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Energy Efficiency Using PEGASIS Bacteria Foraging Protocol in Wireless Sensor Network

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Abstract*:* Sensor networks containing of nodes with restricted battery power and wireless communications are organized to collect beneficial material from the field. Gathering sensed information in an energy efficient manner is dangerous to operate the sensor network for an extensive period of time. In existing work, in a data collection problematic is defined where, in a round of message, each sensor node has a container to be sent to the unfriendly base station. If each node conveys its sensed data straight to the base station then it will deplete its power speedily. Wireless sensor network is turning into a dynamically imperative and testing investigation territory. Progress in WSN empowers an extensive variety of natural observing and item following framework. Routing is a very important aspect in terms of wireless sensor networks. Routing stands for the sending the required data to the destination in such a manner that it reaches efficiently with high throughput and accuracy. The data is transporting over the network each sensor use some energy in receiving data, sending data. The life of the network be contingent how much energy used up in each transmission. The problem occurs when the transmission path meets with some sort of failure like path failure or node goes to sleep mode. The focus, however, has been given to the routing protocols which might change contingent on the application and network architecture. In this thesis, we have proposed the state-of-the-art routing technique using PEGASIS protocol Bacteria Foraging Algorithm Optimization technique to choose an alternative path in WSNs. And compare the evaluated normal PEGASIS result and enhanced PEGASIS with BFO outcome in terms of parameters such as throughput, accuracy as well as bit error rate.

Keywords: WSN, Routing Protocols, PEGASIS, Greedy Algorithm and BFOA algorithm.

I. INTRODUCTION

A wireless sensor network (WSN) usually consists of a large amount of battery-powered sensor nodes. For lifetime extension, it is of utmost importance in WSNs to design an energy-efficient medium-access control (MAC) protocol that minimizes energy consumption while achieving the end-to end delay constraint to meet applications' requirements. wireless sensor networks are becoming an active topic of research, where sensors are units with sensing, processing, and wireless networking capability. They can automatically collect the data & report the quantities to the sink[1]. Recently, many wireless sensor networks have been designed and deployed for kinds of applications. an important role in many WSN operation models and applications, such as average access scheduling, information fusion, beam-forming, target tracking, etc. WSNs are used in a wide range of potential applications together with military, medical coordination, & robotic exploration, which explains the important attention drawn by these types of networks in research field. As demonstrated by, since sensor nodes are usually battery powered, conserving their energy and prolonging the system life time are prime goals while designing protocols for those networks [2].

Discussed assets could be connected with program kind or components kind. The particular devices that kind community to change know-how are referred to as community nodes. These kinds of nodes will adapt to owners just like pcs, cell phones, hosting space moreover while network components. Notebook sites don't agree on the idea connected with actual physical advertising familiar transfer their impulses, the particular communication protocols familiar organize community traffic, the particular proportions of the community, topology utilized in the particular community. Communities could be categorized while using:[3]

1. Transmission media based networks just like wired sites (communication takes place by means of wires) in addition to Wi-Fi sites (communication takes place wirelessly). [4]

2. System Sizing primarily based sites just like MAN, personal computer community in addition to WAN.[5]

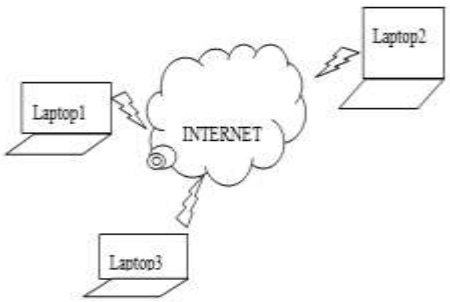

Fig 1. Wireless Sensor Network

Wi-Fi networking is a technology inside which in turn 3 or many computers converse collectively using very common community protocols even though without using cords [2]. The transmission takes place using the help of radio waves at actual physical stage. It's but also known as Wi-Fi or WLAN. The IEEE standard pertaining to wireless network is 802.11.

Wireless networks can be classified into two types:

1. Infrastructure Network
2. Infrastructure-less Network[6]

In research Work, In the building process, to choose a node as the next one on the chain, we make all of the current node's neighbours as candidates and we make all of the current node's neighbours as candidates and take factors such as the remained energy of the candidate [10], the amount of consumed energy if we transmit unit data along the branch between the current node and the candidate, and also the quantity of pheromone on the branch as selection standard. [12] PEGASIS is a

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redirecting method when a chain primarily based method is usually followed.

Table 1: Advantages and Applications in WSN

Sr. No	Advantages	Applications
1.	Energy saving	Military[8]
2.	Simplify network protocol	Smart Parking
3.	Flexibility and autonomy	Environmental monitoring
4.	Wireless Communications	Medical or health [9]

This method employs some sort of greedy approach beginning from the actual furthermost node and each of the sensor nodes form some sort of string just like composition it functions for the process that many node will probably transfer in order to and acquire via it's in close proximity neighborhood nodes. There's a leading light in the string which is in charge of transmitting in the collective facts towards sink node. Nodes take transforms being the best in the network which smoothly allocates the energy load between the nodes. This also do energy sharing and large energy proficiency contributes to the actual extension in the network life span. It tries to cut back the actual delay the facts acquire on the way towards bottom station [7]. Fig. shows the actual on-line of sensor nodes within PEGASIS method.

Bacteria Foraging Optimization algorithm is a new class of geographically confident stochastic international search technique based on mimic the foraging behavior of E. coli bacteria. This method is used for locate, handling, and feasting the food. During foraging, a bacterium can exhibit two different actions: tumbling or swimming [13]. The tumble action modifies the compass reading of the bacterium. During swimming means the chemo taxis step, the bacterium will shift in its recent course. Chemo taxis movement is continuous until a bacterium goes in the direction of positive nutrient rise. After a definite number of complete swims, the best halves of the inhabitants undergo the original and eliminate the rest of the population. In order to escape local optima, an removal dispersal event is accepted out where some bacteria are liquidate at random with a very small chance and the new replacement are initialized at random locations of the look for space.

II. RELATED WORK

[14]"**Meenu and Vandana** "presented a routing protocol for the application of Wireless Sensor Network. PEGASIS protocol is a chain-based routing scheme. One of the problems for Wireless Sensor Networks is the design of energy well-organized Routing Algorithm, because sensor energy is limited. Earlier PEGASIS protocol is based on two parameter i.e. Distance and Residual energy. In this paper modification is being carried out in decision parameter i.e. response which checks the response of nearby node before transmitting the data as well as specifies the proposed procedure for the improved PEGASIS protocol. Major aspire is to increase network lifetime as well as growth the presence of live knobs so that more knobs will remain survive.

[15] "**HetalRana, Sangeeta Vhatkar and Mohommad Atique",** defined as, **t**he region of Wireless Sensor Networks is one of the fast rising and up-and-coming area in the scientific & engineering creation. It is an ad-hoc network that consists of small nodes with sense, compute and communicate wireless ability these sensor nodes are thickly deployed in the sensor field environments. The environment can be an Information Technological structure, a physical world, or a biological system. The major objective of WSN is to sense the critical information from the atmosphere depending on the type of application for which it is deploy and send this information to its Base Station so that it can take corrective actions. These Sensor Nodes speak with each other via various Routing Protocols. Protocols in wireless sensor networks are broadly classified as Flat, Hierarchical and Location Based routing protocols. This document present hierarchical routing protocol, Power Efficient Gathering in Sensor Information Systems and a comparative study on various versions of PEGASIS protocols.

[16]" **Sunita Rani, TarunGulati",** In this well-defined as, Wireless sensor system is an ad hoc network. Each sensor is defined with limited energy. Wireless sensor node deploy into the network to monitor the physical or ecological condition such as temperature, sound, vibration at dissimilar location. Each node composed the information than transmit to the base station. The data is transport over the network each sensor consume some energy in receiving data, sending data. The lifetime of the system depend how much energy expended in each spread. The code of behavior play important roll, which can minimize the delay while donation high energy efficiency and long span of network lifetime. One of such protocol is PEGASIS, it is based on the chain arrangement, every chain have only one cluster head, it is in charge with every note's in receipt of and sending memos who belong to this series, the cluster head consumes large energy and the times of every round rising. In PEGASIS, it takings the benefit of sending information to it the closet fellow citizen, it save the battery for WSN & growth the all-time of the network. The future work is about to select the next neighboring node reliably. For this it will association few parameters such as Space, Residual Energy and Response time. The future system will increase the overall statement and increase the network life.

[17] "**Bipandeep Singh, Er. SimranjitKaur**, in this article described as, the energy efficiency in the WSN is one of the very important presentations Indicator. Sensor network is disseminated event-based systems that differ from traditional statement network. Sensor webs consisting of nodes with limited battery power and wireless connections are arranged to collect valuable information from the area. PEGASIS is series based protocol which is used to concept chain of sensor knobs. In the proposed work BBO is implement along with PEGASIS to get the smallest chain for every round. Moreover to concept chain, energy of each sensor has been taken into account to bring a stability of energy depletion among knobs.

[18]"**Prabhat Kumar, M.P.Singh&U.S.Triar"** extended the work prepared in [5] and he clarified more routing protocols in the field of wireless sensor network. His provided information would be helpful for the future research employees.

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III. SEVERAL ROUTING PROTOCOLS

The aim of this protocol is not to organize the network or maintain the traffic, but to transmit information through hopping and finding the best route to reach the destination. This type of routing is used mainly in flat structures which contain a huge number of sensor nodes. Every node has a separate entry in the routing table. All the nodes in the network are equal and behave in same way in task of information gathering and sensing data [9]. As global IDS cannot be assigned hence this is a data centric approach in which every node is considered as a potential receiver. In this protocol a node sends query in a particular region and waits for a response from that region. SPIN (sensor protocol for information and negotiation) is an example of flat routing protocols. Some other flat routing protocols are Directed Diffusion, Rumor Routing, Minimum Cost Forwarding algorithm, Gradient Based routing, Information Driven Sensor Query and Constrained Anisotropic Diffusion Routing [11].

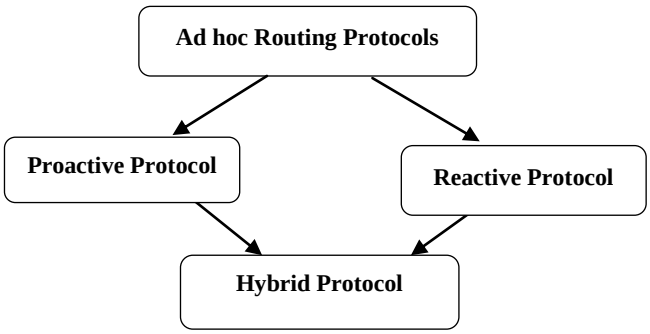

Fig 2.Classification of Routing Protocols

Hierarchical routing protocol is used in hierarchical structures like internet. In these protocols different clusters are formed and then a cluster head is chosen depending on the energy of the nodes. This protocol is efficient in terms of scalability as it reduces the number of entries in the routing table and load on nodes. Hierarchical Routing has two layers. In the first layer cluster head is selected and in the second layer routing is done. Hierarchical Routing reduces the energy consumption in a cluster and reduces the transmitted message by data aggregation and fusion to the base station.

Table 2: Various Routing Protocols

Sr. No.	Proactive Routing Protocols	Re-active Routing Protocols
1.	DSDV	AODV
2.	OLSR	BAODV
3.	WRP	DSR

IV. RESEARCH MATHODOLOGIES

The aim of this work is to improve the throughput by controlling the routing with the change of the power with neighboring nodes. In this work, resourceful routing approach is defined to achieve the energy actual route selection over the network. PEGASIS is collective with BFO for improving energy efficiency and optimizing the network to fulfill desired purposes.

The methodology of implementing the PEGASIS PROTOCOL is quite simple. In this contrast we would be defining with optimization techniques in case of any failure occurrence while the transmission of the data through a wireless sensor network. With optimization techniques would be calling the objective function first for the other optimal path which would list down all those possible paths which may be included to transmit the data with the most possible least energy and the maximum number of data packets transferred.

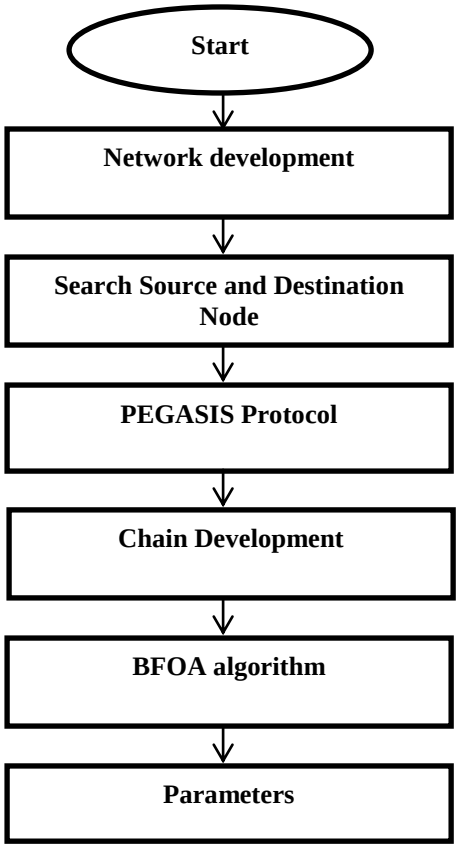

Fig 3. Research Flow Chart

There is a function name fitness function in with optimization techniques which would figure out the best optimal solution for the transmission of the data through the PEGASIS protocol. The ethical PEGASIS protocol would be configured as it is.

1. Firstly node deployment takes place by entering the no. of nodes values, length of network and width of the node in which implementation has been done.
2. Calculate location of x axis and y axis and time stamp of each node.
3. Time stamp of the nodes has been chosen as optimization parameter by genetic algorithm.
4. Starting of optimization
   Calculate time- stamp of node in first block to select cluster head.
   Measure X and Y distance of network.
   Find the coverage set between the nodes.
   Checking of availability of destination.
5. Sending of data packets from source to destination.
6. Selection of any node from coverage set for setting of current node.

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7. Selection of any node from coverage set for setting of current node.
8. Checking of nodes till node9.
9. Termination condition will apply if node is not found between nodes 9.
10. Plot final route between sources to destination.
11. Plotting of remaining nodes in the network.
12. Calculate Packet loss with and without BFO.
13. Calculate End delay with and without BFO.
14. Calculate Packet delivery with and without BFO.
15. Calculate control packets with and without BFO.
16. Calculate network load with and without BFO.

V. SUMULATION RESULTS

The quality of the system is not affected until important amount of nodes die, since together nodes record identical or related data. In this case, the lifetime of the network is the time passed until half of the nodes or some specified portion of the nodes die. The aim of this work is to improve the throughput by controlling the routing with the change of the power with neighbouring nodes. In this work, resourceful routing approach is defined to achieve the energy actual route selection over the network. PEGASIS is collective with BFO for improving energy efficiency and optimizing the network to fulfill desired purposes.

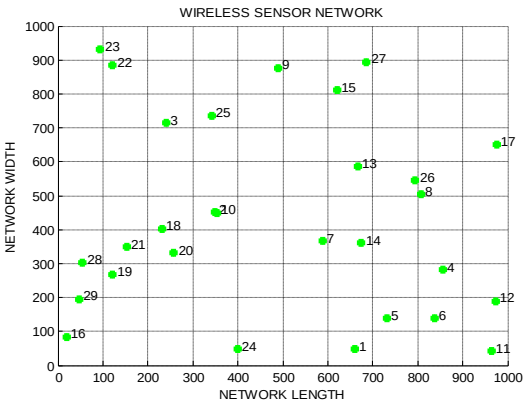

Fig 4. Network Initialization

Above figure shows the network simulation model containing 37 nodes. Length v/s breadth of the network, the channel (CH) captures the routing information from the initiator (source node) and then sends the data from the source to destination node. The blue color circles represent the nodes which can be either active nodes. The whole network has been simulated in 1000*1000.

The above figure defined that the cluster head in the wireless sensor network. In search the cluster head and connect the one node to another cluster head node. Above figure shows the number of nodes that are getting affected due to attack. In above figure 1000 * 1000 network deployment has been done. This figure comes after entering the values for network nodes, length and width of the network.

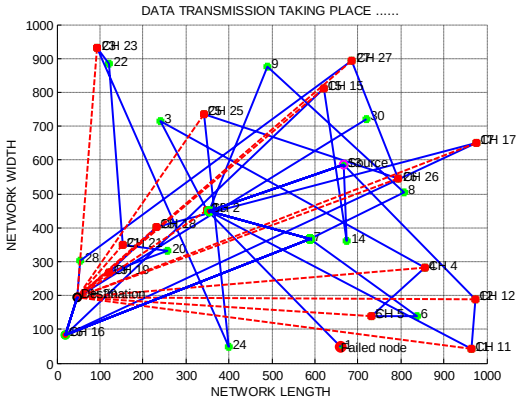

Fig 5. Cluster head Initialization

A foe can easily join the network and compromise a legitimate node then subsequently start dropping packets that are expected to be relayed in order to disrupt the regular communications consequently, all the routes passing through this Node fails to establish a correct routing path between the source and destination nodes.

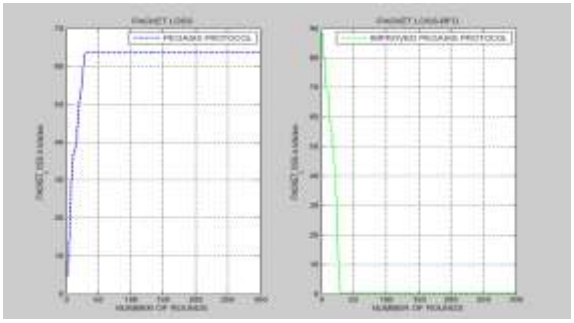

Fig 6. Packet Loss

Packet loss mainly occurs because of the ineffective routing of packets from source to destination in the network. Above figure shows the packet loss improved pegasis using BFO or Normal Pegasis protocol. It has been shown that packet loss is less using BFO.

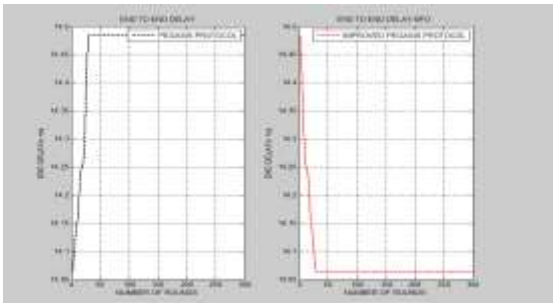

Fig 7.End to End delay

When the node density is high there are more nodes available for data forwarding, and this increases the delivery ratio. PEGASIS offers less packet delivery rates when network size increases. The proposed protocol has maintained constant delivery rates throughout the simulated scenarios because the multipath are selected based on energy availability and minimum delay. Above figure shows the end delay using BFO and with Pegasis.

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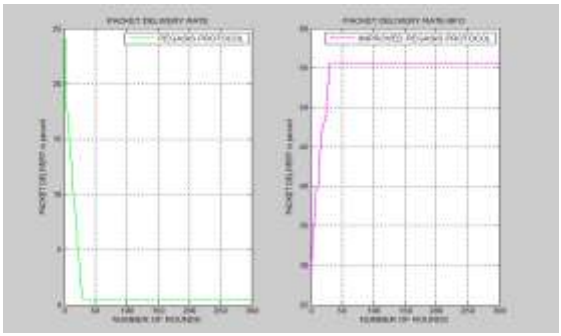

Fig 8 .Packet Delivery Rate

Above figure shows the packet delivery ratio with mobility nodes. It has been seen that packet delivery ratio has been decreased in network without BFO. As packets are sent constantly, they will reach after some time delay to destination and some number of packets is drop between nodes. As round of node increase the packet dropping is also increase.

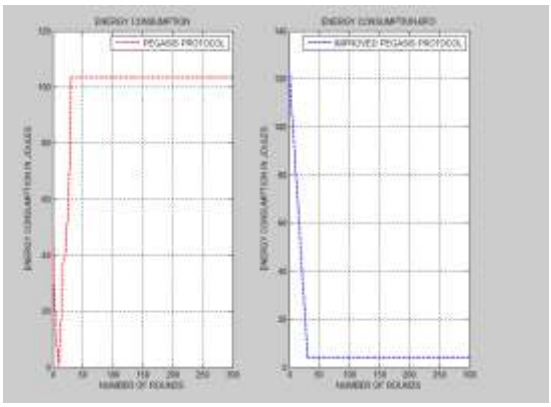

Fig 9 . Energy Consumption

Packet size optimization is an important issue in energy constrained wireless sensor networks. As larger size of packets may cause data bit corruption, wireless sensor networks will suffer from higher frequency of re-transmission. As compared to a larger packet size, small size packets are more efficient but creating too short packet size might cause problems, like higher overhead, due to per packet creation overhead and startup energy consumption for each packet. In order to develop energy efficient wireless sensor networks, an optimal size of the packets must be chosen. Above figure shows the energy consumption using BFO and with pegasis.

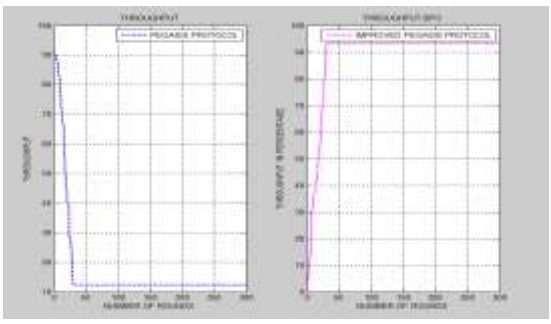

Fig 10. Throughput

Packet size optimization is an important issue in energy constrained wireless sensor networks. As larger size of packets may cause data bit corruption, wireless sensor networks will suffer from higher frequency of re-transmission. As compared to a larger packet size, small size packets are more efficient but creating too short packet size might cause problems, like higher overhead, due to per packet creation overhead and startup energy consumption for each packet. In order to develop energy efficient wireless sensor networks, an optimal size of the packets must be chosen. Increase the performance using improved pegasisi.e BFO algorithm and decrease the performance according to the pegasis protocol.

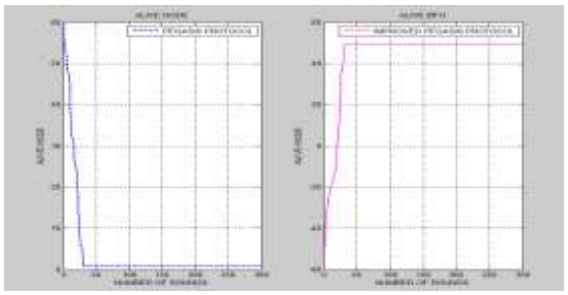

Fig 11.Alive Node

The above figure defined that the performance to the alive node with pegasis protocol more packet and information loss in wireless sensor network. But improve the pegasis protocol with the help of BFOA algorithm more packets sent the destination and alive node into the long time period.

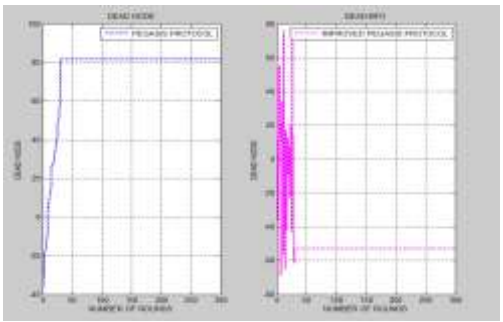

Fig 10 Dead Nodes

The above define that the dead node in the wireless network. With pegasis protocol more information loss and dead node ratio increase the network. But with the help of improved pegasis BFOA algorithm save the nodes and less dead the nodes of the Network.

Table no: 3 Comparison Between dead node (Greedy , ANT and BFOA) area 100*100

Number of dead nodes	PEG-greedy	Protocol PEG-ant	Protocol Peg-BFO
1	895	2970	97
10	2150	2976	85
20	2467	2980	78
50	2780	2994	65

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70	2901	3006	45
100	3038	3006	56

Table no: 4 Comparison between dead node(Greedy , Ant and BFOA) 50*50

Number of Alive nodes	PEG-greedy	Protocol PEG-ant	Protocol Peg-BFO
1	2176	4287	96
10	3629	4296	84
20	4085	4299	73
50	4232	4303	61
70	4236	4310	40
100	4389	4310	34

VI. CONCLUSION AND FUTURE SCOPE

Wireless sensor system is cooperation of sensor nodes that have conveying and handling capacities. These nodes have self-arranging abilities. The essential undertaking of sensor systems is to sense the occasions, gather information and send it to their asked for destination. In this thesis, we have enhanced the proficiency of WSN based, hierarchal directing convention, PEGASIS by executing an enhancement strategy, BFO Algorithm. After evaluation the result of enhanced PEGASIS with BFO in comparison to normal PEGASIS in terms of some specific parameters such as throughput, accuracy as well as bit error rate comes far better than normal. For future degree, more than one advanced routing protocol systems can be actualized to further enhance the convention. More number of parameters can be centred than utilized as a part of this thesis. Future researchers can even pick more refined optimization approaches for system enhancement. The future work, in this thesis can be done if this ABC Algorithm would be half breed with the existing calculation, it may perform better than the current.

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