Max Flow Improvement with Improved Sleep Awake Scheduling in WSN

Deepa Rani
M.Tech Scholar
Computer Science & Engg. Department
R. P. Inderaprastha Institute of Technology, Kurukshetra

Ms. Preeti
Asst. Professor
Computer Science & Engg. Department
R. P. Inderaprastha Institute of Technology, Kurukshetra

***Abstract*- In this work, In WSN, all nodes consume energy while data transmission. So, due to this mostly nodes gets dead after some time and it causes less throughput and increase energy wastage. So, there is a scope of energy efficiency under sleep awake cycle in WSN. The main objective is to provide energy efficiency in network by improving the performance of system using improved sleep awake concept in WSN. In this work, an on demand routing under asynchronous sleep scheduling is proposed for each sensor. The aim of this work is to improve network lifetime by minimizing the energy consumption by nodes. The proposed mechanism is implemented with MATLAB. In this, only useful nodes are wake up by providing wakeup signal to those nodes and only those awake nodes participate in communication in network. Hence provided energy efficiency and also reducing delay in network.**

***Keywords*-Sleep Awake Cycle, shortest path in Networks, wireless sensor networks, sleep scheduling.**

I. INTRODUCTION

Remote Sensor Network has become an important topic in the entrenched field. WSN is a term used to initiate a class of embedded communication devices that provide consistent wireless connections between sensors, processors and actuators. This presents a brief introduction about the Wireless Sensor Networks (WSNs). It provides pictorial overview of WSNs.Sensing method is used for information gathering about a physical object in which occurrence of events include such as changes in state like drop in temperature or pressure etc. Sensing task is performed by Sensor.Devices like millimetre-scale and micro-electro-mechanical are containing sensors, wireless receiver and transmitter, computational processing unit (i.e. CPU) and a power supply [1]. Sensor applications are used in much area like as mining, petroleum exploration, battle operations and even in weather operations. Wireless network form by these sensor nodes and they are work together to gather data from each other and send information to the base station.A WSN is wireless networks that consist of nodes that are spatially distributed in geographical area. These sensors are used to monitor the physical or environmental conditions. Routers and gateways are combining used to create a WSN system.
The paper is ordered as follows. In section II, it provides the sleep scheduling in WSN networks. In Section III, It defines proposed sleep scheduling in WSN. In section IV, it describes the results of proposed system in WSN. Finally, conclusion is explained in Section V.

II. SLEEP SCHEDULING IN WSN

The main objective for WSN is to maximize the network lifetime and minimize the energy consumption. Sensor network should deploy with high densities to improve the network reliability and improve its longevity. However, if all sensor nodes operate at the same time in such a dense deployment scenario, energy will be consumed excessively. Packet collisions will increase due to the large number of packets being forwarded in the network. In addition, when node density is high most of the data in the network will be surplus due to this sensing regions of the nodes will overlap. A non-sleep node for providing minimum coverage of the network field that is connected to the sink. Depending upon the application user constraints may vary. Using only thelocal information, the sensor networks must be a distributed approach. Location information is very costly so it should be desirable not to require any location information for a sensor network.

A. Sleep Scheduling Techniques

Several methods are used to reduce the energy utilization using sleep scheduling technique. Various sleep scheduling techniques are describing in this section to prolong network lifetime and save energy.

- *Asynchronous Sleep Techniques*

In this technique radio is set as a default sleep mode and wakeup only for check traffic or sends and receive message. The different asynchronous sleeping methods are discussed. When secondary radio receives a signal from different nodes a wakeup signal gives the instruction to the primary radio to data transmission. Secondary radio is used as a low power radio. This method is not applicable for WSN topologies which are densely deployed.Another one that is RICER is somewhat differs from TICER. The receiver occasionally transmits beacons in this scheme. A sender wakes up and listens the disadvantage with this approach is that they are failed to find out about the sporadic schedules of another nodes. Another protocol is wise MAC which removes the drawback of the preamble sampling method. In preamble throughput is reduced and energy loss for sender and receiver. Each node watches the sampling time of its neighbouring nodes and using this data decrease the preamble length. To catch for clock, drift this protocol has special adjustment. Low complexity solution is provided by asynchronous sleep techniques. This solution is not well suited for densely deployed WSNs and for large nodal populations so another technique sleep scheduled can be implemented.

- *Sleep Scheduled Techniques*

Main goal of synchronizing sleep schedules techniques is to reduce energy consumption by permit lower duty cycles. The main problem of S-MAC is that multiple schedules arefollowed by a single node, which can strictly affect the average duty cycle. All the features of S-MAC include in Timeout MAC (T-MAC) [2] with some additional featuresuch as adaptive listening scheme. This scheme matches the active segment of each cycle dynamically. To get used the length of the active period, T-MAC uses a timeout mechanism. Node goes to sleep if in timeout interval it does not receive any messages. T-MAC method lessens the idle listening period as compared to S-MAC and it allows higher data throughput bursts in an adaptive active period.

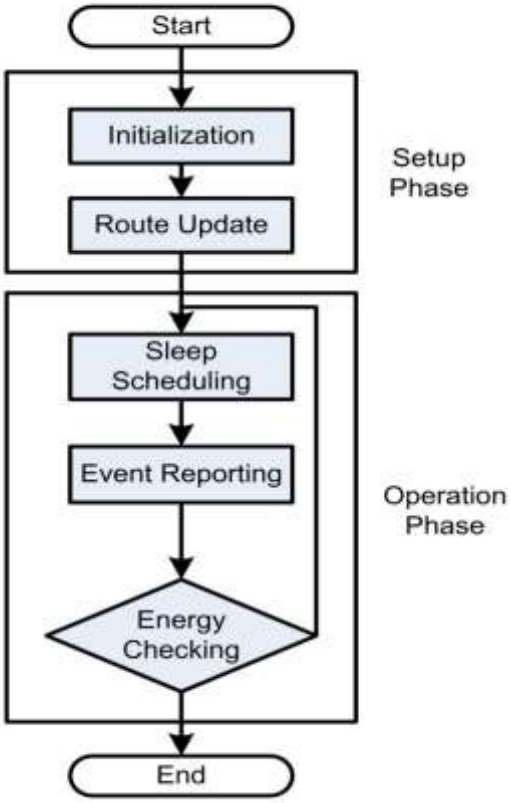

Figure 1: Sleep Awake Scheduling in Wireless Sensor Network

- *On-demand Sleep Scheduling Protocol*

This type of protocol is based on the power management type protocol. The protocol is based on a reality that sensing nodes must be in sleep mode or in off condition when there are no data packets to transmit or receive purpose. The sensor node will become active only there some data packets that wants to be transmitted or received. After that the sensor nodes exchange between sleep & active periods according to the network act. The benefit of this action is that sensor nodes do not waste power by avoidable transmissions and avoidable sensing & therefore the energy utilization is minimized. The main disadvantage of this scheme is that if a different sensor node wants to commune with them then it is hard to notify the sleeping nodes. To overcome this shortcoming use of several radios is required. This methodology is a combination of two channels working at a same time. On demand protocol is a high-performance energy efficient sleep awake protocol for WSNs.

- *The Scheduled Rendezvous Protocol*

The other energy efficient protocol is known as scheduled rendezvous protocol. It is a type of synchronous protocol in this all sensing nodes is simultaneously wake up. In this, a scheduled rendezvous protocol is used for the sleep scheduling of sensor nodes. In this type of protocol according to the wakeup schedule sensor nodes wake up and remain alert for a small-time interval to correspond with their neighbours. The senor nodes will become inactive after the communication of the data is completed. The main benefit of this protocol is that it's crystal-clear that all neighbouring sensor nodes are awake as a sensor node is awake. It is very suitable for data aggregation and allows transmit messages to all neighbours.

The main drawback of this protocol it is a synchronized protocol. To coordinate their clocks this protocol needs all the neighbouring nodes switch the synchronization information. A synchronous protocol having a property that it is equalizing the local times for all the sensor nodes in WSN. This is the most energy consuming protocol due to time synchronization required for all sensor nodes at all time in many applications. It is hard to achieve rather than it is a luxurious protocol. Many other applications want only time management of some sensor nodes at a time.

III. PROPOSED WORK

This part depicts the proposed philosophy of the framework dependent on their destinations. The issue is now characterized and calculations are proposed to determine the issue. It considers diverse planning procedures like synchronous rest booking, offbeat rest planning and proposed on request rest planning technique.

A. Research Methodology

The principle objective is to enhance arrange lifetime by utilizing enhanced interest rest booking calculation in WSN. The proposed calculation depends on vitality adjusting idea in system. At that point, finding the course in every remote correspondence timeslot to augment organize lifetime is proportional to finding the most extreme spill out of source hub to sink hub.pursues its very own wakeup plan for the succeeding time frames. For facilitate we should expect that Tperiod is equivalent to 1. The obligation cycle is characterized as the level of time a hub is dynamic looked at the ideal opportunity for one period Tperiod. The proportion between the prelude lengths P more than one timeframe Tperiod is meant as p, since Tperiod is expected equivalent to 1, in this manner p is equivalent to P in this work. The introduction length in this work is communicated as "prelude p" because of the Tperiod equivalent to 1.
The achieve capacity is characterized as the quantity of the got bundles by the sensor hubs Nr over the aggregate number of sensor hubs N inside the zone. In this manner the achieve capacity is can be composed as R =Nr/N. The quantity of the got parcels can be achieved both straightforwardly by means of the source hub and in a roundabout way through the retransmitting of other sensor hubs in the territory.

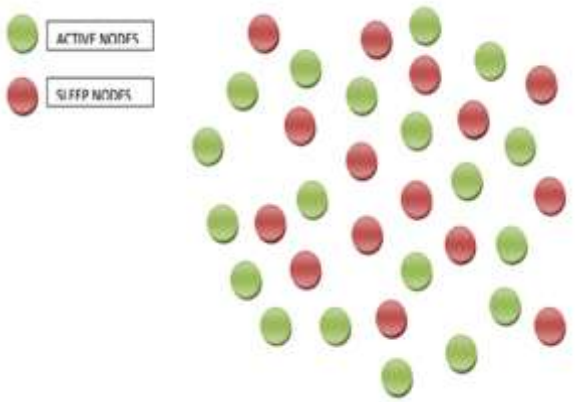

Figure 2: Proposed Sleep Scheduling Scenario

This kind of convention depends on the power the board type convention. The convention depends on a reality that detecting hubs must be in rest mode or in off condition when there are no information bundles to transmit or get

reason. The sensor hub will end up dynamic just there a few information bundles that needs to be transmitted or got. After that the sensor hubs trade between rest and dynamic periods as indicated by the system demonstration. The advantage of this activity is that sensor hubs don't squander control by avoidable transmissions and avoidable detecting and along these lines the vitality use is limited. The primary hindrance of this plan is that in the event that an alternate sensor hub needs to cooperative with them, it is difficult to advise the dozing hubs. To beat this deficiency utilization of a few radios is required. Information channel and a wakeup channel are required for this reason, information channel is utilized for standard information correspondence and wakeup channel is utilized for getting up nearby sensor hubs when required. This philosophy is a mix of two channels working at an equivalent time. On interest convention is an elite vitality effective rest conscious convention for WSNs.

B. The Scheduled Rendezvous Protocol

The other vitality effective convention is known as booked meet convention. It is a kind of synchronous convention in this all detecting hubs is all the while wake up. In Figure 3.3, a planned meet convention is utilized for the rest booking of sensor hubs. In this kind of convention as indicated by the wakeup plan sensor hubs wake up and stay caution for a little time interim to compare with their neighbours. The senor hubs will wind up inert after the correspondence of the information is finished. The principle advantage of this convention is that it's completely clear that all neighbouring sensor hubs are alert as a sensor hub is wakeful. It is truly appropriate for information total and permits transmit messages to all neighbours.A synchronous convention having a property that it is adjusting the nearby occasions for all the sensor hubs in WSN. This is the most vitality devouring convention because of time synchronization required for all sensor hubs at unsurpassed in numerous applications. It is difficult to accomplish as opposed to it is a lavish convention. Numerous different applications need just time the executives of some sensor hubs at once.

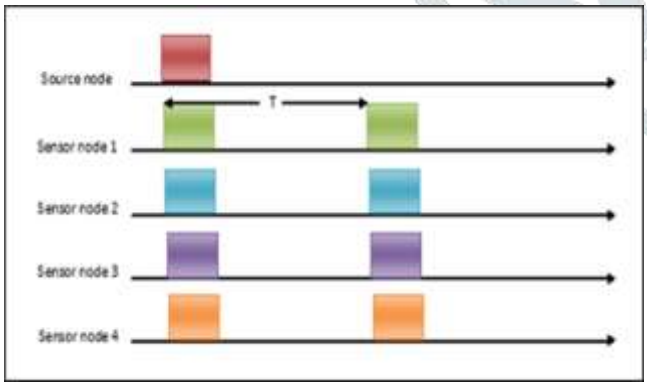

Figure 3: Sleep Scheduling for a Synchronous Protocol

C. Proposed Improved Protocol

For enhancing system lifetime, this proposed is favoured. The main level comprises of battery-fuelled sensor hubs that are thickly sent in the checked region. Their job is to detect and transfer information to an arrangement of sink hubs. The second level comprises of sink hubs, which are matrix controlled and are conveyed at the two finishes of the line. They gather information from the sensor hubs, and transmit the information to a remote checking focus. Because of the length of the observed territory and the relatively little correspondence scope of the sensor hubs, a multi-jump correspondence way from the sensor hubs to the sink hub must be set up. In this convention, every hub wakeup freely and giving confirmation that inside a predefined number of cycles adjoining sensor hubs all the time have covered dynamic period. Figure demonstrates the rest booking of above convention. As appeared in figure just sensor hub 1and 3 can get the transmitted parcel. Here the dynamic day and age of the sensor hubs and the dynamic time of the source hub are sensibly covered. The real advantage of this convention is that at whatever point a detecting hub needs to talk with another hubs detecting hub can wake up at whenever. Along these lines, there isno necessity of trading extra administration data as in the synchronous convention.

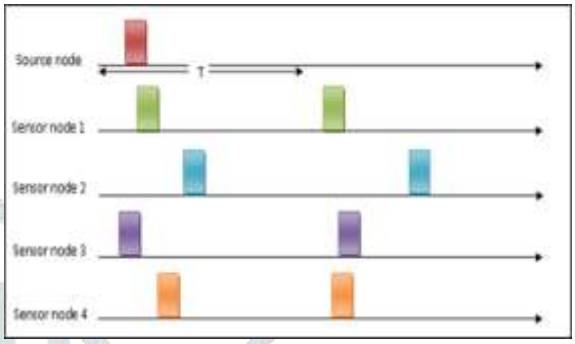

Figure 4: The Sleep Scheduling for an Asynchronous Protocol

The vitality productivity is improved in this technique. In contrast and the planned convention, in one timeframe it is difficult to communicate a message to all neighbouring sensor hubs. Every sensor hub is competent to connect with any of its neighbouring detecting hubs amid settled measure of time; it nearly in no way, shape or form happens that all neighbours are for the most part together dynamic. In contrast with other planned conventions, sensor hubs require to wake up more consistently. Vitality utilization diminished in non-concurrent plot. This methodology is utilized to diminish the obligation cycle and reduce inert tuning in. It exchanges the expense of adapting to sit seeing from the beneficiary to the transmitter.

A sensor hub utilized four kinds of activity: detecting information, getting data, sending data, and process the information to devour the battery control. RF module is the most vitality devouring segment in the WSN. All sensor hubs devour more vitality while sending and accepting information. In remote correspondence transmitting 1 bit of information is very identified with the vitality required to achieve a large number of emphasis of CPU directions. In remote correspondence the utilization of vitality in proficient way likewise increment the system lifetime. Along these lines any sort of convention like MAC, organize layer, and transport layer conventions worked for WSNthat gives the thought to the capable utilization of RF module. These conventions control the message overhead in directing, limiting MAC impact, proficient rest booking, etc. In rest alert cycle WSN systems another tying instrument is proposed. A progressive structure is proposed for convey sensor hubs. The anticipated calculations will be contrasted and some introduced connected calculation and it is more vitality proficient.

D. Proposed Flowchart of System

This work basically performs improved sleep awake scheduling with routing in WSN. In this work, it considers some factors for doing the work.In this work, it thinks about a few variables for taking every necessary step. A hub ought to rest expecting that in any event k of its neighbours will

stay wakeful in order to spare vitality and additionally keep it k-associated. The snoozing or alert condition of hubs ought to be permitted to change between ages with the goal that all hubs can have the chance to rest and abstain from remaining wakeful constantly, along these lines appropriating the detecting, handling, and steering errands over the system to delay the system lifetime. Albeit every hub chooses to rest or wake up locally, the entire system ought to be all around associated with the goal that information transmissions can be performed. Every hub ought to have enough introductory neighbours with the end goal to make it simpler for the hub to fulfill the associated k neighbourhood prerequisite; along these lines, it is bound to be snoozing after rest planning. The neighbour of every hub, which is nearest to sink, ought to be conscious with the goal that geographic directing can use these closest neighbour hubs to make the primary transmission way as short as could be expected under the circumstances. For every hub, however many as could be expected under the circumstances of its neighbour hubs that are nearer to the sink ought to be conscious with the goal that geographic steering can make all transmission ways as short as would be prudent.The hubs' wake interim is expanded as the separation of the hub from the Base station diminishes all things considered hubs send their very own information and in addition go about as transfer hubs for those far from the Base Station. Furthermore, the wake interim of hubs may likewise be expanded because of their topological hugeness. Rest wake booking has been utilized to spare the vitality and expand the system lifetime. Vitality productivity has characteristic trade off with postponement, consequently, typically in such rest wake booking systems, boost in system lifetime is accomplished at the expense of increment in deferral. To accomplish this, defer minimization at three dimensions is watched and tended to: the postponement happened due to movement stack at the hubs close to the Base Station, the deferral happened because of exchange stack at the network hazardous hub, and postponement happened while managing activity burst when an occasion happens.

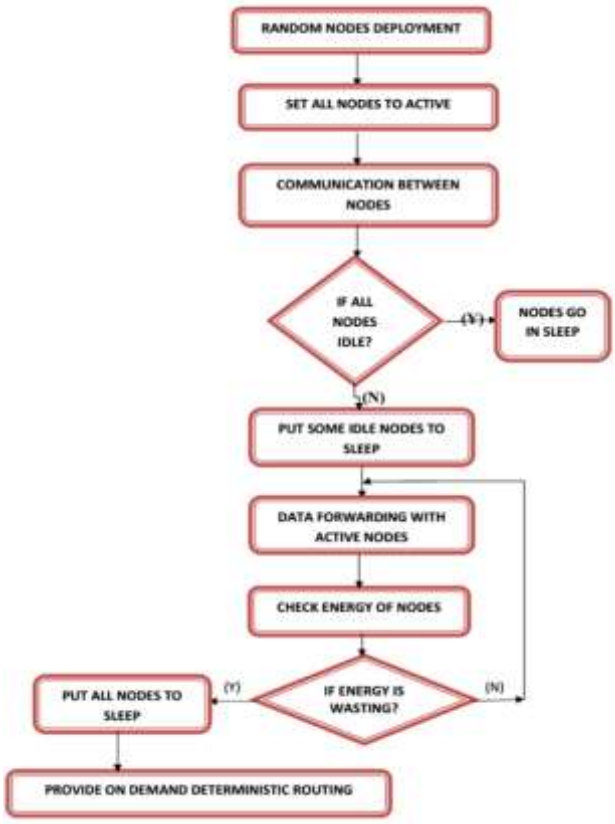

Figure 5: Proposed System Model

IV. RESULTS & DISCUSSION

A. Simulation Results in Synchronous Mode

Following are the implementation results for the scenario. In this work, take the scenario for 50 & 100 nodes and following result will show the information about the placement of sensor nodes in an area. The simulation environment is to randomly distribute 50 sensor nodes to an 25m*25m square. The initial energy of each node is provided. In each round, the sensor node will deliver a packet. All sensor nodes are stationary and homogenous. All sensor nodes can adjust their power levels based on distance.

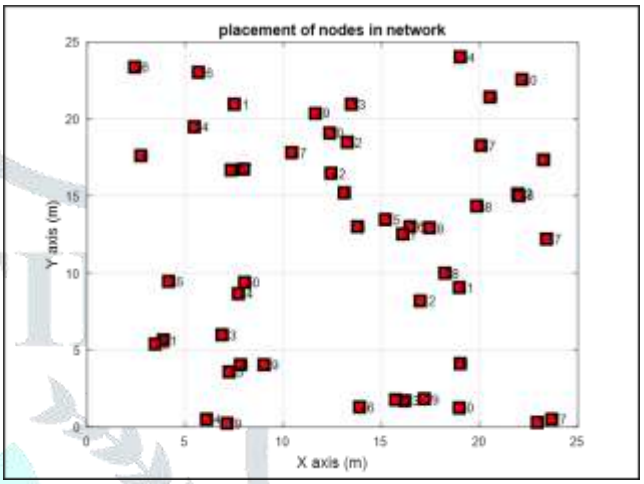

Figure 6: Placement of Nodes

Initially all nodes are in OFF State. If nodes want to communicate with each other, all nodes have a wakeup time and they woke up all at a time i.e. they are synchronous in nature. All nodes are ON & OFF synchronously. They provide communication by multi-hop routing technique. In this, they find the shortest path between nodes and find the best route for source to destination.

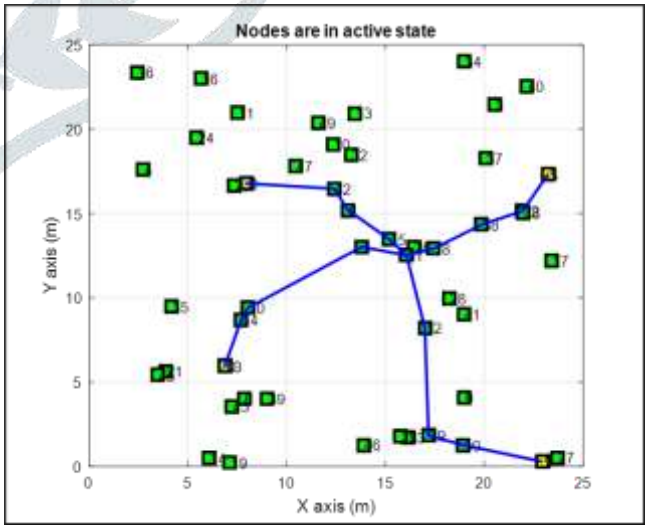

Figure 7: Communication with Other Nodes

In order to reduce the end-to-end latency with energy efficient data transmission proposed a synchronous Wakeup Schedule (SWS) in WSNs. Each node was assigned a particular colour. Data transmission is an important topic of WSNs, as the distance between each sensor nodes is different; the energy consumed by each sensor node is different. When the distance between a sensor node and the

base station is large the data transmission from sensor node to base stations consumes more energy than in the case when the distance is small. Hence the distance between sensor nodes among another and the distance from sensor nodes to the base station impacts the lifetime of the WSNs. Data transmissions can be classified into two categories, namely direct transmissions and indirect transmissions.

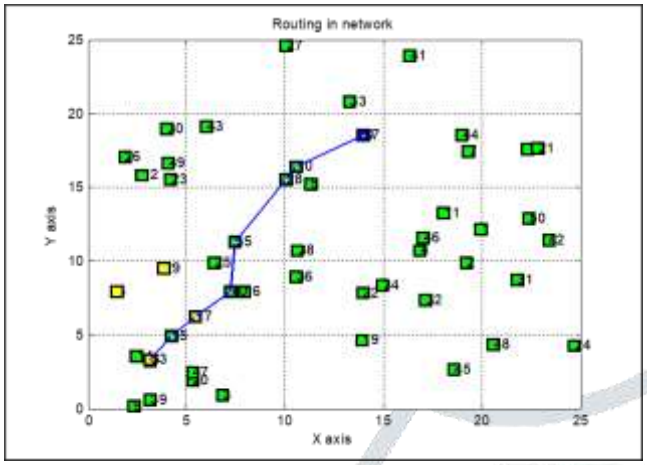

Figure 8: Shortest Path Routing in Synchronous Mode

B. Performance in Asynchronous Mode

In order to decrease the end-to-end latency with energy efficient data transmission proposed an Asynchronous Wakeup Schedule in WSNs. The On-state node was assigned a green colour and OFF State Node are in Red colour. Data transmission is an important topic of WSNs, as the distance between each sensor nodes is different; the energy consumed by each sensor node is different. When the distance between a sensor node and the base station is large the data transmission from sensor node to base stations consumes more energy than in the case when the distance is small.

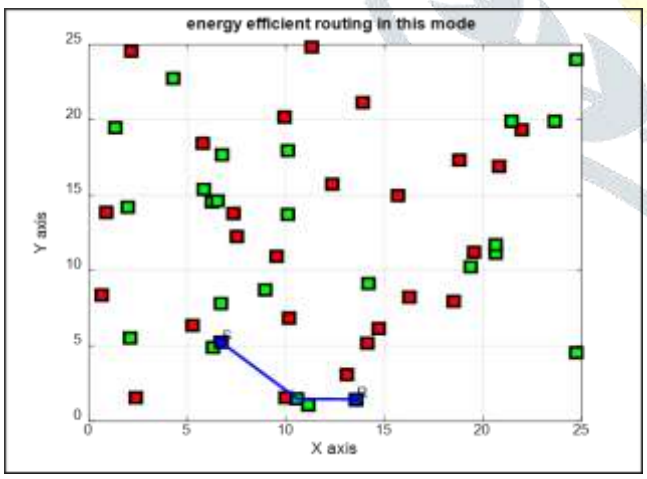

Figure 9: Energy Efficient Routing in Asynchronous Mode

In proposed routing scheme, first, the source node will decide whether to use direct transmission or multi-hop transmission based on the determination standard. If the distance d is less, it will choose direct transmission which is more energy efficient. If d is greater than threshold, it will choose multi-hop transmission. It is worth noting that d is a theoretical value of the threshold distance and sometimes direct transmission is also more energy efficient than multi-hop transmission. After determination of the sub-optimal hop number opt n, the source node will choose a set of its neighbours with distance d as candidates of its next hop. Finally, the neighbour node which is closest to the sink node will be chosen as the next hop.

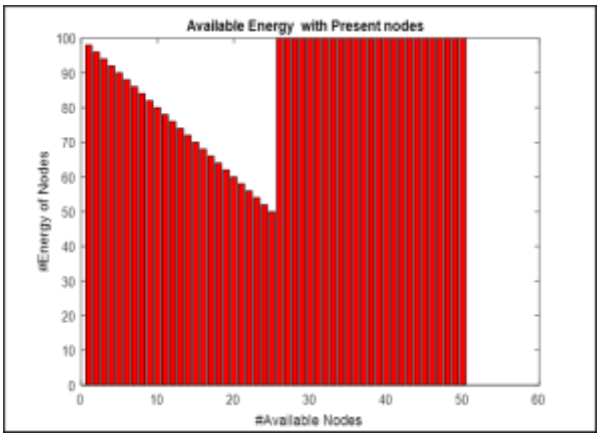

Figure 10: Available Energy in Asynchronous Mode

C. Proposed on Demand Routing

In this case, all nodes are initially in OFF State. As Sender node is chosen and he wants to send data to a particular node. Then he finds initially all present nodes location in the path and stores it. So, only those nodes which are coming in the path gets wakeup call and they may help the sender to communicate with destination.

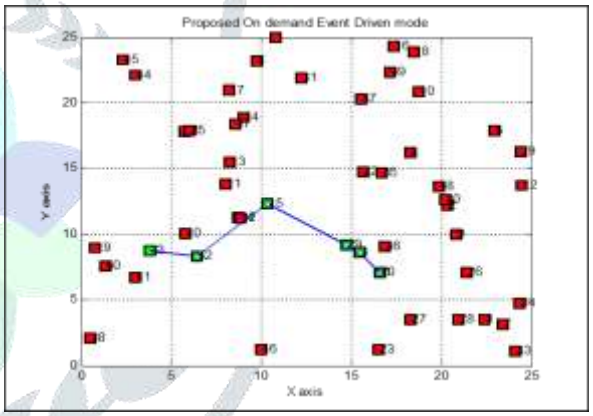

Figure 1: Proposed on Demand Routing

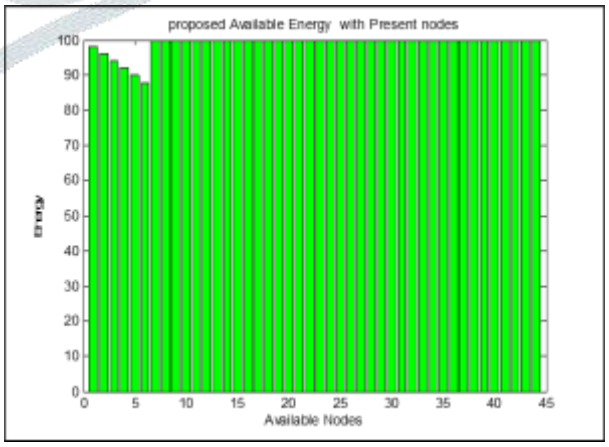

Figure 12: Proposed Available Energy in Nodes

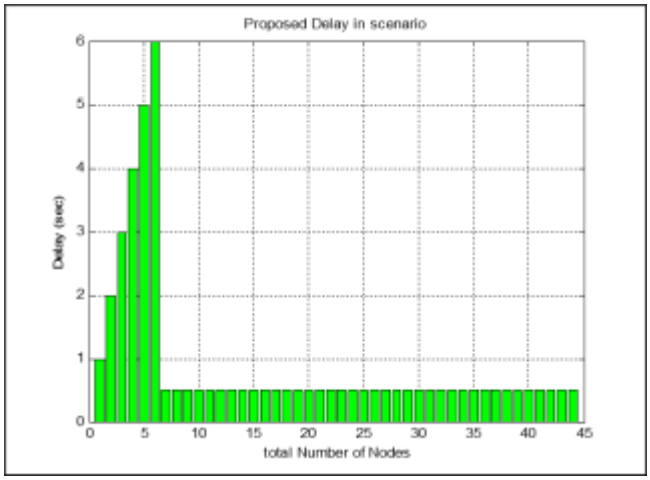

Figure 13: Proposed Available Delay in Nodes

C. Scenario of 100 Nodes

In this, we present the proposed scenarios with 100 Nodes.

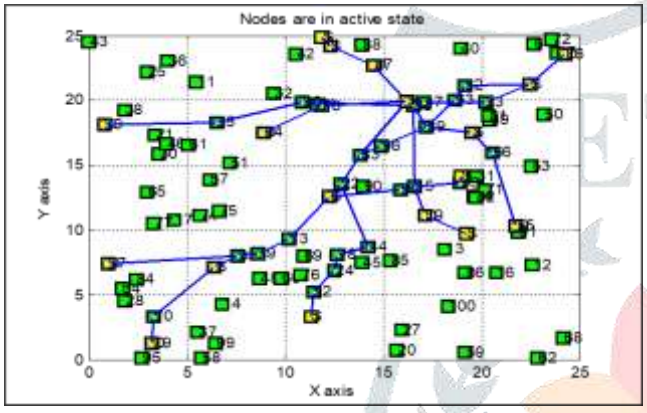

Figure 14: Communication of Nodes in Synchronous Mode

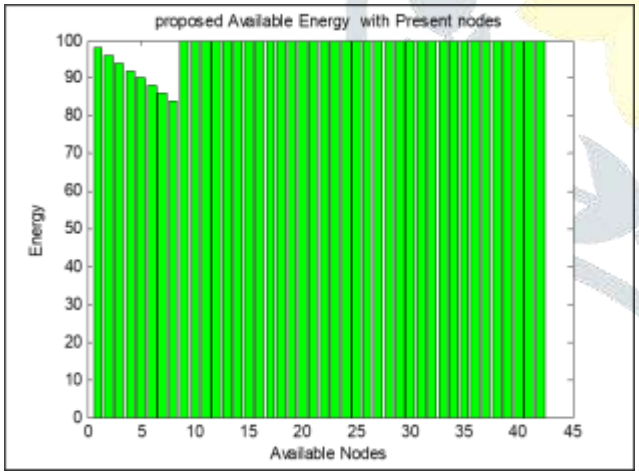

Figure 15: Available Energy in Proposed Mode

The average length of the first transmission path & average lifetime is explored by proposed work based WSNs with a mobile sink is also almost always shorter than that in actual work with a mobile sink. That is also due to that there are much more awake nodes closest to sink. All results are shown in below:

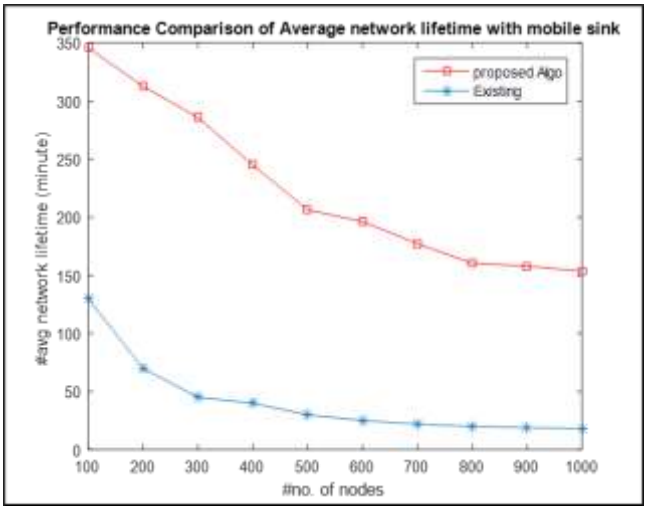

Figure 16: Performance Comparison of Proposed Network Lifetime with Actual Results

V. CONCLUSION

In this work, all nodes consume energy while data transmission in WSN network. So, due to this mostly nodes get dead after some time and it causes less throughput and increase energy wastage. So, there is a scope of energy efficiency under sleep awake cycle in WSN. Also, in synchronous sleep protocol, all nodes get awake at a time so it causes amount of energy is wasted. So, there is a need to develop improved on demand sleep scheduling routing algorithm for energy conservation in WSN using MATLAB. Energy conservation makes sure that the lifetime of the network is maximized. In this work, it presents the sleep scheduling of nodes in WSN. Also, it presents optimal chaining mechanism in network. It takes the scenario of 50 & 100 nodes in network with 25*25 area. In this, it provides different scenarios under sleep awake. It presents synchronous and asynchronous way of communication between nodes. The main objective is to provide energy efficiency in network & also reduce delay. In this, it presents a multipath routing protocol for data transmission. The projected mechanism is implemented with MATLAB. All these are useful for reducing the energy consumption and improve the accuracy. In this, optimal path selection is based on shortest distance between nodes which is to be calculated. It simply show time synchronization for sleep scheduling in first scenario, which requires all neighbouring nodes to wake up at the same time which makes it difficult to use in low duty-cycled WSNs. So, to overcome this, it shows the on demand scheduled routing. In this, only useful nodes are wake up by providing wakeup signal to those nodes and only those awake nodes participate in communication in network. Hence provided energy efficiency and also reducing delay in network. Also, by choosing optimal path, it provides minimum packet loss in this network. The results are compared with some existing approaches and provide improvement in energy & reducing delay. All simulations are done in MATLAB R2015a Tool.

REFFERENCES

[1] Kun Sun, (2006) “Secure and Resilient Clock Synchronization in Wireless Sensor Networks”, IEEE Journal on Selected Areas In Communications, Vol. 24, No. 2, pp. 395-408.

[2] G. Lukachan, (2006) “Scalable and Energy-Efficient Routing for Large-scale Wireless Sensor Networks”, IEEE 6th International Caribbean Conference on Devices, Circuits and Systems, pp. 267-272.

[3] M. U. Ilyas and H. Radha, (2006) “Increasing Network Lifetime of An IEEE 802.15.4 Wireless Sensor Network By Energy Efficient Routing”, IEEE International Conference on

Communications, Vol. 9, pp. 3978 – 3983.
[4] Konrad Lorincz, (2006) "Sensor Networks for Emergency Response: Challenges and Opportunities", IEEE Pervasive Computing, Vol. 3, Issue 4, pp.16-23.
[5] Yao Lan, (2006) "The Research on Certainty-Based Secure Routing Protocol in Wireless Sensor Networks", International Conference on Wireless Communications, Networking and Mobile Computing, Wuhan, pp.1-5.
[6] Justin T. Kautz, (2007) "An Adaptable Energy-Efficient Medium Access Control Protocol for Wireless Sensor Networks", In Proceedings of the 40th Annual International Conference on System Sciences, pp. Hawaii.
[7] Kejie Lu, Yi Qian, (2008) "A Framework for a Distributed Key Management Scheme in Heterogeneous Wireless Sensor Networks", IEEE Transactions On Wireless Communications, Vol. 7, No. 2, pp. 639-647.
[8] Fengyu Ren, (2008) "Self-Correcting Time Synchronization Using Reference Broadcast In Wireless Sensor Network", IEEE Wireless Communications, pp.79-85.
[9] K. Chowdhury and Ian F. Akyildiz, (2009) "Interferer Classification, Channel Selection and Transmission Adaptation for Wireless Sensor Networks", IEEE International Conference on Communications, pp.297-301.
[10] Roxana Albu, (2010) "An Energy-efficient Clock Synchronization Protocol for Wireless Sensor Networks", IEEE International Conference on Communications, pp. 84-89.
[11] Mei Leng and Yik-Chung Wu, (2010) "On joint synchronization of clock offset and skew for Wireless Sensor Networks under exponential delay", IEEE International Symposium on Circuits and Systems Proceedings, pp.461-464.
[12] Yuanfang Chen, (2011) "The Insights of DV-based Localization Algorithms in the Wireless Sensor Networks with Duty-cycled and Radio Irregular Sensors", IEEE International Conference on Communications (ICC), Kyoto.
[13] Luís M. L. Oliveira and Joel J. P. C. Rodrigues, (2011) "Wireless Sensor Networks: a Survey on Environmental Monitoring", IEEE Journal of Communications, Vol. 6, No. 2, pp.143-151.
[14] Elma Zanaj, BlerinaZanaj, (2017) " Link Failure Impact on The Lifetime of WSN", International Conference on Modern Power Systems, IEEE, pp. 01-04.
[15] N. HajiakhoondBidoki, M. Baghbahari , (2018) " Joint Value of Information and Energy Aware Sleep Scheduling in Wireless Sensor Networks: A Linear Programming Approach", IEEE, pp. 3180-3185.
[16] J. Choe, D. Mas Montserrat, (2018) " Sleep Analysis Using Motion and Head Detection", IEEE, pp. 29-32.
[17] Rashi Srivastava, Muzammil Hasan, (2018) " Selective Sleep-Awake Scheduling in WSN-Cloud Integration", IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering, pp. 5002-5007.
[18] Jeehyun Choe, A. J. Schwichtenberg, (2019), "Classification of Sleep Videos Using Deep Learning", IEEE Conference on Multimedia Information Processing and Retrieval, pp. 115-120.