

MOBILE SINK BASED NLEACH PROTOCOL BY USING ANT COLONY OPTIMIZATION

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Abstract

Wireless sensor networks (WSNs) are becoming popular in real world applications. As sensor nodes are battery-powered. So using the energy is well-organized way may result in delay the lifetime of the WSNs. Sensor nodes acquire a negative characteristics of limited energy which pulls back the network from apply its peak capabilities. Hence, it is necessary to gather and transfer the information in an effective way which reduces the energy dissipation. Ant Colony optimization (ACO) is being widely used in optimizing the network routing protocols. Ant Based Routing can play a significant role in the enhancement of network life time. In this paper, inter-cluster ACO algorithm will be used that build upon ACO algorithm for routing of data packets in the network and an attempt has been made to minimize the efforts wasted in transferring the redundant data sent by the sensors which lie in the performance of NLEACH protocol. The overall goal is to find the effectiveness of the NLEACH when ACO inter-cluster data aggregation is applied on it.

Keywords: - WSN (Wireless Sensor Network), Data Aggregation, NLEACH, ACO

I. Introduction

A wireless sensor network act made of ‘nodes’ from a few to several hundreds or even thousand, where each node is related to one or sometimes several sensors. WSN are commonly composed like big figure about little amount also actual short similar sensor node connected by wireless sensor network because aggregate data toward exist thing nearby or

deliever through the sink node by multi-hop wireless communication. It uses mainly:Radio tranceiver, Microcontroller, Electronic circuit.

Wireless sensor networks are along with the broadly used types of Ad hoc wireless networks. The major purpose of WSNs is identifying, getting, and giving out the information inside a monitoring area. WSNs are collected of hundreds or thousands of sensor nodes to be randomly circulated in the monitoring geographical region It does not involve a set network maintain, thus it can be broadly used in lots of field such as military investigation, medical care, monitoring the physical or environmental experience like: temperature, sound, vibration, pressure, and motion at different locations, and other particular areas.

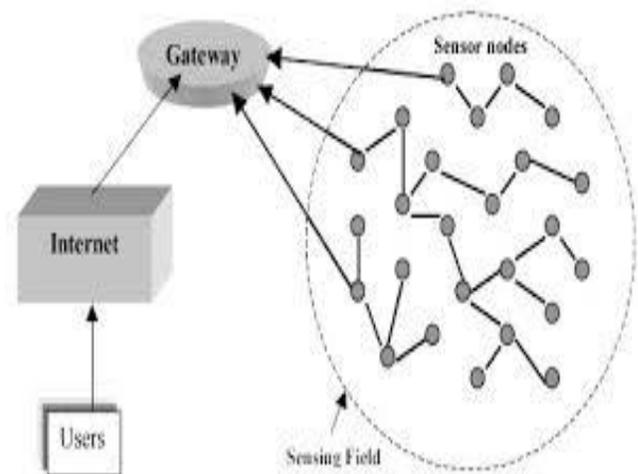


Fig 1: - Architecture of WSN

The four input units seen in structural design of each sensor nodes comprise sensing unit, processing unit, radio unit, and the power unit. The sensor nodes are complete by non-rechargeable batteries mounted on sensors, so, minimizing energy use in organize to expand the duration of network is of significance matter in WSNs. Because the main part of energy use in sensor nodes is outstanding to radio transportation, collection of a capable routing algorithm considerably reduces the statement energy. Routing algorithms is able to decrease the energy use of WSNs during collection of least routes. WSNs, cluster-based algorithms be additional efficient in gathering WSNs supplies largely energy use. By clustering of sensor nodes into several groups called clusters, sensor nodes of every cluster send their information simply to exact sensor nodes in the Cluster head (CH). After that, CH nodes broadcast gathered information to the Base Station (BS). As CH nodes play a significant task in the performance of cluster based routing algorithms, the strategy of CH nodes election deeply affects network parameters i.e. network lifetime, energy consumption rate, and packet delivery delay.

SENSOR NODE

A sensor node, also well-known as a mote, is a node during a sensor network so as to be able of performing arts a few giving out, gathering sensory information and communicating through extra associated nodes in the network. A mote is a node however a node is not constantly a mote. The major mechanism of a sensor node is a microcontroller, transceiver, outside recollection, power supply and one or more sensors. Organizer performs tasks, processes information and controls the functionality of additional mechanism in the sensor node. Whereas the mainly general organizer is a microcontroller, further alternatives that are able to be used as an executive are: a general purpose desktop microprocessor, digital signal processors, FPGAs and ASICs. A microcontroller is regularly

used in various surrounded systems such as sensor nodes since of its short charge, suppleness to attach to additional strategy, ease of program, and small power utilization. A broad idea microprocessor usually has upper power use than a microcontroller; consequently it is regularly not measured as appropriate option used for a sensor node. Digital signal processors may be selected for broadband wireless communication applications, but in wireless sensor networks the wireless communication is frequently reserved i.e. simpler, easier to development modulation and the signal giving out tasks of real sensing of data is fewer difficult.

Consequently the compensation of DSPs are not generally of much importance to wireless sensor nodes, FPGAs be able to be reprogrammed are reconfigured according to supplies, however this takes extra instance and power than preferred. Sensor nodes frequently create use of ISM band, which gives free radio, range distribution and worldwide accessibility. The probable choices of wireless broadcast medium are radio frequency (RF), optical communication (laser) infrared. Lasers need less energy, but require line-of-sight for statement and are responsive to inspiring situation. Infrared, like lasers, wants no transmitter other than it is partial within its distribution ability. Radio frequency based statement is the mainly related so as to fits most of the WSN applications. WSNs

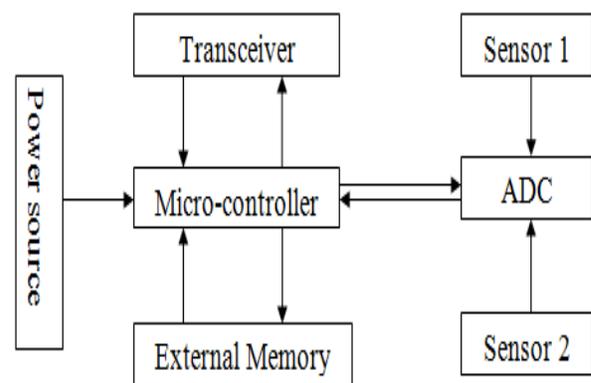


Fig 2: - Architecture of Sensor node

are liable to utilize license-free communication frequencies: 172, 433, 868, and 915 MHz; and 2.4 GHz.

WSN are spatially spread independent sensors to observe physical or environmental conditions, such as temperature, noise and force, etc. and to kindly exceed their information during the network to a main position. The additional recent networks are bi-directional, also enabling manage of sensor action. The enlargement of wireless sensor networks is provoked through armed applications such as front line observation; now such networks are used in a lot of manufacturing and customer applications, such as developed procedure monitor and organize machine health monitoring, and so on.

1.1 DATA AGGREGATION

In data aggregation processes are used to aggregate the sensor data effectively. Data aggregation techniques enhances the network lifetime by gathering and aggregating the data in an energy efficient manner. A sticking method for data gathering in wireless sensor networks involves dispersed system architectures and dynamic way in via wireless connectivity. In the case of energy control wireless sensor networks, the data aggregation techniques plan to eliminate the unnecessary data transmissions thus improving the lifetime of the network. Due to the sensor nodes are strongly filled in the sensor networks, there are possibilities for the close by sensor nodes to be related sensing ranges. Because of this, unnecessary or connected data are composed by the sensor networks. In organize to save the energy, the data connected is dominated which efficiently reduces the quantity of data transmitted in the network. In

wireless sensor networks routing, data aggregation proves to be a significant aspects.

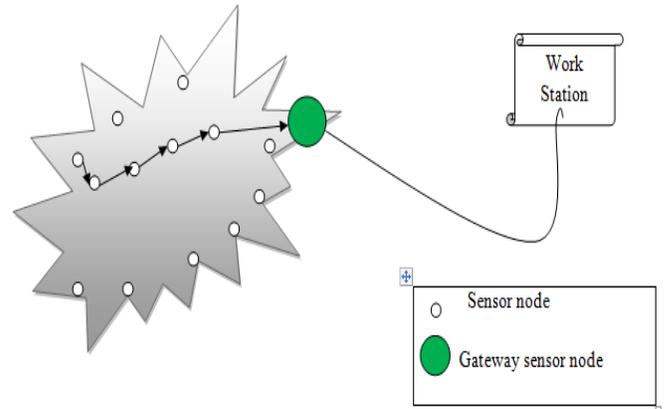


Fig 3: - Data Aggregation

The major reason of the data gathering in wireless sensor network is to get important information as of the in use location. It has been proven that the data redundancy can be eradicated and the communication load can be reduced by the data aggregation techniques. Multiple data sources and a data sink are included in the quality statement example of data aggregation. A data aggregation tree is constructed using the transmitted packet and this is parallel to the stay multicast arrangement. Compensation of the data aggregation: Robustness and accuracy of information acquired from the network can be enhanced capably. The data aggregation requires the data grouping dealing out in assemble to decrease the unnecessary information which is nearby in the data composed from the sensor nodes. Interchange lots is minimized and the energy in the sensors can be preserved with the assist of data aggregation. Difficulty of data aggregation is the cluster heads are also known as the data aggregator nodes which join the data in arrange to throw it to the base station. There are probability of mean attackers of the aggregate data sent to the base station cannot be certain as the cluster head is compromised. The uncompromised nodes send a number of copies of the aggregate effect to the base

station which increases the power extreme at these nodes.

This method is to aggregate the valuable data by removing duplicate of sensor. It support to reduction the communication cost by developing energy use and network life time of wireless sensor network. It also tries to minimize the difficulty of congestion. Data aggregation methods are:-

(a) In Network data aggregation:-It is greater energy chosen as aggregator. This aggregation considered the fix predefined network or area for aggregation on of data. This scheme is correct for fixed node not for mobile node. It is difficult to recover the original data due to in network processing as compression clarify & combination which losses the accuracy.

(b) Cluster based data Aggregation: -In this technique to overcome the problem i.e. transmission delay & damage of result response as node loss in the root to sink & minimize using cluster based size aggregation. To overcome the complexity such as broadcast delay and loss of data caused due to node breakdown in the root to sink, and minimizes using cluster based aggregation. In huge sized network, well-organized communication of data to the sink requires to discover the best lane according to the number of hops. It increases communication charge and reduces the competence. In such a situation instead of communicating data independently to sink, it can be aggregated data to sink. A review of dissimilar cluster based protocol used to aggregate the data and get better the energy use along with network life time.

(c) Grid based data aggregation: - An aggregator selects based on the geographical location with respect to either sink or network hub. It sends only serious in sequence to the sink. This come near is appropriate for mobile environments and not for the restricted actions. It addresses the subject of selecting the aggregation position and best direction-finding of data. It shows improvements in the scheme duration with suitable levels of latency.

(d) Tree based data aggregation: - It uses data centric protocol for aggregation of data from leaf nodes. The data collection is in two phases viz distribution phase and collection phase. In collection phase, all the leaf node forward data to its parent and then it roots toward the sink. The node failure in the root blocks data and increases latency with the decrease in packet delivery ratio.

II. Related Work

Zahra Beiranvand, et al. (2013) [1] have discussed large capacity of energy in nodes of a Wireless Sensor Networks (WSN) is assign as the near network connection. Energy useful routing methods arranged which saves a meaningful allocation of close network communication energy. It checks sensor nodes correctly and make clusters specific technique through access WSN period lower common energy abstraction per each sensor node. Tripti Sharma et al. (2014) [2] have discussed Wireless Sensor Networks collection of nodes which are collect through the field to choose valuable data pass the meaning full data to the base station for another transmission. In WSNs, nodes have fixed power and shorter period so, it is systematic to collect the information in an energy able address and improve the lifetime of network. Madhumita Panda et. al (2014) [3] has discussed Wireless sensor networks consist of independent sensor nodes close to one or more base stations. As Wireless sensor networks continue to produce, they become susceptible to attacks and therefore they require for efficient protection mechanisms. Classification of appropriate cryptography for wireless sensor networks is a important dispute due to limitation of energy, calculation ability and storage assets of the sensor nodes. Symmetric based cryptographic schemes do not level well when the number of sensor nodes increases. Therefore public key based schemes are widely used. We present here two public –key based algorithms, RSA and Elliptic Curve Cryptography (ECC) and found out that ECC have a important advantage over RSA as it reduces the calculation point and also the quantity

of data transmitted and stored. Shweta Agarwal et al. (2014) [4] have discussed a Wireless sensor network are the compilation of individual nodes which are able to perform mutually with physical environment statically or dynamically by sensing or scheming physical constraint. Wireless sensor network develop into a leading result in lots of significant applications such as interference detection, target tracking, industrial mechanization etc. A main difficulty with WSN is to formative a most well-organized protocol for conserving energy of organize basis. The plan of an energy well-organized Medium Access efficient Control (MAC) protocol is one of the major issues in wireless sensor networks (WSN). In this paper we study some individuality of WSN that are significant for the plan of MAC layer protocols and grant a short beginning of several recently come MAC protocols with orientation to energy effectiveness for WSN. Jyoti Rajput et al. (2014) [5] have discussed data aggregation is a significant method to attain control effectiveness in the sensor network. In a few applications such as: data mining, wireless sensor networks, cloud computing data aggregation be generally used. As sensor nodes contain partial battery power so data aggregation techniques have been planned for wireless sensor networks. An analysis to data aggregation is how to protect aggregated data as of disclosing during aggregating procedure as well as get precise aggregated consequences. In this review paper we described a variety of protocols for securing aggregated data in wireless sensor networks. Divyatheja Gadikota et al. (2014) [6] have discussed in wireless sensor networks the compilation of data as of a position of sensors to a common sink above a tree based routing topology is a main process. It is significant to give a declaration on the release time as well as amplify the speed of such data collection in lots of applications. The purpose of minimizing the number of time slots required to total a reporting transmit is first think about as time development on a particular frequency channel. The use of multi regularity development can be enough to reduce

mainly of the interfering as we also estimate the presentation of different channel task method. We observe and approximation number dissimilar techniques using reasonable replication models below the many-to-one communication prototype recognized as reporting transmit. To improve the effects of interference we merge preparation with broadcast power control, and show that power manages help in falling the program duration below a single incidence; location up transmissions by several frequencies is more capable. When interfering is entirely eliminated, then inferior limits on the agenda duration are known, and the algorithms that attain these limits are planned. Jianbin Xue et al. (2013) [7] has arranged a routing method established on Ant Colony Algorithm. This method renews pheromone allow to the direction length, to access the shortest direction against the starting node to end node. The interval is enough there but the energy is not huge. Thus, the nearby the interval, the lesser the energy is not necessarily. Uncertainly demand toward choose the direction give to the energy need of the direction. It is situated about the energy call through refresh the pheromone and that arrangement the cluster head node to the coming node. Again, search a direction which the transmission energy need of the network. Jyoti Kaurav et al. (2013) [8] has planned wireless Ad hoc and sensor networks give simple, effectual and cheaper solutions for actual existence multidisciplinary troubles because in armed, robotics, climate forecasting and medicinal discipline. The energy constraints and safety issues approach straight in brain as discussion of WASN. Because the areas of WASNs are rising, safety and energy wants challenging concentration so that the network does not consequences in a breakdown. As conversation regarding energy there are three major areas of WASN which preserve be worked in front get well their capability. They are: sequence, circuitry & topology and direction-finding protocols used. Now we are functioning merely on the protocols with specific assumptions used for the node hardware. In arrange to make sure energy

competence by falling quantity of transmissions; data aggregation system this ensures concentrated total energy use of the network as fine.

It is demonstrate that Data aggregation can help in minimizing the duration improving the energy effectiveness of a WSN, reducing the quantity of packets desirable, and enabling a high amplify in power competence. As the existing replica assumes uniform nodes but data aggregator nodes use extra energy as compared to further nodes and aggregator nodes can expire away quickly. Guangsong Yang et al. (2013) [9] has discussed Wireless Sensor Networks consisting of a great number of nodes, are generally deployed in a huge area for environmental monitoring, security and observation. The data composed during high tightly distributed WSN is enormous. To recover calculate correctness and extend network lifetime, falling data transfer is required. Compressive Sensing (CS) is a unique travel toward to attain greatly inferior example rate for light signals. In control to reduce the number o data transmissions and put aside additional energy, we relate CS theory to collect and rebuild the spares signals in energy-constrained important WSN. Instead of distribution full pair-wise capacity data to a sink, every sensor transmits only a tiny number of compressive capacities. The processes of CS aggregation in WSN are specified, as well as spare arrangement of signal, observation environment and transformation algorithm plan. The association between observations and rebuild MSE are also discussed. Recreation consequence shows that our system can get better the unidentified data with acceptable correctness as well as decrease worldwide scale cost. Basavaraj S. Mathapatisiddarama et al.(2012) [10] has discussed a current energy arranged for the sensor nodes are securely arranged in the routing protocol called energy maintain various routing sensor networks, there are capabilities as the nearby sensor protocol for wireless sensor accepting data nodes to extend along sensing range. Whereas, irrelevant or aggregation method, data aggregation is mostly used to gather and aggregate data popular an energy

useful way so that parallel data are composed through the sensor networks. In layout to network save the energy, the data combine is affected which lifetime is improve. Shuo Shi et al. (2012) [11] have a cluster method in which cluster heads are randomly chosen against the nodes by energy upon the normal, and the image strengthen method is apply to discover the perfect result among suitable area to make less the energy waste of cluster head. First, we choose a combine of cluster heads and then enchanting retransmission as well as acknowledgement interested within analysis creates a representation of cluster head energy apply. It resolve estimate the quadratic calculation of the distances as of every cluster head toward its associate nodes within the finest result. At last, the great energy operate used for a particular cluster head in the subsequently about resolve exist expected, and every nodes among stability energy better than the measured occupy determination been use near a new surrounding of image strengthen to discover a superior result. Hence, failure of the cluster head used for each about is able to be continued eventually. Bhoopathy et al. (2012) [12] have discussed grave safety risk is originated by node capture attacks in hierarchical data aggregation where a hacker achieves complete be in charge of over a sensor node during straight physical access in wireless sensor networks. It makes elevated threat of data in secret. We suggest a securing node capture attacks for hierarchical data aggregation in wireless sensor networks. Firstly network is divided into amount of clusters, every cluster is headed by an aggregator and the aggregators are straight associated to sink. The aggregator ahead identifying the detecting node choose a place of nodes randomly and transmit a single price which contains their verification keys, to the chosen set of nodes in first surrounding of data aggregation. While some node inside the collection wants to move the data, it transfers slices of data to additional nodes in to cluster, encrypted by individual authentication keys. Every getting node decrypts, sums up the slices and move the

encrypted data to the aggregator. The aggregator aggregates and encrypts the data among the common secret key of the sink. The set of nodes is reselected by fresh set of verification keys in the second round of aggregation. By simulation penalty, we show that the planned technique resolves the security threat of node capture attacks. ChamranAsgari et al. (2012) [13] has discussed a number of algorithms have been developed intended for complexity of data aggregation in wireless sensor networks, each one of which tried to improve networks period. We agree during this complexity by an extra efficient method, and there a heuristic algorithm based on discrete information automata to decide data aggregation throughout creating backbones and formation linked dominating sets (CDS) in network lowers the ratio of responding hosts to the hosts reachable in efficient backbones, we operational this consideration to our algorithm, irritating to increase networks duration think such parameters as sensors existence, remaining and employ energies in assemble to contain an about most excellent data aggregation within networks. Finally, we assess our algorithm intended for make CDS lifetime known improved broadcast range and enlarged sensors number. AamirShaikh et.al (2012) [14] as wireless sensor skill improves; a rising number of organizations are by it used for a wide range of purposes. ZigBee skill is a new characteristic in wireless individual area following Bluetooth. Following to an introduction to this skill, a new wireless meter-reading system based on ZigBee protocol has evolved. This arrangement, which is comprised of ZigBee system and database management system, has much important come yet again such as low cost, low power use, and low data rate. Wireless Sensor Network based on ZigBee expertise is a wireless network which is collected of lots of nodes of ZigBee RF chip, sensor and MCU, especially suitable for application of the remote monitoring system in combustible and volatile environment. Combination of RFID and Zigbee is also likely which revolve away to be benefit for

wireless sensor network technology. A whole summary of wireless sensor network expertise is given in this paper. Wireless sensor network technology has developed into one of technical essential needs of us. Edwin Prem Kumar Gilbert et al. (2012) [15] Wireless Sensor Networks (WSN) are used in collection of fields which in clues armed, healthcare, environmental, organic, home and other profitable applications. Through the enormous sequence in the field of fixed computer and sensor skill, Wireless Sensor Networks (WSN), which is composed of numerous thousands of sensor nodes which are able of sensing, actuating, and relaying the collected in series, have entire important collision all over? This paper presents a general consideration of the selection of examine issues in WSN based applications.

III. PROPOSED TECHNIQUE

Step 1: Initialize network

Step 2: Check whether

‘r’ all current nodes

‘1/p’ optimal percentages become dead if yes then show no. of employed bees representing any set of node is equal to zero else continue next step.

If $r \% 1/p == 0$

(1)

Step 3: Where ‘S’ is no. of employed bees

‘i’ represent any node that wants to become the CH in that round

‘G’ is the set of nodes that selected as CHs Cluster head in previous ‘1/p’ round.

S(i).G=0

(2)

Step 3: Check if no. of employed bees representing any node in residual energy is equal to zero if yes then dead node is dead +1 else continue to next node.

dead= dead + 1

(3)

Step 4: Check if ‘rand’ is less than threshold value if yes then elect as cluster head (CH) and announce

all nodes else wait for join message and join with mean set cluster head.

If $rand \leq T(n)$

(4)

Step 5: find relay node from Cluster Head.

Step 6: Apply Ant Colony Optimization (ACO) on CHs to find shortcuts path between CHs and sink.

Step 7: Communicate data and update energy dissipation.

Step 8: check whether dead is equal to no. of nodes 'n' if yes then Join with mean set (CH) cluster head else continue to step 2.

Is dead == n

IV. EXPERIMENTAL SET-UP

In order to implement the proposed algorithm, design and implementation has been done. Table 1 has shown various constants and variables required to simulate this work. These parameters are standard values used as benchmark for WSNs.

Table 1: Experimental Setup

| Parameter | Value |
|--|-----------------------------|
| Area (x, y) | 100,100 |
| Base station(x, y) | 50, 50 |
| Nodes (n) | 100 |
| Probability (p) | 0.1 |
| Initial Energy (E ₀) | 0.1 |
| transmitter_energy | 50nJ/bit |
| receiver_energy | 50nJ/bit |
| Free space(amplifier) | 10nj/bit/m ² |
| Multipath(amplifier) | 0.0013pJ/bit/m ⁴ |
| a (energy factor between normal and advance nodes) | 1 |
| Maximum lifetime | 7500 |

| | |
|--------------------------------|----------------|
| Message size | 4000 bits |
| m (fraction of advanced nodes) | 0.1 |
| Effective Data aggregation | 5nJ/bit/signal |

Performance Evaluation

On applying Ant Colony Optimization functions, following results will be achieved.

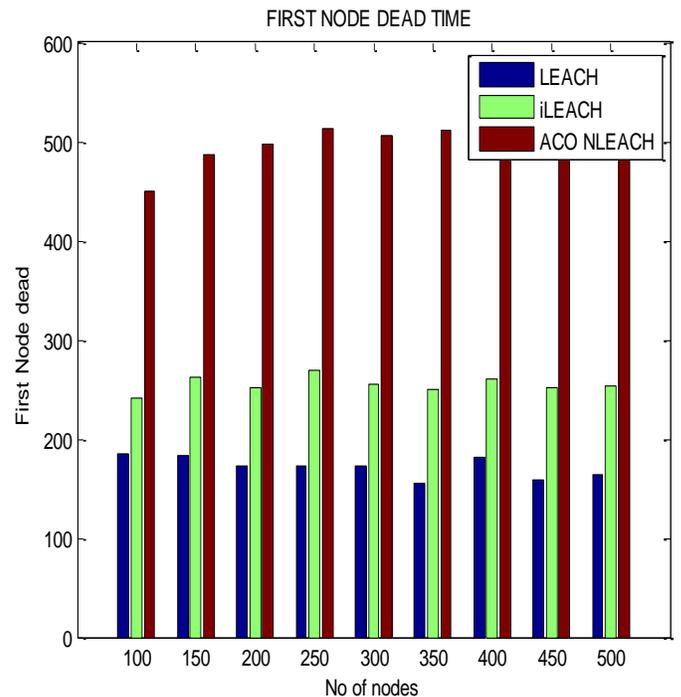


Fig 1:- First Node Dead Time

Fig.1 is showing the active environment of LEACH based ACO. Blue line is representing the LEACH. Green line is representing the iLEACH. Red line is representing the ACO LEACH. LEACH, iLEACH and ACO LEACH representing how data communicate to the base station. These three lines are showing the First Node Dead Time Communication between member nodes to cluster head.

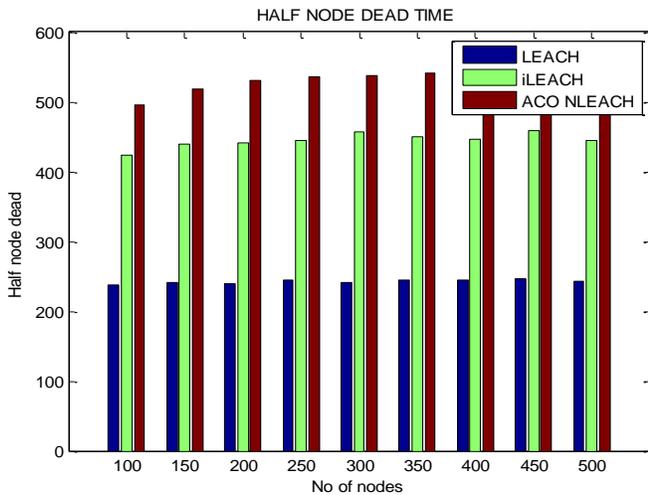


Fig 2:- Half Node Dead Time

Fig. 2 is showing the active environment of LEACH based ACO. Blue line is representing the LEACH. Green line is representing the iLEACH. Red line is representing the ACO LEACH. LEACH, iLEACH and ACO LEACH representing how data communicate to the base station. These three lines are showing the Half Node Dead Time Communication between member nodes to cluster head.

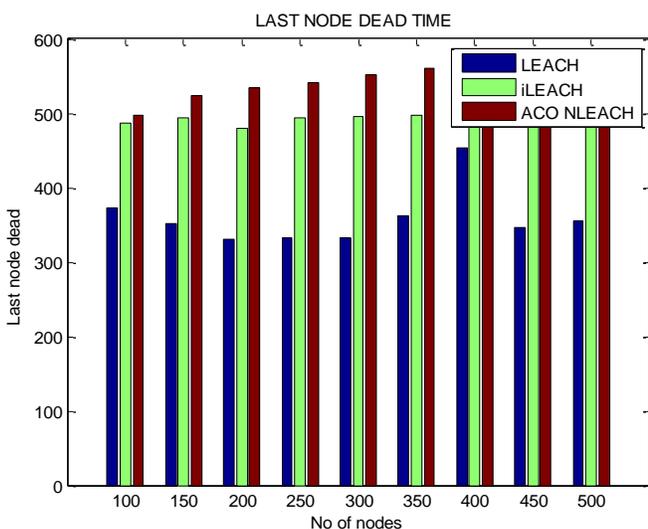


Fig 3:- Last Node Dead Time

Fig. 3 is showing the active environment of LEACH based ACO. Blue line is representing the LEACH. Green line is representing the iLEACH. Red line is representing the ACO LEACH. LEACH, iLEACH and ACO LEACH representing how data communicate to the base station. These three lines are showing the Last Node Dead Time Communication between member nodes to cluster head.

V. CONCLUSION

Wireless sensor networks (WSNs) are attractive accepted in real world applications. As sensor nodes are battery-powered. Therefore use the energy is efficient technique may result in wait the lifetime of the WSNs. Sensor nodes obtain a negative character of inadequate energy which pulls back the network as of concern its peak capabilities. Thus, it is essential to collect and transmit the information in an efficient way which reduces the energy dissipation. Ant Colony optimization (ACO) is being broadly used in optimizing the network routing protocols. Ant Based Routing can play a important function in the improvement of network life time. In this paper, inter-cluster ACO algorithm resolve be used that construct upon ACO algorithm for routing of data packets in the network and an attempt has been made to reduce the efforts wasted in transferring the unnecessary data sent by the sensors which lie in the performance of NLEACH protocol. The overall goal is to discover the efficiency of the NLEACH when ACO inter-cluster data aggregation is applied on it.

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