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An Hybrid Approach for Enhancement of Energy and Network Life Time in WSN with PEGASIS and Artificial Neural Networks

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ABSTRACT **–**with the recent advancements in Wireless Sensor Networks (WSNs) researchers focus on developing a wide range of applications in commercial, industrial, military, health monitoring, process control (SCADA systems), infrastructure protection, surveillance systems ,wireless networks, embedded systems and Intelligent Transport Systems (ITSs) etc. WSN is basically formed by a huge number of wireless sensors. These sensor nodes are able to do some kind of processes, gathering sensed information and as well as communicating with other connected nodes in the network and transmitting the gathered data to a particular user or a Base Station (BS). These sensor nodes have some constraints due to their limited energy, storage capacity, transmission delay, packet loss etc. The efficiency of wireless sensor network abundantly depends on the routing protocol used.

The routing protocol is an important aspect, which can reduce the delay while offering high energy efficiency and long span of network lifetime. One of that protocol is Power-Efficient Gathering In Sensor Information System , it is based on the chain structure and every chain have only one cluster head, it take the profit of sending data to its closet neighbour.

In this paper a more efficient technique based on the PEGASIS protocol using an improved ant colony algorithm and neural network rather than the greedy algorithm to build the chain is proposed. Compared with the original PEGASIS, the propose method can achieve a global optimization. It forms a chain that makes the path more even-distributed and the total square of transmission distance much less. The protocol uses the thought of neural networks algorithm to select the chain head, it utilizes ant colony algorithm to find the best path to send data to the BS and the whole area divided into multiple equal parts. It brings about a balance of energy consumption between nodes. Simulation results using Mat lab Simulink have shown that the proposed protocol significantly improves energy and prolongs network lifetime.

Keywords –Wireless Sensor Network, Enhance Routing Protocol (PEGASIS), Artificial Approach feed forward neural networks (AN-FFNN).

INTRODUCTION

The sensor nodes consists of sensing elements, processer, memory, transceiver and battery. However senser nodes have got constraints in memory, processing capabilities, bandwidth and in battery power. This is due to the tiny nature of sensor nodes. In WSN's sensor nodes are deployed in very hazaradous environments for sensing the events and forwarding it to the base station(BS). After being installed the replacement and recharge of sensor battery is not possible. So energy efficiency is found to be most important design challenge of WSN's to enhance lifetime of network and to ensure node connectivity and coverage.

The received signal strength plays an important role to achieve self configuration, in which each node finds itself its neighbouring node and compute link quality and distance to the neighbouring node to construct efficient stable network with high link quality by avoiding packet retransmission, collision and interference, this significantly conserves battery and enhance network life span.

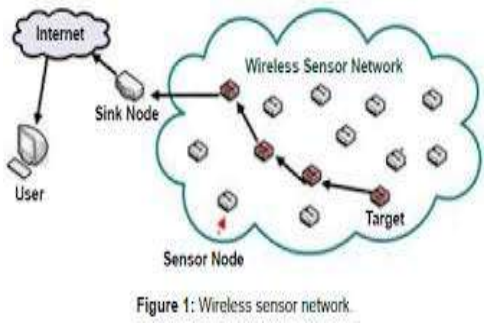


figure 1: Wireless Sensor Networks

There are various types of wireless sensor networks as:

1. **Terrestrial WSNs:** There are sorts of systems comprise of hundreds or thousands of remote sensor hubs. These hubs can be sent in an unstructured or an organized way. The hubs are conveyed arbitrarily in an unstructured mode, yet they are kept inside the objective zone. As these are the 'earthly' sensor organizes in this way they are over the ground and sun based cells can be utilized to control up these systems. The vitality can be moderated by limiting

postponements and by utilizing operations of low obligation cycles and so forth[3].

2. **Underground WSNs:** These sensor systems are all the more expensive when contrasted with earthbound systems. The hardware's utilized are costly and appropriate support is required. These are adequately used to screen the underground conditions in this way their entire system is underground yet to pass on the data to the base station, sink hubs are utilized which are available over the ground[4]

3. **Multimedia WSNs:** The sensor system can assemble in the form of audio, video and imaging. The sensor nodes in these systems are connected with cameras and microphones. They can track and monitor different events occurring and can keep a visual display of the events also. The purpose of information pressure, recovery and relations, these nodes are also interconnected with one another through a wireless association. As audio and visual information can also be transmitted through these networks therefore they require high utilization of power and high bandwidth. Advanced methods of data producing and compression are used in it [5].

The advantages and disadvantages of wireless sensor networks are :

Advantages

1. Systems arrangements is infrastructure less .
2. Used for the non-reachable places like mountains, over the sea, rural areas and deep forests.
3. Flexible if there is a casual situation when an additional workstation is required.
4. Execution pricing is inexpensive.
5. It avoids plenty of wiring.
6. It can connect with the new devices at any time.
7. It can be opened by using a centralized monitoring.[6]

Disadvantages

1. Less secure because hackers can enter the access point and get all the data.
2. Lower speed compared to a wired system.
3. complex to configure than a wired system.
4. Easily affected by surroundings (walls, microwave, large distances due to signal attenuation,[7]

I. RELATED WORK

WenjingGuo et al., 2015 [8] proposed a routing protocol for the applications of Wireless Sensor Network (WSN). It is a protocol based on the PEGASIS protocol but using an improved ant colony algorithm rather than the greedy algorithm to construct the chain. Compared with the original PEGASIS, this one, PEG-ant, can achieve a global optimization. It forms a chain that makes the path more even-distributed and the total square of transmission distance much less. Moreover, in the constructing process, the energy factor has been taken into account, which brings about a balance of energy consumption between nodes. In each round of transmission, according to the current energy of each node, a leader is selected to directly communicate with the base station (BS).**Dr. G. T. Raju et al., 2011 [9]** introduced that the remote sensor organize (WSN) for ecological observing with improved lifetime. The hub is furnished with multi mode sensors for detecting distinctive ecological parameters. An effective usage of energy is basic keeping in mind the end goal to utilize systems for long length, thus it is expected to decrease information activity inside sensor systems, lessen measure of information that need to send to sink. This paper goes for concentrate distinctive systems to augment the WSN lifetime, including directing, information accumulation, information exactness and vitality utilization. The fundamental thought is to characterize a multi-measurements convention that considers the lingering vitality inside sensor hubs, information accumulation and information precision. This survey thinks about three streamlining measurements. As a matter of first importance, it considers the development of directing tree with vitality and separation parameters. The goal is to augment the quantity of information gathering questions replied until the point when the principal hub in the system falls flat. Furthermore, information total is finished by social occasion information in a vitality proficient way .

ZeenatRehena et al., 2011[10] presented that the data transmission is one of the significant difficulties in remote sensor organize (WSN). Diverse steering conventions have been proposed to spare vitality amid information transmission in WSN. Directing conventions in view of information driven approach are reasonable in this setting performs in-organize collection of information to yield vitality sparing information dispersal. They propose an adjusted form of SPIN convention named M-SPIN and contrast its execution and customary SPIN convention utilizing communicate correspondence, which is a notable convention as benchmark. We assess the M-SPIN convention utilizing reproduction in TOSSIM condition. They find that, M-SPIN shows huge execution picks up than conventional SPIN steering.

Shigeaki tanabe et al., 2011[11] recommended that the save robot sensor organize framework in which a transported save robot sets up a remote sensor arrange (WSN) to assemble calamity data in post-fiasco underground spaces. In this framework, the safeguard robot conveys remote sensor hubs (SNs) and sends them between passages in an underground space on request by the administrator's charge to build up a sheltered

approach way before protect specialists enter. Be that as it may, a solitary correspondence way just is setup, in light of the fact that the protect robot straightly conveys SNs between portals. Henceforth, the safeguard robot can't be worked remotely if the correspondence way is disengaged by, for instance, SN disappointment or changes in the ecological conditions. Along these lines, SNs must be adaptively conveyed in order to keep up WSN correspondence network and invalidate such circumstances. Introduced that the depicts a SN organization procedure for development of a WSN vigorous to correspondence separation, caused by SN disappointment or weakening of interchanges quality, keeping in mind the end goal to keep up correspondence availability between SNs. They hence propose a SN arrangement system that utilizations excess correspondence association and guarantees correspondence conditions between end-to-end interchanges of the WSN. The proposed system kept up correspondence conditions with the end goal that throughput between end-conditioned interchanges in the WSN. Trial comes about checking the viability of the proposed strategy are likewise portrayed.

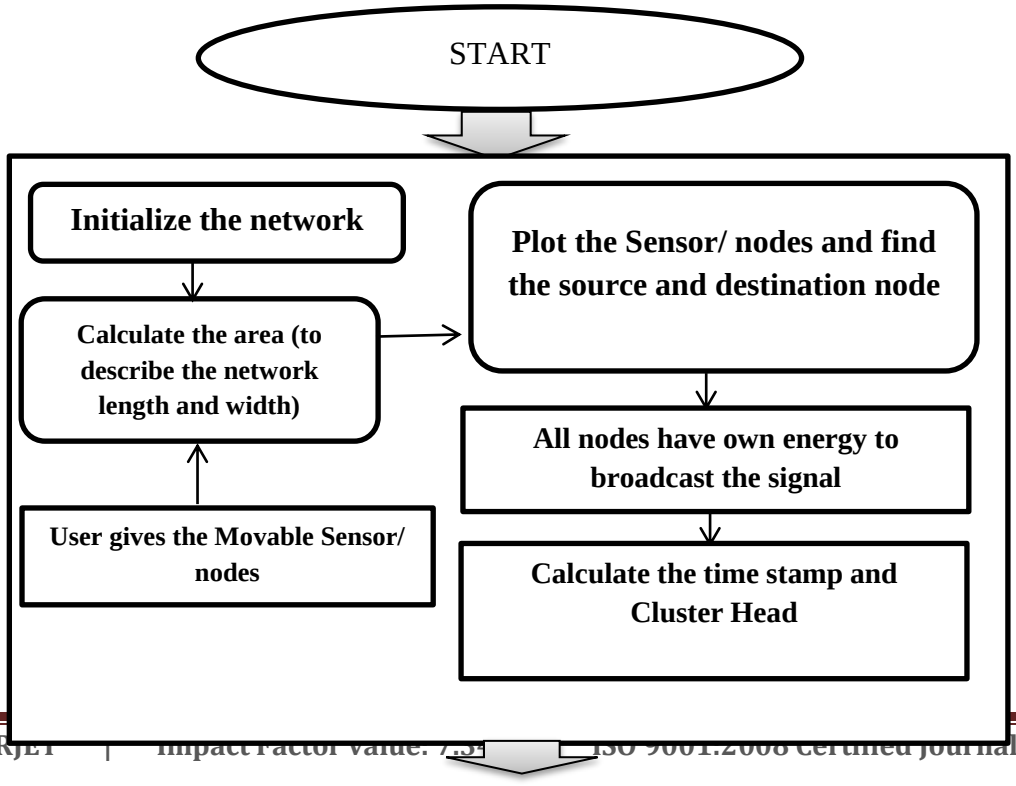
II. ISSUES OCCUR IN WIRELESS SENSOR NETWORK

Energy efficiency is the most compulsory quality in a sensor network where each node devours some energy with each transmission over the network. Energy efficiency is one of the key features to improve the network life. A sensor network is one of the hardest network on which large amount of dissimilar kinds of data is interconnected over the network[12]. The problem is to find a routing scheme to distribute data packets collected from sensor nodes to the base station, which adventures the lifetime of the sensor network under the organization model given overhead. However, the meaning of the lifetime is not clear unless the caring of service the sensor network carries is given. In requests where the time that all the nodes operate composed is important, since the quality of the system will be histrionically decreased after first node death lifetime is well-defined as the number of rounds until the first sensor is drained of its energy. In another case, where the nodes are densely arranged, the quality of the system is not affected by 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 dies [13].

Solution: The aim of this proposed research is to improve the throughput by controlling the routing with the change of the power with neighboring nodes. In this research, the resourceful routing approach is defined to achieve the energy actual route selection over the network. PEGASIS is collective with FFNN for improving energy efficiency and optimizing the network to fulfil desired purposes [14,15].

III. METHODOLOGY

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



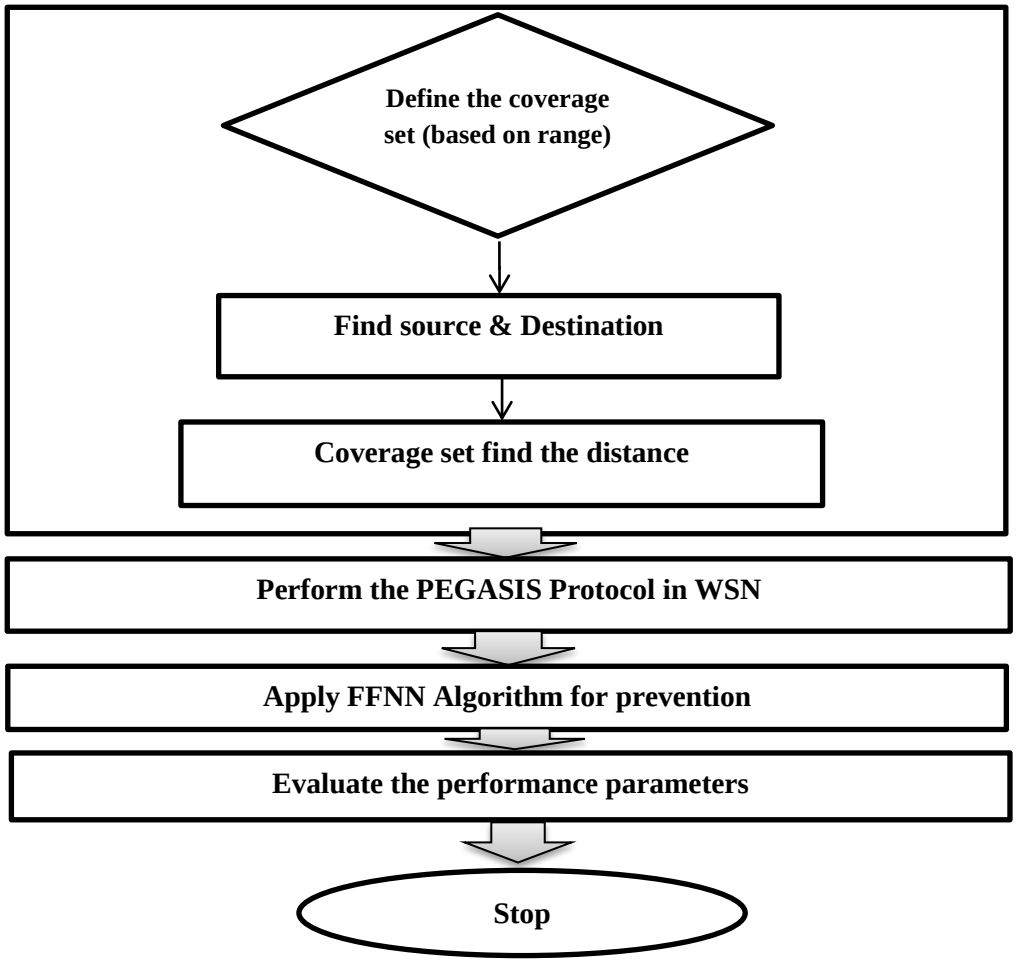


Fig 2.Workflow diagram

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. 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 node values, length of then 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 classify parameter by genetic algorithm.
4. Starting of optimization
   - Calculate time- stamp of nodes in the first block to select a 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 the current node
7. Checking of nodes till node9.
8. Termination conditions will apply if node is not found between nodes 9.
9. Plot final route between sources to destination.
10. Plotting of remaining nodes in the network.
11. Calculate Packet loss, Energy Consumption and Throughput with and without FFNN.

IV RESULT AND DISCUSSIONS

The efficiency and throughput of any work done could only be judged by its results and consequences created. Based on the types of network designed and some performance parameters, based on which system is approved or rejected. This efficiency could be measured only when the system runs on different evaluation method and the values of dissimilar are recorded and further used to deduce the net results.

Before we can proceed with performance evaluation, we must choose the different metrics that would help us in making comparisons. There could be different metrics to determine the performance like throughput, delay, jitter, packet loss. The choice of metric would depend upon the purpose the network has been set up for. The metrics could be related to the different layers of the network stack. For example, TCP throughput is based on the application layer, whereas an IP round trip time is based on the network layer. For example, a network supporting multimedia applications should have minimum delay and jitter.Packet loss might not be a critical issue for such network. However, packet loss might be a considerable factor for networks supporting textual data oriented applications.

The table1 : below shows different metrics of evaluation, and categories they are appropriate for

Category	Metric	Units
Losses	Packet Loss	Loss %ge
Accuracy	Throughput	%ge
Buffer Issue	Energy Consumption	Joules (j)

Following are some of the performance measurement metrics:

(i) **Throughput:** The amount of traffic a network can carry is measured as throughput, usually in terms such as kilobits per second.

(ii) **Packet Loss:** It reflects the number of packets lost per 100 of packets sent by a host.

(iii) **Energy Consumption:** The energy consumption is the sum of used energy of all the nodes in the network, where the used energy of a node is the sum of the energy used for communication, including transmitting (Pt), receiving (Pr), and idling (Pi). Assuming each transmission consumes an energy unit, the total energy consumption is equivalent to the total number of packets sent on the network.

Table 2 : Comparison Between Packet Loss (Pegasis , FFNN) area 100*100

Number of Rounds	PEG-greedy	Protocol PEG-FNN
10	8	10
20	50	12
30	65	17
40	72	25
50	80	50

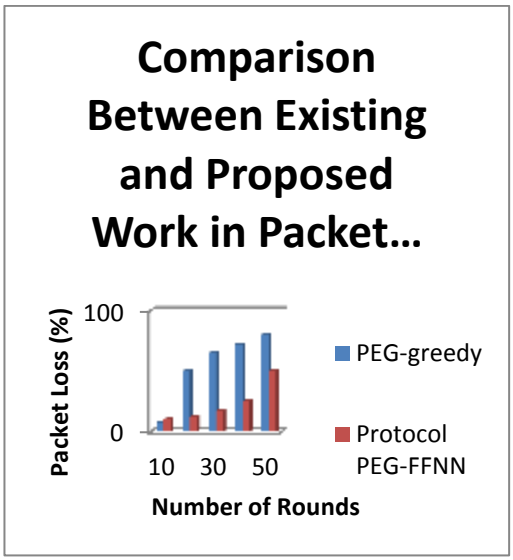


Fig :3 Comparison between amount of rounds packet loss (Greedy-PEG and PEG-FFNN)

The above figure defines that the performance of the packet loss improves performance of the Wireless sensor network using FFNN algorithm. As compare to the previous techniques using Greedy and FFNN .We check the dead node according to the network area.

Table : 3 Comparison between Energy (Greedy and FFNN)

Number of Rounds	PEG-greedy	Protocol PEG-FFNN
10	0.1	0.2
20	0.3	0.23
30	0.4	0.25
40	1.2	1.21
50	4.5	1.7

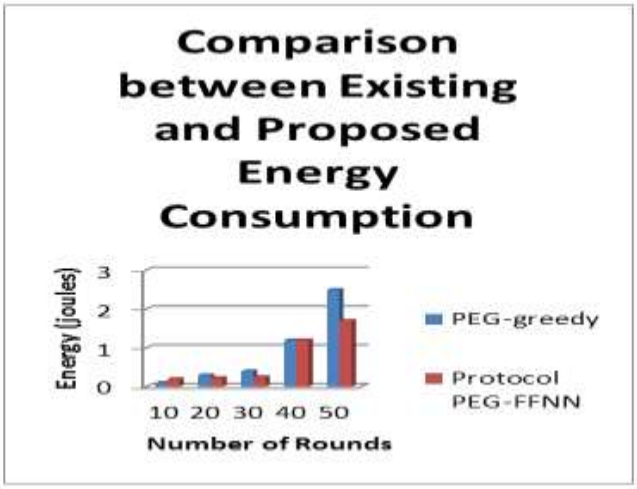


Fig 4 Comparison between (Greedy and FFNN) with Energy Consumption

The above figure defines that the performance of the energy consumption improves performance of the Wireless sensor network using FFNN algorithm. As compare to the previous techniques using Greedy and FFNN .We check the number of rounds according to the network area 50*50.

Table no: 4 Comparison Between Throughput (Pegasis , FFNN) area 100*100

Number of Rounds	PEG-greedy	Protocol PEG-FFNN
10	**9**	**21**
20	**14**	**35**
30	**19**	**47**
40	**22**	**53**
50	**28**	**68**

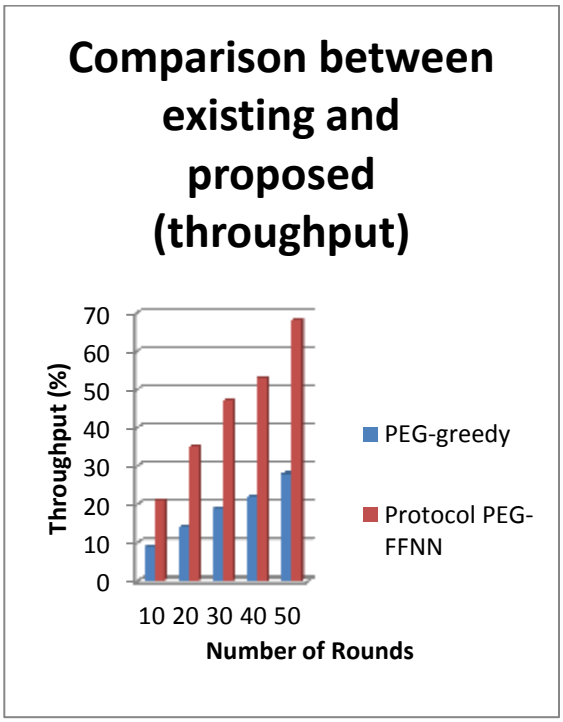


Fig 5 Comparison between (Greedy and FFNN) with Throughput

The above figure defines the comparison between Pegasis and ant colony optimization in throughput. Pegasis protocol is chain based routing approach. One of the main issues for WSN is the design of energy efficient algorithm since energy is limited. Throughput achieved is 28% in value and the value is improved using FFNN algorithm and is 68%.

V. CONCLUSION AND FUTURE SCOPE

Recently, upgrades in wireless communication have prompted the improvement of Wireless Sensor Networks. WSN has been connected in many fields, for example, military investigation, medicinal treatment and industry management. But how to extend the system lifetime is an imperative and testing issue, so many routing protocols have been proposed . The vitality proficiency is an essential issue for the systems particularly for WSNs which are described by constrained battery abilities. Along these lines, we focus on the vitality effective protocols that have been created for WSNs. We have implemented a routing protocol using ant colony and Particle Swarm optimization algorithm to build the chain of the Pegasis protocol. We discussed the protocol in detail, and through the simulation tool in MATLAB 2013. The performance of FFNN algorithm with the PEGASIS till now is better and compared with the original PEGASIS which uses the greedy algorithm to build the chain is validated. The mentioned comparison is to understand the existing solutions and also design a robust energy efficient routing for WSN and satisfy other parameters like throughput, packet loss and energy consumption.

For future degree, more than one advanced routing protocol systems can be actualized to further enhance the convention. More number of parameters can be centered than utilized as a part of this thesis. In future scope, we can implement the enhance particle swarm optimization algorithm to minimize the square sum of transmission distance and consider energy parameter in both chain designing and Main head selection to further pro-long the lifetime of WSN.

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