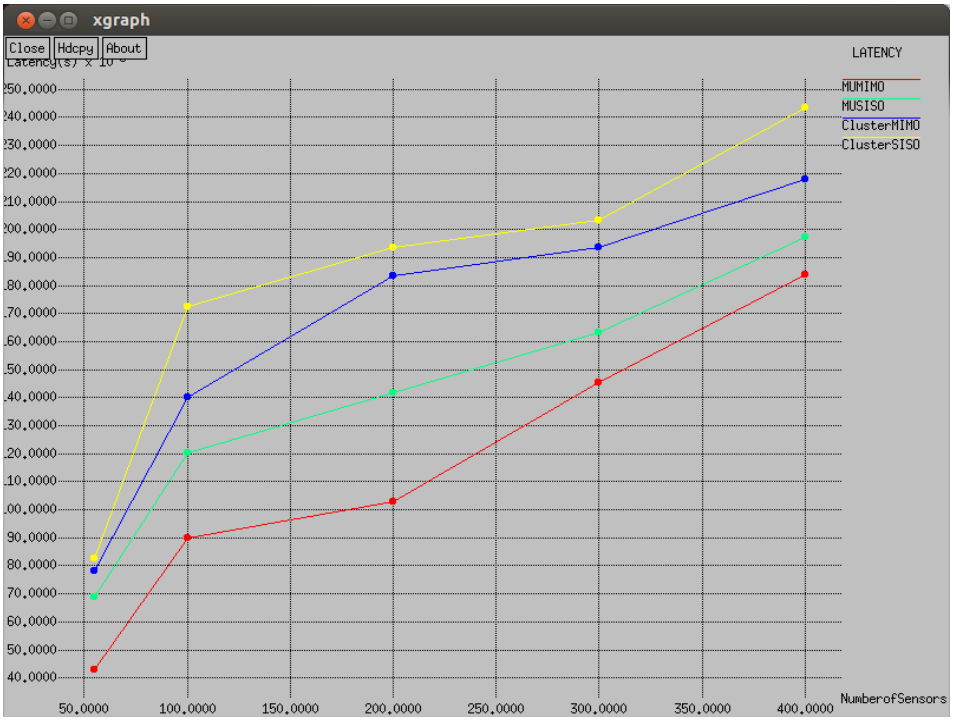

Fig 5: Latency: Nodes vs Latency

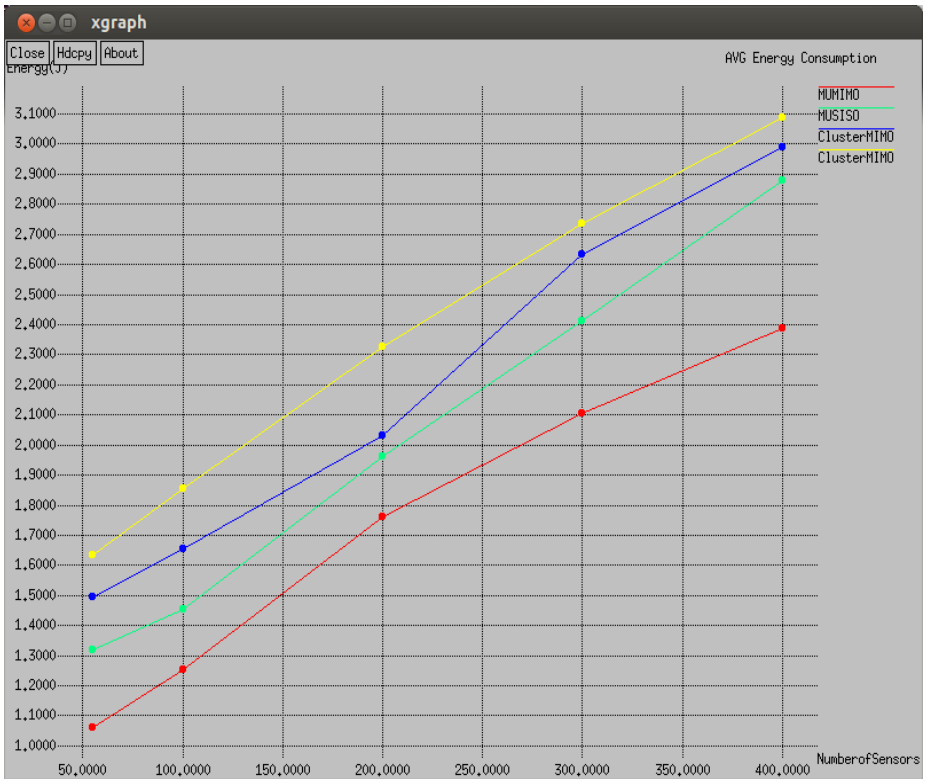

Fig 6: Energy consumption: Nodes vs Energy consumption

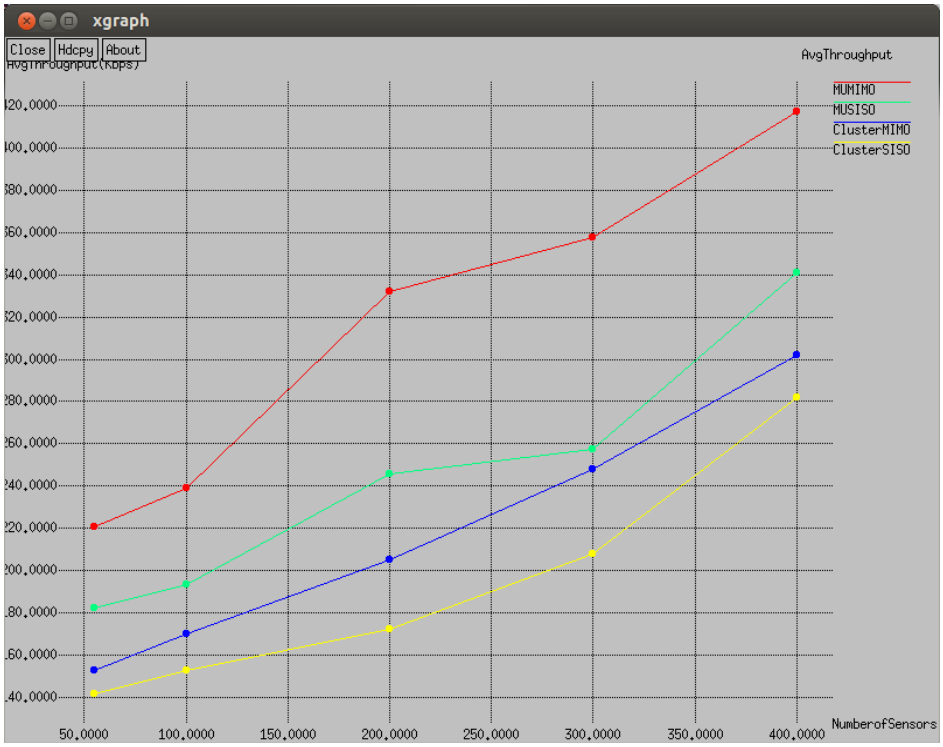

Fig 7: Throughput: Nodes vs Avg Throughput

CONCLUSION

In this, LBC-DDU structure is proposed for gathering the data from the mobile nodes in WSN. There are three frameworks of layer which is in the integrated form such as mobile collector layer, sensor layer and cluster head layer. The results of LBC-DDU establish that it diminishes energy consumptions by dropping the routing burdens on nodes and balancing workload in cluster heads. In this, we discuss about the understanding the performance of routing approach and comparing it with M-LEACH. A protocol with higher throughput and larger lifetime is desirable. The proposed protocol is tested under the influence of mobile sensor nodes.

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