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IMPROVE PERFOERMANCE OF MOBILITY AWARE ENERGY EFFICIENT CONGESTION CONTROL IN MOBILE WIRELESS SENSOR NETWORK BY WLAECH

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ABSTRACT

In this research, a protocol that is mobility concerned & congestion controlled in terms of energy is put up as W-LEACH (Weighed Low Energy Adaptive Clustering Hierarchy Aggregation Algorithm) for WSNs(wireless sensor networks). W-LEACH is constituted on the schema of hybrid LEACH protocol that sends the signals to sensor nodes to wake up or go to state of listening to save energy. The mobile WSN is said to be comprised of several wireless mobile nodes & base station that formulates a network on ad-hoc basis. Such network is deployed in those regions like underground. Every node is provides with a confined amount of energy & mobilization in a randomized pattern. As the expenditure of energy is a high recognized factor, this issue is solved by the hierarchal protocols such as LEACH. The protocol of W-LEACH I considered as extended version of LEACH which provides durability to network. Though, the protocol requires location of sensor for regulating the network & hence it cannot be deployed in regions where no mobility is possible. In this research, a conventional algorithm is improvised to some latest protocol that is termed as W-LEACH Decentralized for providing durability to network without involvement of any kind of maps. By this the protocols of SMAC & TSEEC are put in contrast for the lasting time & absorption of energy by implementation of Network Simulator. In this document, the performance of Network is enhanced & ration of packet delivery for a 50 MSN & 100 MSN with 3 CHs.

1. INTRODUCTION

The wireless sensor networks are comprised of self dependent sensors that imply a sharing technique to watch over the physical attributes like pressure, sound, temperature & vibrations & this information is shared with the main stations. The devices are used for purpose of monitoring which has three sub elements that are described as: storage, processing & sensing sub system. The enhancements in WSNs along the divided robotics methods [1] that formulated some modern sets of MWSN which is termed as Mobile MSN. These MWSN possess a structure that looks similar to the WSNs but they are incorporated with implicit & explicit methods which gives it an ease of mobility to sensor nodes so they are able to move in a provided region (such as underwater, terrestrial robot car) with respect to time [2]. Further MWSN can formulate their own positioning coordinates with the help of relative techniques (like localization methodologies [3]) or either absolute methodologies (like GPS). There are few categories of MWNS which can be further disintegrated into sum categories that are: (1) high mobility. In such a type, devices gain some velocity in themselves like cars, humans etc. (2) almost static. In this situation, devices possess a very slow speed in mobility like robots. (3) Hybrid. In such method, both types of classes, static & mobile are considered like sensors placed in cars that are in motion [2]. The applications & need of MWSN got diversified by the conventional WSNs which had some issues related to congestion & energy along with them. Any MSN that is integrated to a MWSN is comprised with a battery but it is highly difficult to recharge the battery & in few circumstances the battery can't be charged even. Thus, fundamental unit for transformation of energy is taken as some crucial design incorporated in MWSN & it is felt as important to enhance the durability of network & other attributes like bandwidth, efficiency, latency etc. It is clear that the functions transmission of signals, receiving of signals & listening ideally to drain of energy that occurs in chain. Also congestion puts an adverse impact on the retention of energy. The transmission of information in a constant manner leads to approach the state of congestion when the data is relayed from nodes to sink & it causes some loss to packets that also leads to deduction in aggregated efficiency of network. Eventually the

proportion for absorption of energy can be reduced by employing a MAC protocol which allots the recourses that are being shared by various sensor nodes in a MWSN. As per the described limitations, the aim of this research is to assign such mobility aware MAC protocols that are energy efficient in a MWSN. The algorithm proposed for scheduling targets towards attaining an energy efficient traffic that is sensitive with respect to time. Further aim is to attain the minimal absorption of energy. TSEEC incorporates some patterns of mobility that activates the protocols to acts dynamically for regulation of patterns of mobility so it can easily get along in low & high mobilize sensor conditions. TSECC already takes this assumption that MSNs are aware of their positioning by employing any methodology for localization [2]. This data about positions can be used for drawing the patterns of mobility by making use of [4]. In main paper, reason for congestion is explained in two different classes which are (1) NLC i.e. Node Level Congestion & (2) LLC i.e. Link Level Congestion. The overflowing of buffer leads to NLC. And in the situations when huge amount of information is extricated by associative nodes on the same instance, it leads to LLC. So, a protocol that is constituted on STDMA is employed for enhancing the performance of LLC & NLC & makes the network for efficient in terms of energy. Every MSN is permitted to share the static information of Hello Packet to CH by support of STDMA. The Hello Packet is comprised of information about position, information of battery & a distinct ID in a cluster. After that CH then makes use of feedback it receives from MSN along the methodologies of TDMA for allotment of slots of time to the MSN in a particular cluster. Such modern technology makes TDMA more efficient in terms of energy & also leads to reduction in congestion on sink side in MWSN. Such methodologies act fine in that situation where the mobile nodes are either able or not able to detect the physical attributes of environment & join or leave the other clusters & CH acts like a coordinator in this time period. The shortages in WSN of static type [5,6] are moderated by mobile sensor nodes.

With the rise in population, the diseases in human have also increased. The networks in nursing homes & private homes support the residents by giving them constant monitoring of medical conditions, improvisation in memory, controlling appliances & communication in any situation of emergency. Researchers working in the field of networking & computers are working to enhance the scope of healthcare. There are three aspects considered in implementation of WSN for medical purpose: optimization for absorption of power, security techniques, enhancement in transmission of data for medical purposes, regulation of WSNs. The systems like wireless physiological data monitoring incorporates a radio channel to transmit some cardinal signs of a radio channel by the wearer biomedical sensor devices to coordinator. Patients are able to wear up the devices that are able to identify physiological circumstances wirelessly & transmit this information to doctors on the same instance. The health monitoring systems that are wireless gains various superiorities over the wired ones. First advantage is that the patients will not have to wait for their turn to have a meeting with doctor. Also it saves the costing of the doctors & hospitals by implying the wireless systems. It helps the patients to do their regular tasks even under the observation of doctor. Also these systems can create some medical emergency if there is any drastic change is observed in patients.

The basic constituents of applications of medical science in future integrating them with the present practices, long term & live monitoring, care to patients suffering from chronic diseases, handicapped persons. This wireless system will take the healthcare from conventional hospitals to various other fields of implementation like retirement homes without putting any much burden in terms of cost. WSNs have a lot of advantages as it has the mentioned characteristics:

- Probability & discreetness
- Positioning & Scalability
- Real time & always activated
- Reconfiguration & self organization

Background: WSNs are the new emergence in field of technology to provide an ease of living. A genuine case is implied in these several attributes like motion of respiration, blood pressure etc. By making use of some devices such a PDA, these attributes can be attained & processed.

2. PROBLEM STATEMENT & EXISTING DESIGN

As WSN possesses a nature of broadcasting, it is not an easy task for inclusion of control of congestion on the node of sink. So, another protocol of MAC is needed that focus on design for making an efficient use of energy & controlling of congestion. The protocols so formed leads to enhance the durability of network & improvise its efficiency. There are 2 states in the nodes of a network that are: (1) state of mobility: in this node travels from a position to another position in a network & (2) state of stagnant: in this a node remains stable at a particular position for a fixed duration. This state lies in two mobility states. It is not possible to execute the algorithm that is based on sharing of time in such scenarios in which the stagnant state either is not present or is present for a very short period of time. In the provided

situation of formulation of TSEEC, duration of stagnant is enough that a node can retain in a cluster & in that duration, it is very easy to execute algorithm constituted on sharing of time with no issues over it. Also, information of nodes can be implied for deciding the model of mobility in the algorithm. Therefore algorithm constituted on sharing of time is executed on mentioned scene. In overview of 3.1.a MWSN is considerably taken that is invaded with n MSNs which are presented in a plane of x & y coordinates. The nodes are put together & they formulate a cluster. In each of the cluster they choose a CH i.e. Cluster Head. CH is responsible for allocation of time durations to the adjoining MSNs by support of STDMA. The static data of MSN is incorporated by the STDMA which has a unique ID, information of battery & information of location.

As this static data is attained, it is assessed by CH & the slots of time are dynamically allocated by CH. Two major stratagems are incorporated by TSEEC that sorts out the delay in network. This delay gets free by those allocated slots of time & several other major problems are addressed. These stratagems are TAL & LBA.

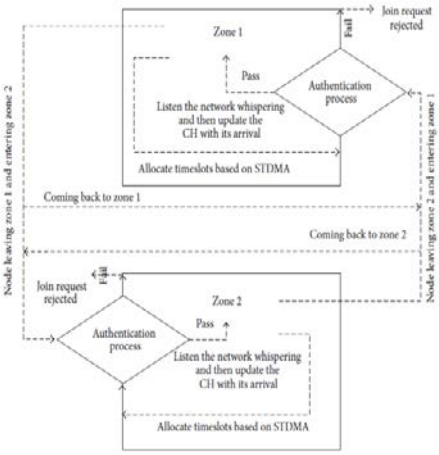

Figure 1: Defined functioning of TSEEC

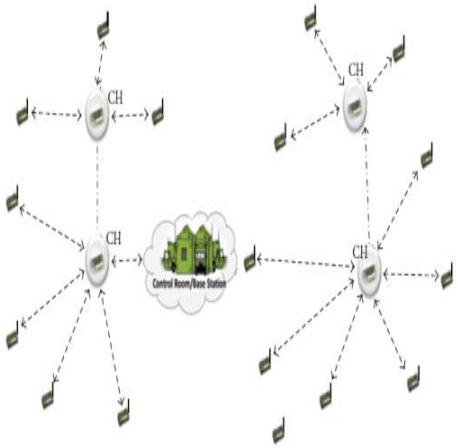

Figure 2: Distribution of sensor nodes along the CH

CH has the ability to manage the sensor nodes. It is presumed that every MSN is aware of its position & their associates in VH. The vicinity is the term for the adjacent areas of sensor nodes that are relatively adjoined for CH. This allocation of sensor nodes gets settled on the initial state, along with a CH. As MSN is a homogenous, so MSN having maximum associated nodes are chosen as CH. As the CH got elected every MSN hooks up to CH on a base of RSSI. When a MSN got request from adjoining CH, the provided algorithm is them implemented

$$Sweight_i > Sweight_j \; \forall \; j, \qquad (1)$$

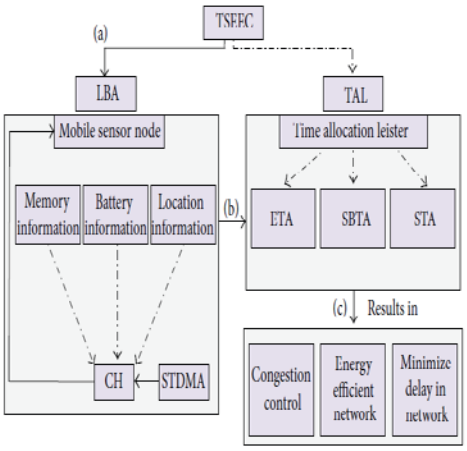

Figure 3:-Functioning of TSEEC.

Here $Sweight$ is termed as strength of signal received of the CH that is invited.

So if

$$Sweight_i = Sweight_j \; \forall \; j, \qquad (2)$$

Then choice is made as per

$$Eweight_i > Eweight_j \; \forall \; j, \qquad (3)$$

Here $Eweight$ is strength of level of energy of CH that is invited if

$$Sweight_i > Sweight_j \; \forall \; j, \qquad (4)$$

A. Problem Statement

A protocol related to control of congestion with mobility & efficiency in energy i.e. TSEEC for WSNs. TDMA & STDMA are considered as the main platform for TSEEC that activates & deactivates the sensor nodes as per need in order to reduce absorption of energy. This leads to deduce the congestion & enhance the retention of energy in LBA & TAL methodologies. Basis of LBA is considered to be STDMA which makes use of data of sensor nodes to allocate the durations to nodes. TAL is responsible for functioning of mobility that is comprised of 3 nodes further which is adjoining cluster, leaving cluster & absence or redundant of data along a ETA, SBTA & STA methodologies. Along with it, protocol of TSEEC provides the patterns of mobility for regulation of

MSN for activation of protocol that will adapt by itself as per environmental situations & mobilization. Simulations of type NS2 & computations reveal that TSEEC performs along SMAC in a very fine manner for absorption of energy & deliverability of packets. Further a contrast of TSEEC along the relative protocols of MAC is also provided. On a base the function for a 50 MSN along 2 clusters & 100 MSN for 3 clusters. On the base paper, proportion of delivery by SMAC & TSECC is around 0.8 for a 2 cluster. The proportion of delivery is 0.7 & 0.5 for TSEEC & SMAC for a 100 MSN along 3 clusters. The proportion of delivery can be improvised.

3. PROPOSED METHODOLOGY

A. Low Energy Adaptive Clustering Hierarchy

LEACH is the short abbreviation for Low Energy Adaptive Clustering Hierarchy that is a protocol of MAC constituted on a TDMA technique that is incorporated with a basic protocol for routing & clustering in a WSN. LEACH targets to minimizing absorption of energy that is needed for formulation & regulation of clusters for enhancement of a forever WSNs.

B. Introduction To Leach Protocol

A model constituted on clustering, clusters are considered as a smaller constituents that is segmented into whole of the network. Several clusters are combined together to form the nodes. A cluster gets an opportunity to lead & is said as a cluster head that takes up a responsibility to route data to main station from node. In the process of transmission, data gets compressed & is transmitted to the upper layer of cluster from low level of cluster. The protocol LEACH that is for routing is employed in WSNs which is responsible for choosing head of clusters in a network. The LEACH is incorporated for minimization of absorption of energy & enhances lasting period of nodes in WSNs.

Several main attributes of LEACH are mentioned as:

- Formulation of clusters & its working is regulated.
- The dynamic transformations in 'lead cluster & 'main station' is allowed.
- The global transmission is minimized by compression done on local basis.

Lesser distance for transmission in nodes leads to deduction in number of nodes that are transmitting to main station. Use of clusters is indeed done to relay the data to main station.

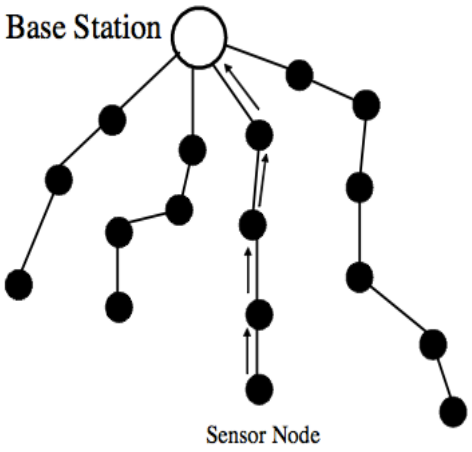

Figure 4: Multi hop planer model

C .W-LEACH

Weighted LEACH: It is an elaborated version of LEACH [7] in contrast to non uniform & uniform network types. In a phase of setting up, main station is constituted on the volume of nodes that form segments of associating nodes into two different sections. A node from the group relay the data till the other nodes remain in silent state. It is determined centrally which nodes will remain in silent state.

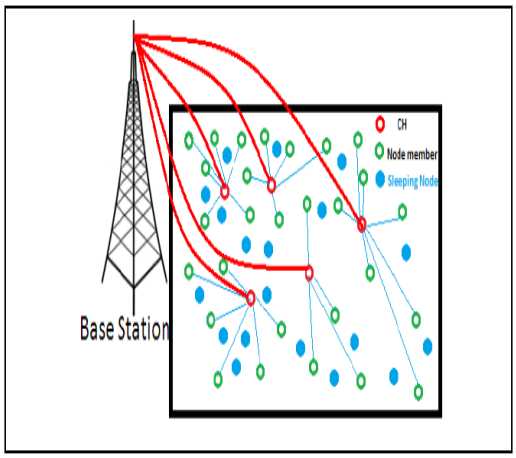

Figure 5: W-LEACH & W-LEACH Decentralized aggregation algorithms

D. W-LEACH Decentralized

W-LEACH is an elaborated version of LEACH to regulate non-uniformed distribution of WSNs. It also enhances the durability of WSNs. The protocol is regulated in a centralized manner as main station helps to choose passive & activated nodes. But this protocol is centralized because the base station is the only responsible for selecting sleeping nodes and active nodes. Additionally, main station requires nodes for positioning for managing the volume of nodes when some extra traffic is put over the nodes. In this document, an algorithm is suggested in a decentralized manner that computes the volume of LEACH with no maps of nodes.

E. W-LEACH Decentralized Details

The W-LEACH Decentralized is considered as a decentralized algorithm. It is also divided into two parts like the LEACH. In this, each f the round commences with setup phase where a cluster is formulated & a CH is chosen. After that the turn is of steady phase where information is transmitted to the base station. Every node chooses its associates before the starting of transmission as per the computed distance & it is responsible to manage the nodes so that no duplicated data is sent by the associating nodes. The nodes themselves decide to be in active or passive state as per the amount of neighbors & this allows the sensor having lesser density to be in active state as per the requirement. By this, the sensors are densely allocated & transmit the data to CH that lead to the deduction in the aggregated absorption of energy & they have to share the data that is sent with their CHs. After that the aggregated absorption of energy is reduced that enhance the life of a network. In every network, the member nodes are chosen in two sets: Active & sleeping nodes.

F. W-LEACH Decentralized Algorithm

In the W-LEACH that is decentralized, the formulation of clusters & selection of CH is performed just like the LEACH. Every sensor node N (1) chooses itself to be a CH by the probability as per equation 1. In the presented chart, it is presumed that N2 is elected to be as CH & N1 and N2 are not elected as CHs. Thus, N2 spreads ADV CH for informing the neighbors as it turns out to be a CH. The N1 & N3 sums to the messages of ADV CH coming from CH & selects the nearer CH. After this, a JOIN REQ is transmitted to CH & the JOIN REQ message that is received determines the associative nodes & the distance in the two nodes. Also, CH gets a message of JOIN REQ from cluster & formulates a TADM schedule. Then the ADVSCH message is spread for informing the member nodes that are able to transmit the information. After receiving of ADVSCH, member nodes tend to compute the amount of nearer associates to determine the least maximum distance. If this is less than the least amount, then node goes to sleep state in the round of N3. Or else nodes compute the time slots to relay the information as N1.

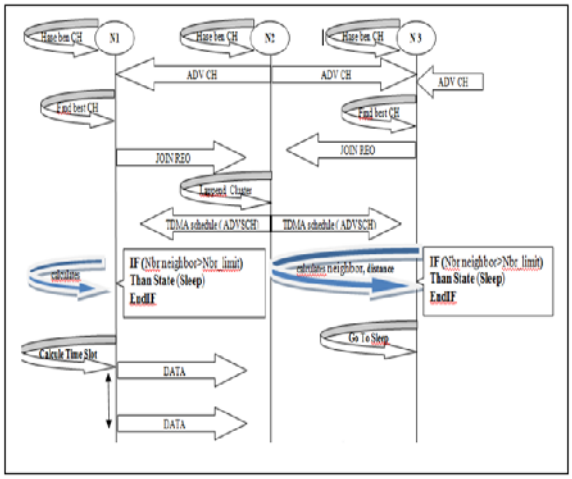

Figure 6: Diagram of W-LEACH Decentralized

4. RESULTS

The deployment of WSNs is done on random basis in a region of area 1000 x 1000 m. the different numbers like 50 & 100 are implied to perform simulations. The distance in MSNs doesn't remain constant but they rely on the pattern of mobility for every MSN of a cluster. In such scenario where 50 MSNs are deployed, there are two of the clusters & every one of them possesses a stable CH. Though in a scenario where there are 100 MSNs, three CHs are appointed keeping the proportions same. At the starting, energy provided to every MSN was 15 Joules. Also a MAC type 802.11n is employed for minimization of delay in network. The CHs that needs the method of frame aggregation employs 802.11n [33] for transmission of packets of data to surface base. The packets of data are produced by MSN by making use of CBR, but hello packet is initiated once when the transmission started.

A. Message Interval Time (MIT)

By the figures 7 & 8, it is presented that MIT in TSEEC is either indulged or not indulged with the scheduling methodologies. There are 50 MSNs in Figure 7 in the two clusters. Every cluster is comprised of a CH where CH1 & CH2, each of them has 25 members. The methodologies of scheduling along periodic & active listening absorb much less amount of energy when put in contrast. As the scheduling is initiated, MSNs get in queue for their turn to be triggered along their CHs & turn on their radios on listening mode. So a minimal amount of energy is absorbed by this methodology which is only 35J, for purpose of listening & there is no need to transmit the packets of data. Though, without active listening scheduling methods every MSN switch their radio to complete active mode for detecting the environment. As an illustration, if 50 sensor nodes are implied, TSEEC without the active method intakes around 58J energy. So the TSEEC with periodic listening is put over as the additional sensing of MSN is prevented by it. So,

active methods of scheduling intakes around 35J energy in whole of the period of communication. While as per figure 5.2, with a rise in MSNs to 100, the consumption of energy will also get a hike that is 118J without periodic listening. This is because more packets are lost as the time slots are not allocated finely. So, some advantageous outcomes are observed while the active scheduling methodology is implemented on rise in quantity of MSNs that is 43J. 6.2 is Level of Energy in Mobile Sensor Nodes

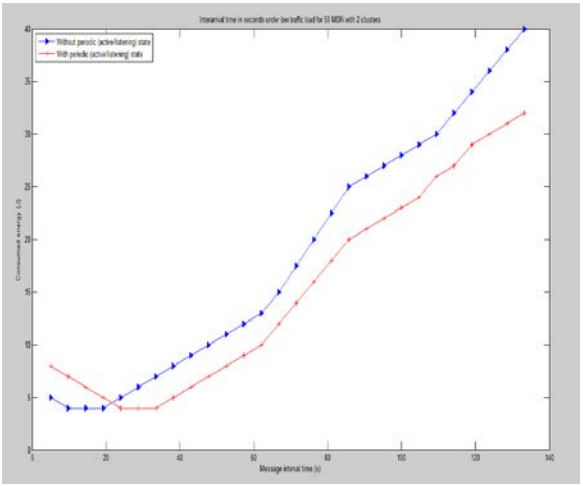

Fig 7: Interarrival time in seconds under low traffic load for 50 MSN with 2 cluster

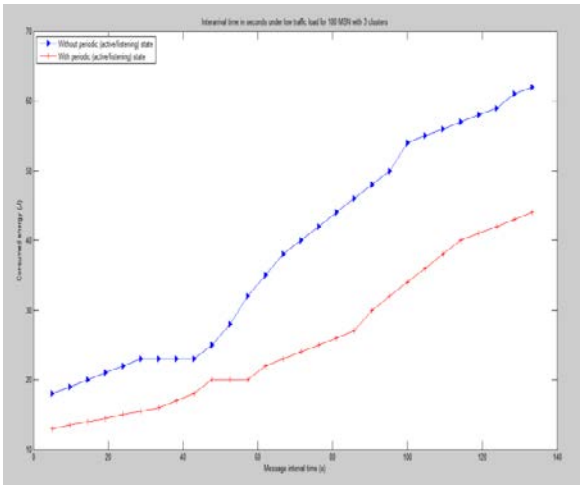

Fig 8: Inter arrival time in seconds under low traffic load for 100 MSN with 3 cluster

B. Energy Level of Mobile Sensor Nodes

As per figure 9, the usage of energy by both SMAC & TSEEC protocols is observed. The SMAC is executed in MWSN to make some comparisons & these outcomes are put in contrast to TSEEC. While in SMAC, the duration of SCMA take more time but this scheduling methodology looses more packets in sleep/listen state. SMAC protocols don't get along with the MWSN, as latter possess some dynamic movements in sensor nodes which also puts an effect on scheduling process. In the WSNs that have information of mobility, a frame of data that advertises location of a node can be dropped by that node residing in state of sleep. Thus, the node that is going in sleep mode doesn't have any kind of information related to pattern of mobility of nodes in a particular cluster. A network incorporated with mobile nodes face an effect when the mode is sleep/listen while talking about the complete absorption of energy. As by figure 5.3, a maximum of 9J of energy is used by SMAC for every cycle. But less amount of energy will be absorbed in TSEEC as it uses active/listening mode. As an illustration, if the quantity of MSN gets increased as per figure 10, efficiency of SMAC is degraded as it absorbs 14.5J in contrast to TSEEC which absorbs 11.5J energy.

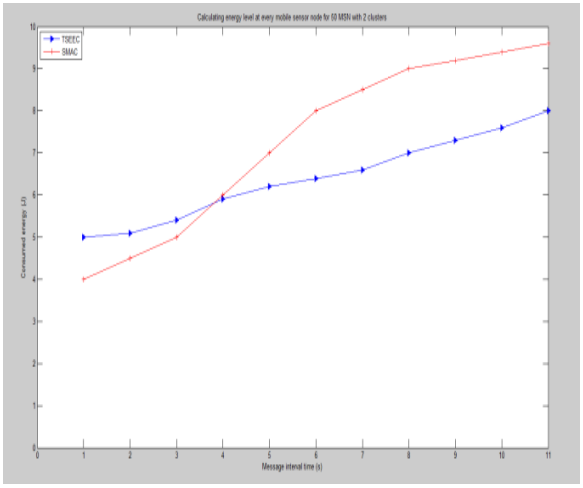

Figure 9: Computing energy level on every mobile sensor node for 50 MSN with 2 cluster.

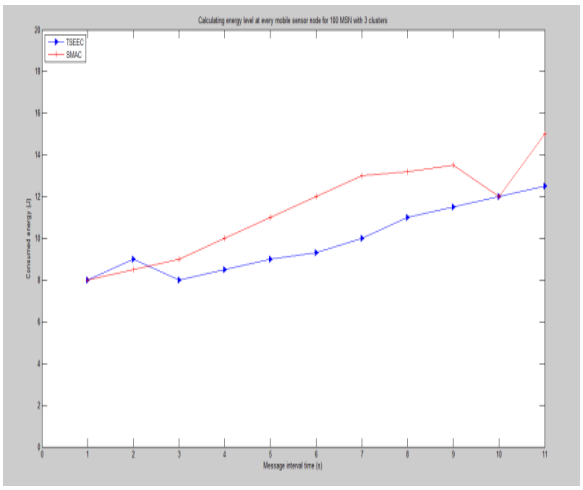

Figure 10: Computing energy level on every mobile sensor node for 100 MSN with 3 cluster.

C. Delivery Ratio

The proportion of delivery of packets is presented in figure 11 & 12 for both of the protocols. While in SMAC, more energy gets preserved because of more sleep listening period. But in such a scenario, load of traffic & patterns of mobility of the MSN leads to drop the packets of data. As no data is received by the MSN the losses some information regarding the clusters. This system also puts an impact on the complete transmission of data so maximum quantity

of packets of data gets dropped because the information is no longer present. As by figure 7(a), rise in the speed of MSN impacted the mechanism of SMAC & so the proportion for delivery gets lowered by 0.5%. Though, TSEEC is comprised of 0.69% of delivery proportion. As an illustration, is the number of MSNs is raised to 100 as by figure 5.4, the proportion of delivery will be lowered by 0.4% though TSECC has no effect by the quantity of nodes in a cluster & so the proportion of delivery will be 0.3%.

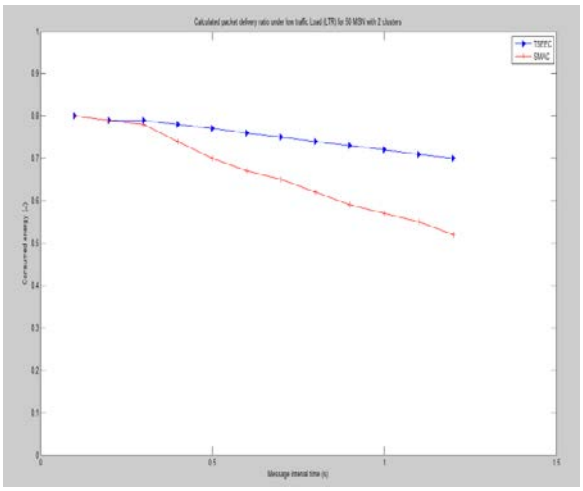

Figure 11: Computed packet delivery ratio under low traffic Load (LTR) for 50 MSN with 2 cluster

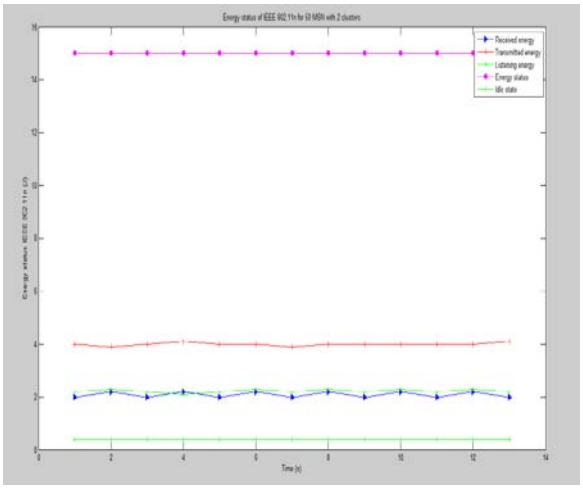

Figure 12: Computed packet delivery ratio under low traffic Load (LTR) for 100 MSN with 3 cluster

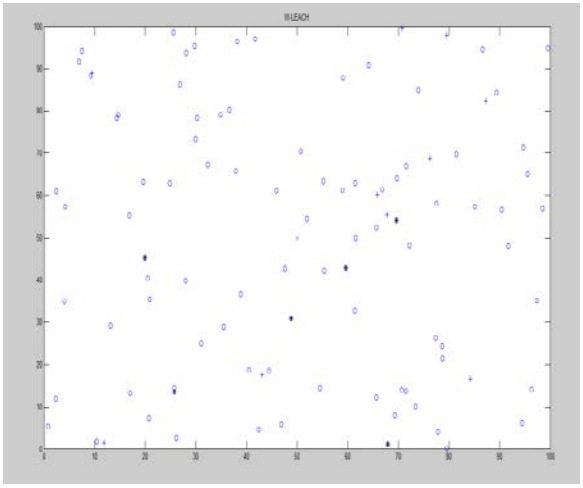

Figure 13: W-Leach protocol design

As by figure 14, it presents a contrast of SMAC, TSEEC & W LEACH protocols. As presented by the graph it is observed that proportion of delivery of packets is higher than 0.8 in W-LEACH but in the SMAC & TSEEC, it is 0.8. The contrast is provided for whole of the three protocols.

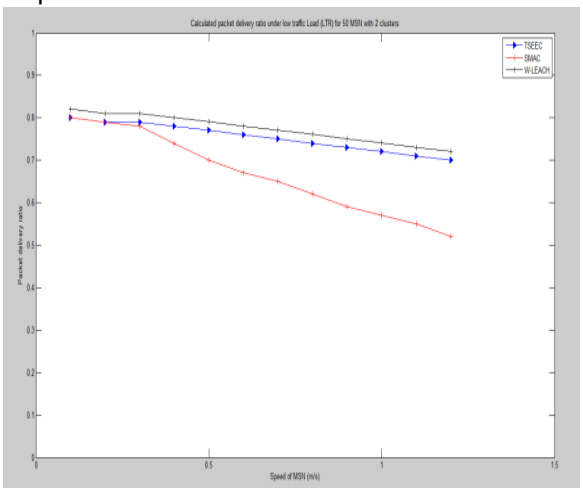

Figure 14: Contrast of TSEEC, SMAC and WLEACH for 50 MSN with 2 cluster

As by figure 15, it presents a contrast of SMAC, TSEEC & W LEACH protocols. As presented by the graph it is observed that proportion of delivery of packets is higher than 0.7 in W-LEACH but in the SMAC & TSEEC, it is 0.7. The contrast is provided for whole of the three protocols.

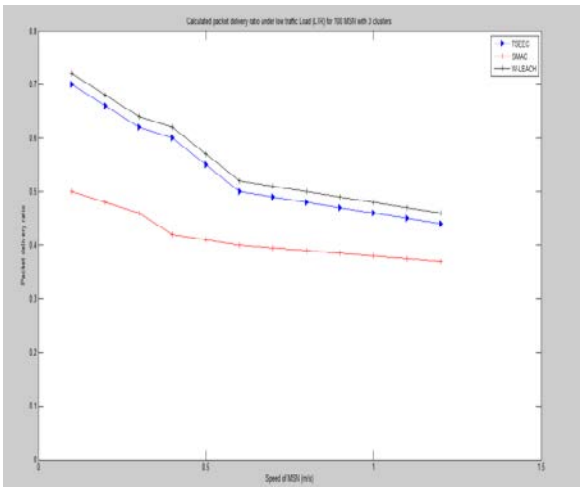

Figure 15: Contrast of TSEEC , SMAC and WLEACH for 100 MSN with 3 cluster

5. CONCLUSION AND FUTURE SCOPE

A. CONCLUSION

For fulfilling the terms such as delay, wastage of energy & control of congestion in a network are examined for presented diversified methodologies. Also for the congestion control, an efficient method is implemented that furnish the efficiency & deduction in delay for inter arrival time & message interval in WSN. We have put the SMAC, TSEEEC & W-LEACH in contrast for the durability of network & decadence of energy by implementation of network simulator. In

this research we have enhanced the performance of proportion of packet delivery for 50MSN with two clusters & 100 MSN with 3 clusters.

B. FUTURE SCOPE

In the future research, we will follow up to find the associated nodes in a mobile sensor. The nodes of mobile sensor are free to move & lead to cause some dynamic variations in networks of WSN. The dynamic variations in topology impact the scheduling of TDMA which lead to delay of network. The further research explains that such schema can have many advantages in several omnipresent networks [26, 27, 29-34]. Thus a model of mobility submerges the non presence of associated nodes as per requirement.

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