ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

CLUSTER-TREE DATA GATHERING FOR LARGE SCALE WIRELESS SENSOR NETWORKS

R.DIVYA, Mr.V.KARTHIK
[1]PG Scholar, 2Assitant Professor, Department of ECE
[1, 2] Sri Krishna College of Engineering and Technology,

ABSTRACT

Wireless Sensor Networks (WSNs) are used widely in today's world. Various data gathering schemes are used in WSNs. They are multipath, chain, tree, cluster and hybrid topologies. These schemes are failed to provide a guaranteed reliable network in terms of mobility, traffic and end-to-end connection. Here, a Velocity Energy-efficient and Link-aware Cluster-Tree (VELCT) scheme is used for data gathering to overcome the problems of coverage distance, mobility, delay, traffic, tree intensity and end-to-end connection. This VELCT schemes constructs the Data Collection Tree (DCT) depending on the cluster head location. The Data Collection Nodes (DCNs) in DCT does not perform sensing, it only collects the data packet from the cluster head and transmit it to the sink. This scheme reduces energy exploitation, delay and traffic in cluster head in WSNs. Simulation results shows that this scheme provides better QOS in energy consumption, throughput, delay and network lifetime.

I.INTRODUCTION

At first WSNs are used for deployment in remote and hazardous environment. It's goal is to sense the data from the sensor nodes and deliver it to the sink. Data collection is an important factor for determining the performance of WSNs. Network topology defines the types of routing path, determines the size, type of packets, dimension of the sensor node group, manages the addition of new members and withdrawal of members. When a right topology is chosen it improves the performance, coverage, lifetime and QOS of the network. An efficient topology provides the neighbors at minimum distance and reduces the probability of the packet loss. Energy consumption is an important parameter that plays a major role in the performance of WSNs. Topologies such as flat, chain, tree, cluster and hybrid are already existed. In this paper Velocity Energy-efficient Link-aware Cluster-Tree (VELCT) scheme is proposed to overcome the existing limitations such as energy consumption, delay, traffic, coverage, connection time, RSS (Received Signal Strength), data collection, and lifetime on WSNs.

II. LITERATURE SURVEY

For data collection purpose various algorithms were used in WSNs. Some algorithms are used in cluster topology, some are used in tree topology and some are used in cluster tree topology. Low Energy Adaptive Clustering Hierarchy (LEACH) is a clustering algorithm which selects cluster head based on threshold value and received signal strength (RSS). All the sensor nodes will get a chance to act as a cluster head for a particular time. This algorithm improves the lifetime of the network and increases energy conservation as it uses single hop transmission. However it increases overhead as it causes link failure and it is not applicable for large scale WSNs. Hybrid Energy-Efficient Distributed clustering (HEED) is an energy efficient multi-hop clustering algorithm. It selects the cluster head based on the high average residual energy. This increases energy conservation and scalability. The main drawback is it uncovers several sensor nodes. Cluster head near to the sink die earlier. In Mobility Based Clustering, each sensor have a chance to elect cluster head based on threshold value. It provides better performance than LEACH, HEED and other existing protocols. But it is failed to address the critical node occurrence problem which causes link breakage, packet dropping and reduces the network utilization.

Tree Based Data Collection Scheme (TBDCS) is a protocol with a collection of query messages. It uses flooding avoidance method and it sets a tree with least intermediate nodes and selects an appropriate time to

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

aggregate the received data. It minimizes the network traffic and improves the network lifetime. However time consumption is high. Energy Efficient Data Collection Protocol Tree Based (EEDCP-TB) is a protocol which uses flooding avoidance scheme and cascading timing scheme to perform data aggregation. It minimizes energy consumption and increases network lifetime.

III VELCT DESIGN

Velocity Energy-efficient Link-aware Cluster-Tree (VELCT) is used to overcome the existing algorithms limitations such as energy consumption, coverage, RSS, throughput, connection time, end-to-end delay, and network lifetime. It is an improved version of CIDT. This scheme consist of two phase. They are set-up phase and steady-state phase. This scheme overcomes the existing problems in CIDT.

The fig1 shows the VELCT structure which helps to improve the network lifetime and executes the data gathering effectively with minimum delay. This scheme is an efficient hybrid scheme suitable for the dense wireless sensor networks. On mobility-based environments, it provides better performance.

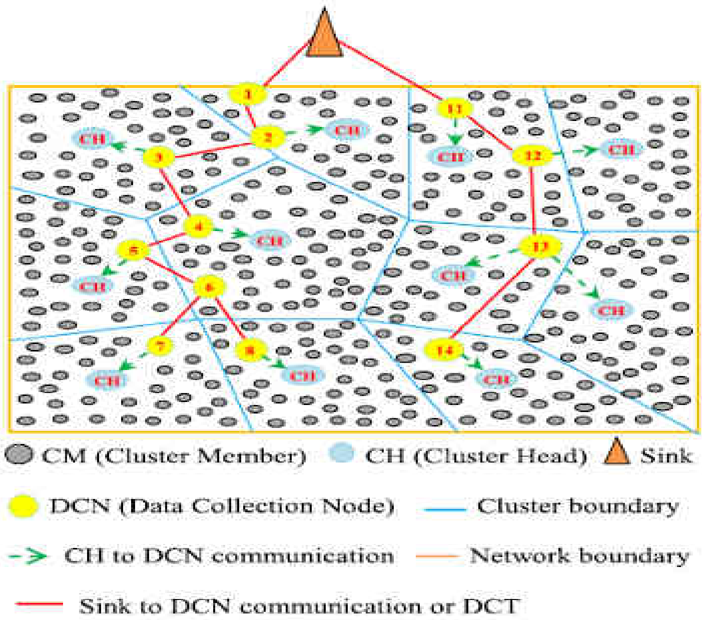


Figure 1: VELCT Structure.

A.Set-Up Phase

It consist of intra cluster communication and DCT communication operations. Here the cluster formation and data collection tree (DCT) construction is initiated to identify the correct path between the cluster members and sink. In intra cluster communication all sensor nodes selects cluster head based on threshold value and forms a cluster with better connection time, RSS, coverage time and robustness for connection. Here the sensor nodes are deployed densely over the region. During this phase, the beacon signal is used to identify the sensor nodes location and position. After this the cluster head election algorithm is used to elect the cluster head. Then the cluster head collects data from its cluster members. After this DCT communication is initiated to collect data from cluster heads and forward it to the sink.

In DCT communication sink initiates the DCT formation process. Depending on the location of cluster head and connection time, a few nodes are selected as DCNs (Data Collection Nodes) to generate DCT. These DCNs does not participate in sensing and they are not part of any cluster. Hence they may act as the ordinary sensor nodes. They simply forward data from cluster head to the sink. Thus DCT is a hierarchical tree structure

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

which uses DCNs to collect data from the cluster heads and deliver it to the sink. To maintain the life time of the network new DCNs are selected every time whenever the new cluster heads are elected.

B. Algorithm steps

(a) Declare the variables.

(b) Initialize the number of DCT to cover all the CHs over the network.

(c) Assign the value to NN and iterate the value to identify the TIN from NN.

(d) Assign the variable _ to store all CNI in TIN.

(e) Consider _ to identify the one-hop distance from NN.

(f) Check the one-hop distance NN is CH or not.

(g) Set the identity of NN as CNI.

(h) Set the NHC is one-hop distance from NN or HC.

(i) Check the CNI is NN then NHC is one-hop distance from HC, NH is the next one-hop distance from N and NH is CH or not.

(j) Store CNI value into TIN array.

(k) Return null value.

(l) Check whether the value of hop count is l and NN is CH.

(m) Store null value in TIN[l+1] which uses to skip the selection of CH as CNI.

(n) Increment i for the next iteration to identify the next TIN.

(o) Assign TIN[0] to select the best value from TIN.

(p) Consider j to decrement the array length of TIN which is used to identify the DCN.

(q) Select the best value from TIN[j].

(r) Assign that best value to TIN[].

(s) Reassign the value of TIN to CM.

(t) Assign that best as DCN.

(u) Compute the frame duration of DCN as $t\,f\,DCN\,(o)$.

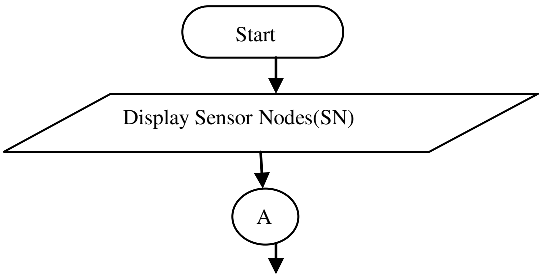
(v) Compare MFD and $t\,f\,DCT$ (_).

(w) Add that DCN in DCT.

(x) Now, HC is incremented from _, and it is considered to identify the one-hop distance SN from DCN _ for next DCN selection.

(y) NN is considered to one-hop distance SN from DCN _ for next DCN selection.

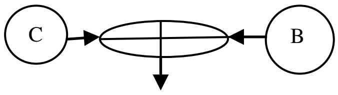
(z) Go to L1 for next DCT generation.



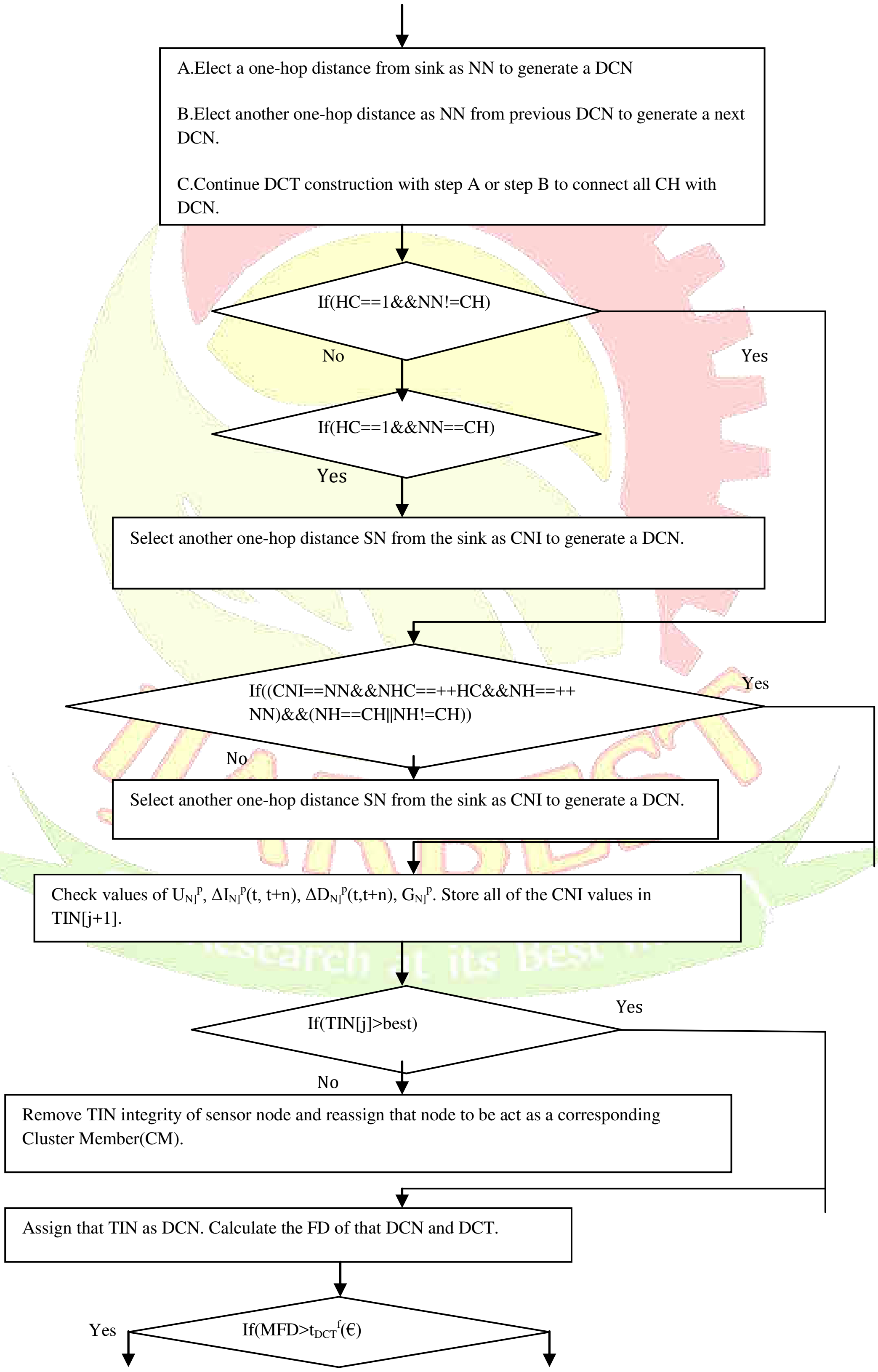
ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016



contd



ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

contd

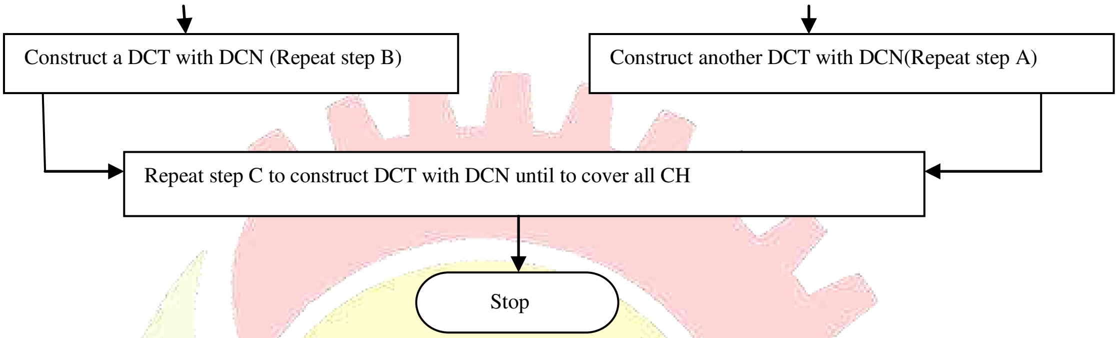


Figure 2: Flow chart

The above figure shows the flow chart which explains the DCT construction procedure. The DCN collects data from the cluster head, aggregates it and forward it to the next DCN. Sink executes the DCT construction algorithm to select the DCN and to form an independent tree structure.

C. Steady-state phase

This phase is initiated when the set-up phase is completed. Here all the cluster members transmit the data to the cluster head in allocated time slots. Here DCT communication uses direct sequence spread spectrum (DSSS) to transfer the data from the cluster head to DCN and then the sink. DCN collects and aggregates the data from the corresponding cluster head or DCN.

IV.RESULTS

Here, various graphs are plotted for energy consumption, throughput, delay and packet delivery ratio. This is done by using the software called Network Simulator (NS-2). Here this software is used to carry out the performance study of VELCT.

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

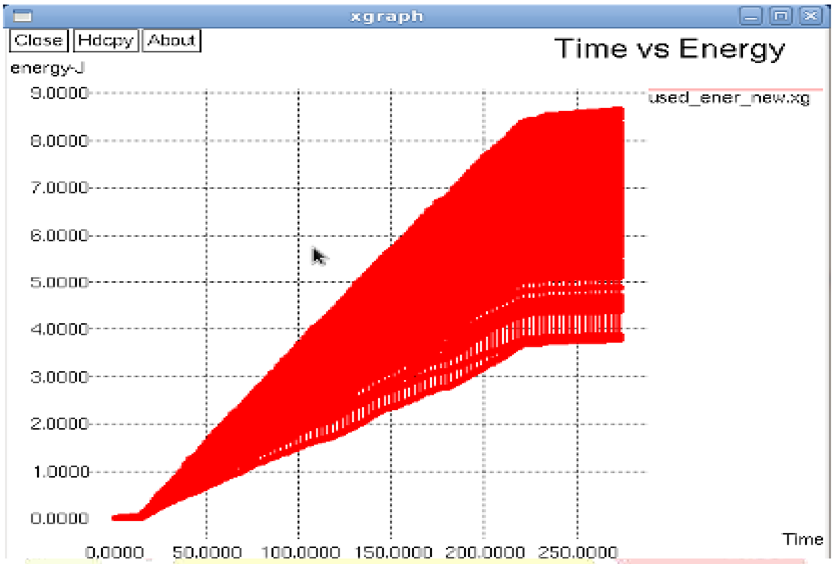


Figure 3: Time Vs Used energy

Fig 3 explains the energy used or spent for each packet during transmission at the time of every second. Thus x-axis shows time which is represented in seconds and y-axis shows energy which is represented in joules. Initially energy used or spend is very low before the packet transmission. When the packet transmission begins, the energy used or spent for the transmission increases at increase in time.

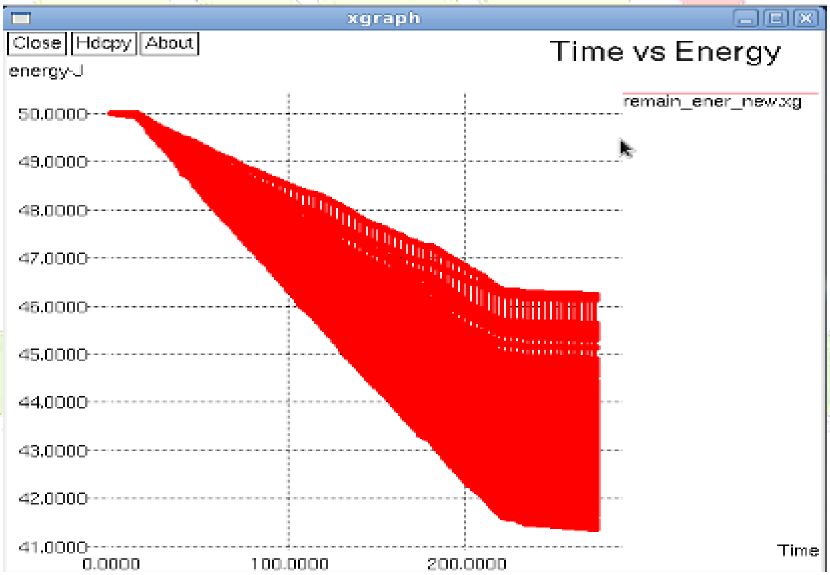


Figure 4: Time Vs Remaining energy.

Fig 4 explains the remaining energy or the energy existed in nodes during the transmission of packets at the time of every second. Initially, i.e before transmission, the energy remains high. When the transmission begins the remaining energy decreases at each second. Here also x-axis shows time which is represented in seconds and y-axis shows energy which is represented in joules. Fig 5 explains the throughput for each second during transmission. Throughput is defined as the total number of bytes being received. In below graph throughput remains constant throughout the graph. So there is no packet loss. Thus the throughput of the

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)
International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)
Vol. 2, Special Issue 10, March 2016

transmission at the time of every second is approximately 230 bytes. Thus x-axis shows time which is represented in seconds and y-axis shows throughput which is represented in bytes.

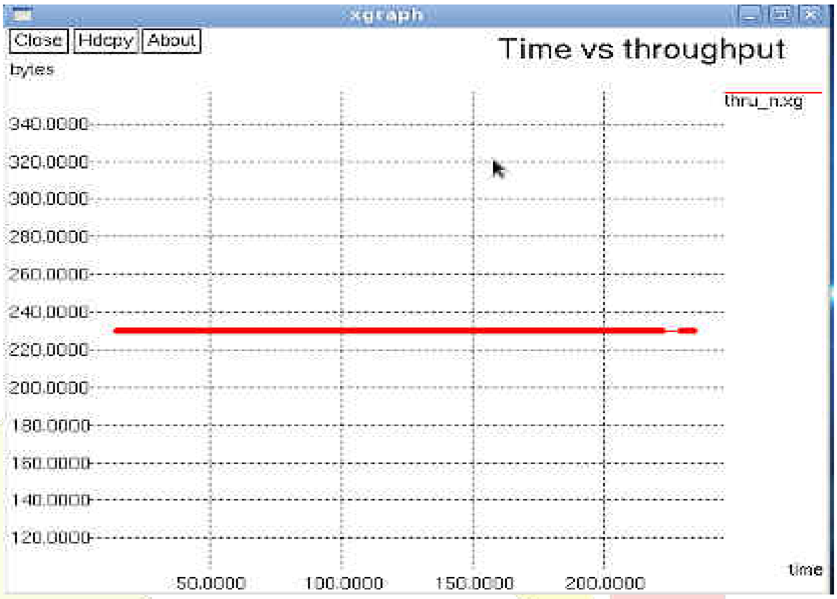


Figure 5: Time Vs Throughput

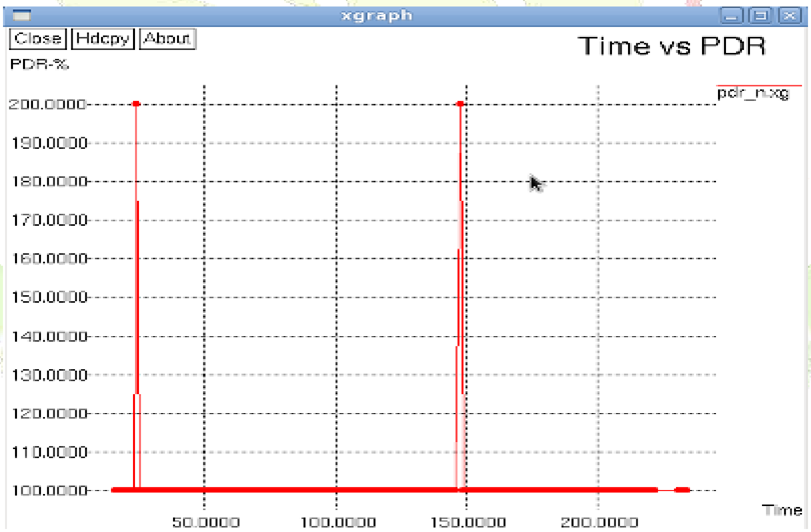


Figure 6: Time Vs Packet Delivery Ratio.

Fig 6 shows the Packet Delivery Ratio (PDR), at the time of every seconds. The communication begins at 15^{th} second. Packet Delivery Ratio is defined as the ratio of total number of packets received to total number of packets transmitted. Thus x-axis shows time which is represented in seconds and y-axis shows packet delivery ratio (PDR) which is represented in percentage. In the above graph, packet delivery ratio remains high i.e 200% at a particular time.

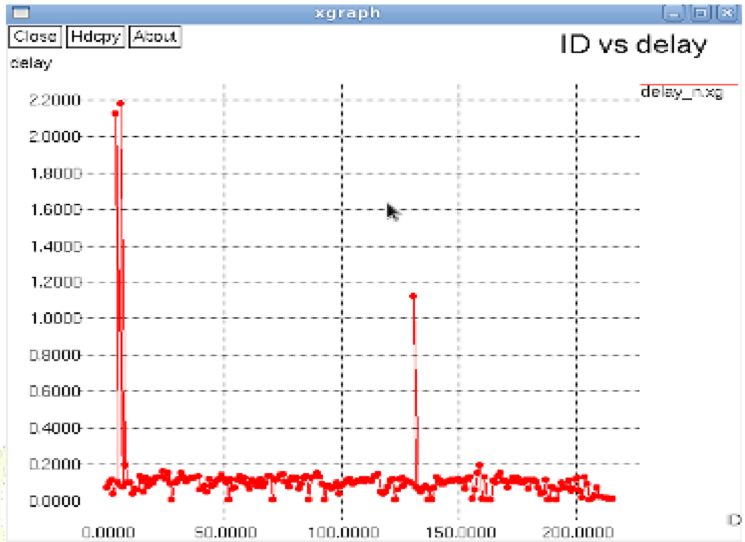


Figure 7: Packet ID Vs Delay

The above graph shows the delay for the each packet identity (ID). Thus x-axis shows the ID of the each packet and y-axis shows the delay which is represented in seconds. The delay for the particular packet ID is maximum i.e 2.2 seconds. This graph represents the delay occurred for each packet during the transmission.

V. CONCLUSION

Generally more number of sensor nodes is required to monitor the large scale areas. In this project, VELCT (Velocity Energy-efficient and Link-aware Cluster-Tree) is a proficient method to construct a network management architecture for WSNs, to improve the network lifetime, connection time, residual energy, RSSI, throughput, PDR and stable link for the sensor nodes, whereas each cluster member chooses the cluster head with better connection time and forwards the data packets to the corresponding cluster head in an allocated time slot. Similarly, the sink or DCN elects the one-hop neighbor DCN or cluster head with maximum threshold value, connection time, RSSI and with less network traffic. From the simulation results, it is revealed that VELCT provides more stable links, better throughput, energy utilization and PDR with reduced network traffic than existing protocols such as EEDCP-TB, CREEC, CTDGA, MBC and CIDT.

V. REFERENCES

[1] H. Karl and A. Willig, “Protocols Architectures for Wireless Sensor Networks”. New York, NY, USA: Wiley, 2005.

ISSN 2395-695X (Print)
ISSN 2395-695X (Online)

International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST)

Vol. 2, Special Issue 10, March 2016

[2] S. Chen, S. Tang, M. Huang, and Y. Wang, “Capacity of data collection in arbitrary wireless sensor networks,” IEEE Trans. Parallel Distrib.Syst., vol.23, no. 1, pp. 52–60, Jan. 2012.

[3] K. Akkaya and M. Younis, “A survey on routing protocols for wireless sensor networks,” Ad Hoc Network., vol. 3, no. 3, pp. 325–349, 2005.

[4] Q. Mamun,“A qualitative comparison of different logical topologies for wireless sensor networks,” Sensors, vol. 12, no. 11, pp. 14887–14913, 2012.

[5] W. B. Heinzelman, A. P. Chandrasekasan, and H. Balakrishnan, “An application-specific protocol architecture for wireless microsensor networks,” IEEE Trans. Wireless Communication., vol. 1, no. 4, pp. 660–670, Oct. 2002.

[6] K.-W. Fan, S. Liu, and P. Sinha, “Structure-free data aggregation in sensor networks,” IEEE Trans. Mobile Computer., vol. 6, no. 8, pp. 929–942, Aug. 2007.

[7] J. Kulik, W. R. Heinzelman, and H. Balakrishnan, “Adaptive protocols for information dissemination in wireless sensor networks,” in Proc. 5th Annu. ACM/IEEE Int. Conf. Mobile Comput. Netw. (MobiCom), pp. 174–185, Seattle,WA, USA, Aug. 1999.