International Journal of Engineering Applied Sciences and Technology, 2018
Vol. 3, Issue 1, ISSN No. 2455-2143, Pages 47-52
Published Online May 2018 in IJEAST (http://www.ijeast.com)

IMPLICATIONS ON SORTING WITH PSO

Raj Kumar
CSE
CT Institute of Engg & technology
Jalandhar, India

Varsha saini
Information Technology
CT Group of Institutions, Shahpur
Jalandhar, India

Abhishek Bhardwaj
Information Technology
CT Group of Institutions, Shahpur
Jalandhar, India

Abstract— In this paper, we have proposed the Non-dominated Sorting Genetic Algorithm for the efficient selection of routing. The significant improvement has been shown using this approach comparison with PSO in terms of network lifetime, dead nodes, alive nodes and remaining energy. Our expectations are demonstrated by simulation results. We have introduced the superior characteristics of our protocol and discussed the routing phenomena by using suitable technique. The investigation ascertains the stable region and maximized lifetime of a network .

Keywords—PSO(Particle Swarm Optimization),Routing,network lifetime,dead nodes, alive nodes and remaining energy.

I. INTRODUCTION

In wireless sensor network the number of sensor nodes can be in order of hundreds or even thousands. Now a days wireless network is the most popular service utilized in industrial or commercial applications, because of its technical advancement in processor, communication and usage of low power embedded computing devices. Sensor nodes are used to monitor environmental conditions like temperature, pressure, humidity, sound, vibration, position etc. In many real time applications the sensor nodes are performing different tasks like neighbor node discovery, smart sensing, data storage and processing, data aggregation, target tracking, control and monitoring, node localization, synchronization and efficient routing between nodes and base station. Wireless sensor nodes are equipped with sensing unit, a processing unit, communication unit and power unit. Each and every node is capable to perform data gathering, sensing, processing and communicating with other nodes. The sensing unit senses the environment, the processing unit computes the confined permutations of the sensed data, and the communication unit performs exchange of processed information among 3 neighboring sensor nodes. The basic building block of a sensor node[1,2].

The sensing unit of sensor nodes integrates different types of sensors like thermal sensors, magnetic sensors, vibration sensors, chemical sensors, bio sensors, and light sensors. The measured parameters from the external environment by sensing unit of sensor node are fed into the processing unit. The analog signal generated by the sensors are digitized by using Analog to Digital converter (ADC) and sent to controller for further processing. The processing unit is the important core unit of the sensor node. The processor executes different tasks and controls the functionality of other components. The required services for the processing unit are pre-programmed and loaded into the processor of sensor nodes. The energy utilization rate of the processor varies depending upon the functionality of the nodes. The variation in the performance of the processor is identified by the evaluating factors like processing speed, data rate, memory and peripherals supported by the processors. Mostly ATMEGA 16, ATMEGA 128L, MSP 430 controllers are used in commercial motes. The computations are performed in the processing unit and the acquired result is transmitted to the base station through the communication unit. In communication unit, a common transceiver act as a communication unit and it is mainly used to transmit and receive the information among the nodes and base station and vice versa[3]. There are four states in the communication unit: transmit, receive, idle and sleep.

ARCHITECTURE OF WIRELESS SENSOR NETWORK

Wireless sensor network can be classified into:

- **Homogeneous network**
  In homogenous sensor networks, all sensor nodes have the same property in terms of computation, communication, memory, energy level and reliability. If all the sensor nodes within the cluster are having the same properties (homogenous) it is referred as distributed WSN (DWSN)[4].
- **Heterogeneous networks**
  In heterogeneous sensor networks, nodes are of different capabilities in terms of computation, communication, memory, energy level and reliability. If the sensor nodes have different properties (heterogeneous) it is called as hierarchical WSN (HWSN).

Sensor nodes in an open environment regularly sense the physical and environmental changes and transmit the information to the centralized server called a gateway. The computational rate and interaction of sensor nodes with the physical environment is different for different nodes in the network. In real time, sensor nodes are more constrained in its computational energy and storage resources. The sensor nodes are intelligent to observe an extensive diversity of ambient

circumstances that includes flow, temperature, pressure, humidity, moisture, noise levels, mechanical stress, speed, etc. Many novel applications are being developed due to the new concept of micro sensing and wireless networking for these smart sensing devices. Some of the possible assorted applications of WSN's are temperature control, inventory management, physiological monitoring, habitat monitoring, precision, agriculture, forest fire detection, nuclear, chemical, and biological attack detection,military, transportation, disaster relief, and environmental monitoring[5].

WSN ORGANISATION

Any WSN can be configured as a five layered architecture as explained below

- The physical layer is responsible for frequency selection, modulation and data encryption.
- The data link layer functions as a pathway for multiplexing of data streams, data frame detection, Medium Access control (MAC) and error control.
- The network layer is used to route the data supplied by the transport layer using special multi-hop wireless routing protocols between sensor nodes and sink nodes[6].
- The transport layer maintains the flow of data if the application layer requires it.
- The application layer makes the hardware and software of the lower layers transparent to the end user.

II. Literature Review

Md Azharuddin et.al In this paper, we propose a PSO-based scheme to solve hot spot problem caused by multi-hop communication in a cluster-based wireless sensor network. The scheme consists of routing and clustering algorithms which are shown to be energy efficient. In the routing phase, traffic load over the cluster heads (CHs) is distributed, whereas in the clustering phase, we take care of all the CHs whose energy is exhausted fast by assigning lesser number of sensor nodes. In this unequal clustering and distribution of data forwarding load of CH nearby BS to address the hot spot problem. This technique extend network life time by removing the traffic load of the gateway. Its performed a extensive simulation result are compared with the existing algorithms namely PSOK, GARA.

Jun Zheng, Abbas Jamalipour "Introduction to wireless sensor network": This book gives introduction about wireless sensor network, its characteristics, components, applications and various protocols involved in its functioning. Enabled by recent advances in microelectronic mechanical systems(MEMS) and wireless communication technologies,tiny,cheap and smart sensors deployed in a physical area and networked through wireless links and internet provide unprecedented opportunities for a variety of civilian and military applications, for example, environmental monitoring, battle field surveillance and military process control.

SP Singh, SC Sharma "Improved clustering algorithm for wireless sensor networks". In: Soft computing: Theories and applications pp 379-386;Springer,2018: This paper focuses on the cluster-based or hierarchical routing algorithms for sensor networks. The authors perform the analysis of popular hierarchical routing algorithm low-energy adaptive clustering hierarchy (LEACH) and focus on how to choose the next hop nodes during data transmission phase. Since the sensor nodes have limited energy supply, optimization of energy must be considered as the important aim in sensor network design. Clustering is a process used to handle the energy usage effectively. In this scheme, each and every group of sensors has a head node recognized as cluster head (CH) that performs data fusion and data forwarding toward the base station (BS) or sink node. In this paper, the authors proposed an improved clustering algorithm to increase network lifetime. The main initiative in proposed algorithm is CH election with consideration of residual energy.

Vishal Gupta, M.N.Doja "H –LEACH: Modified and efficient leach protocol for hybrid clustering scenario in wireless sensor networks". In: Next generation networks pp 399-408;Springer,2018: This paper presents H-Leach protocol for improving the efficiency of wireless sensor networks. The hierarchical protocols are the category of protocols that has got the most concern in this field. The characteristic of these protocols is to cluster the field nodes, thereby reducing the overhead for transmissions. In this paper, the authors first partition the complete area in as many zones as the desired number of clusters. The protocol chooses one node from each zone as the CH of that area on the basis of LEACH criteria in each round. The role of the CH is rotated amongst the nodes of the respective zones in each round to balance the energy dissipation of the nodes. The member nodes of a particular zone talk to their respective zone cluster head.

Javaid N, Aslam M, Djouani K, et al. ATCEEC: a new energy efficient routing protocol for wireless sensor networks. Proceedings of the 2014 IEEE International Conference on Communications (ICC'14), Jun 10-14, 2014, Sydney, **Australia. Piscataway, NJ, USA: IEEE, 2014: 263-268:** This paper proposes an application aware Threshold-based Centralized Energy Efficient Clustering (ATCEEC) protocol for routing in wireless sensor networks. The proposed protocol assumes that each wireless sensor node is capable of sensing two types of environmental dynamics; temperature and humidity. Operation of ATCEEC is based on an advanced central control algorithm, where base station is responsible for selection of cluster heads (CHs). This selection is carried out on the basis of nodes' residual energy, average energy of the network and relative distance between the nodes and the base station.ATCEEC achieves significant stability, extended network lifetime and better control over the network operation. The proposed hybrid protocol is suitable for both proactive and reactive networks.

Thakkar A, Kotecha K. Cluster head election for energy and delay constraint applications of wireless sensor network. IEEE Sensors Journal, 2014, 14(8), 2658−2664: This paper deals

International Journal of Engineering Applied Sciences and Technology, 2018
Vol. 3, Issue 1, ISSN No. 2455-2143, Pages 47-52
Published Online May 2018 in IJEAST (http://www.ijeast.com)

with the energy conservation of a multi-hop wireless sensor network[7,8]. WSN is made of large number of energy, communication and computational constraint nodes, to overcome energy constrains replacing or recharging the batteries of the WSN nodes is impossible task, once they are deployed in a hostile environments. Therefore, to keep the network alive as long as possible, communication between the WSN nodes must be done with load balancing. Time critical applications like forest fire detection, battle field monitoring demands reception of data by the sink with the bounded delay to avoid disasters. Hence, there is a need to design a protocol which enhances the network lifetime and provides information to the sink with a bounded delay. This paper addresses this problem and solution. In this paper, a routing algorithm is proposed by introducing Energy Delay Index for Trade-off (EDIT) to optimize both objectives –energy and delay. EDIT is used to select Cluster Heads (CHs) and "next hop" by considering energy and/or delay requirements of a given application. Proposed approach is derived using two different aspect of distances between a node and the sink named Euclidean distance and Hop-count, and further proven using realistic parameters of radio to get data closest to the test bed implementation.

III. PSO

Particle swarm optimization (PSO) is a population based optimization technique proposed by Kennedy and Eberhart. PSO technique is basically inspired by the social behavior of bird flock searching for the food. PSO has been extensively applied to a number of engineering fields for optimization due to its unique searching mechanism, computational efficiency and an easy implementation[8]. In PSO, the term particle refers to population of members which are mass-less and volumeless (or with an arbitrarily small mass or volume). Each particle in the flock represents a solution in a high dimensional space with four vectors, its velocity, the best position found so far, its current position, the best position found by its neighborhood particle and adjusts its position in the search space based on the best position reached by itself (pbest) and on the best position reached by its neighborhood particle (gbest) during the search process. It on the basis of behavior of animals in which there is no head or group leader such as flock of animals. In flock of animals find food randomly which is nearest to food position. Animals inform to each other about position of food. It will happen again and again until food source found. According to PSO, velocity and acceleration is changed to its lbest and gbest locations. The first one is lbest and the second one is gbest. Particle swarm optimization (PSO) is a computational method that reduces the problem by iteratively trying to improve the candidate solution with improved quality. PSO optimizes a problem by having a population of candidate solutions. PSO is an algorithm modelled on swarm intelligence, that locate a explanation to an optimization crisis in a search space, or model and expect public activities in the existence of objectives. The PSO is a stochastic, population-based computer algorithm based on SI. The particle swarm suggests this type of communal optimization. A problem is given, and some way to estimate a proposed clarification to it exists in the structure of a fitness function. A communication organization or social network is also defined; allocate neighbors for each individual to cooperate with. Then a population of persons defined as arbitrary guesses at the problem clarification is initialized. These individuals are aspirant solutions. They are also known as the particles, hence the name particle swarm. An iterative process to enhance these candidate solutions is set in motion. The particles calculate the fitness of the candidate solutions repeatedly and retain information about the location of best success. The individual's best solution is called particle best or the local best. Each particle formulated this information accessible to its neighbors[9].

Advantages of PSO:

1 It is easy to implement.

2 Only few parameters need to adjust.

3 It is efficient in global search.

4 Good quality solutions are possible because of its ability to escape from local optima.

5 It has quick convergence .

6 Centralized nature of PSO minimizes the area of coverage holes of stationary node positioning.

7 Data aggregation is quite suitable for PSO

8 PSO shows better performance in selecting the high energy node as CHs in each round and can find an optimal route effectively.

IV. NSGA

The Non-dominated Sorting Genetic Algorithm[10] is a Multiple Objective Optimization(MOO) algorithm and is an instance of an Evolutionary Algorithm from the field of Evolutionary Computation. NSGA is an extension of the Genetic Algorithm for multiple objective function optimization.The objective of the NSGA algorithm is to improve the adaptive fit of a population of candidate solutions to a Pareto front constrained by a set of objective functions. The algorithm uses an evolutionary process with surrogates for evolutionary operators including selection, genetic crossover, and genetic mutation.A binary representation can be used in conjunction with classical genetic operators such as one-point crossover and point mutation

NSGA Advantage and Disadvantage:

- Explicit Diversity prevention mechanism.
- Overall Complexity of NSGA is at most o(MN2)
- Crowded Comparison can restricted the convergence.
- Non dominated sorting on 2z size.

V. SIMULATION

In this simulation environment, the 500 sensor nodes are deployed in the area of (500,500). The MATLAB simulator is used for the given experiment. The parameters are listed

International Journal of Engineering Applied Sciences and Technology, 2018
Vol. 3, Issue 1, ISSN No. 2455-2143, Pages 47-52
Published Online May 2018 in IJEAST (http://www.ijeast.com)

below in the given table. The metrics used for the simulation are:-

- Dead Nodes
- Number of alive nodes
- Number of packets send to base station
- Energy Consumption

Table1:- Simulation Parameters

Parameters	Value
Area(x,y)	500*500
Base Station(x,y)	500,250
Number of nodes	100
Probability	0.2
Initial Energy	2.0J
Transmitter Energy	50 nJ/bit
Receiver Energy	50nJ/bit
Free space Energy(amplifier)	1.0nJ/bit/m^2
Multipath Energy	0.0013nJ/bit/m^2

This is the simulation environment of wsn in which 500 nodes are deployed.

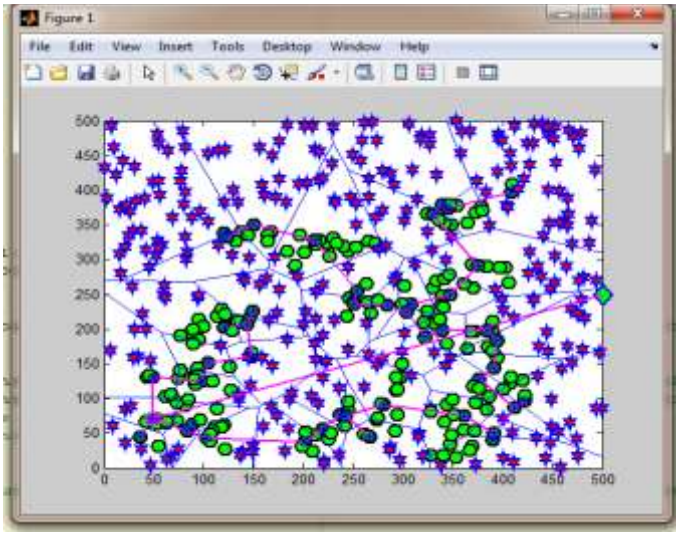

Fig.1. Square region of 500*500 having 500 nodes

Dead Nodes:- Fig.1 is showing the dead nodes .X-axis is representing the number of rounds and Y-axis is representing the nodes. From the figure, we observe that all the nodes are dead at 750 round in case of PSO and in NSGAPSO, all the nodes are dead at 1700 rounds.

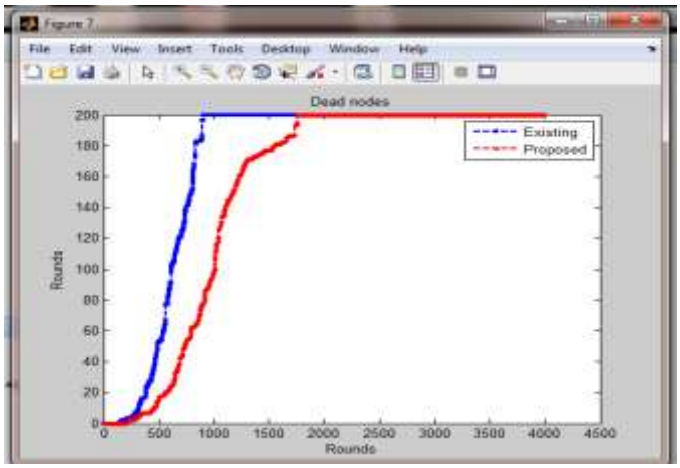

Fig 2. Dead nodes Vs Rounds

Alive Nodes:- Fig.2 is showing the alive nodes.X-axis is representing the number of rounds and Y-axis is representing the Nodes. In this case the rounds are increasing then the nodes are decreasing.

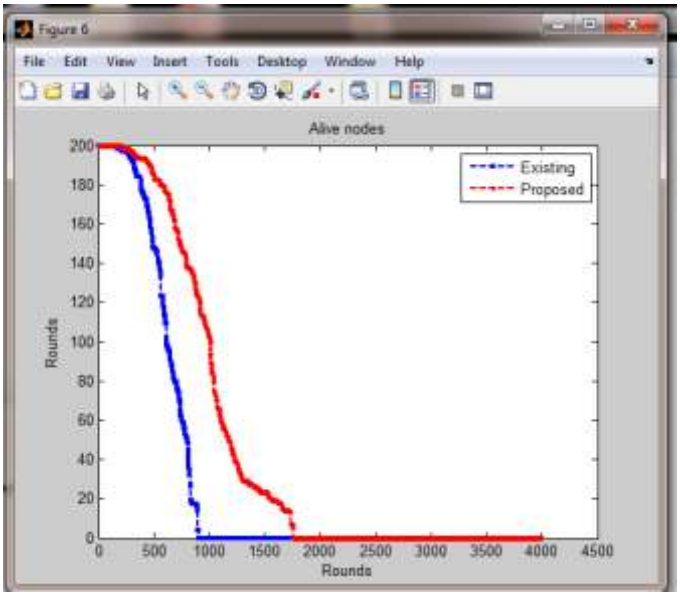

Fig 3. Alive nodes Vs Rounds

Packets Send to base station:-

This is the graph of Packet send to base station after simulation. This graph shows the total number of packets send to the base station by the sensor nodes. At the round of 500, the total number of packets send to base station is $2.5*10^4$ while in case of proposed it is $3.5*10^4$.

International Journal of Engineering Applied Sciences and Technology, 2018
Vol. 3, Issue 1, ISSN No. 2455-2143, Pages 47-52
Published Online May 2018 in IJEAST (http://www.ijeast.com)

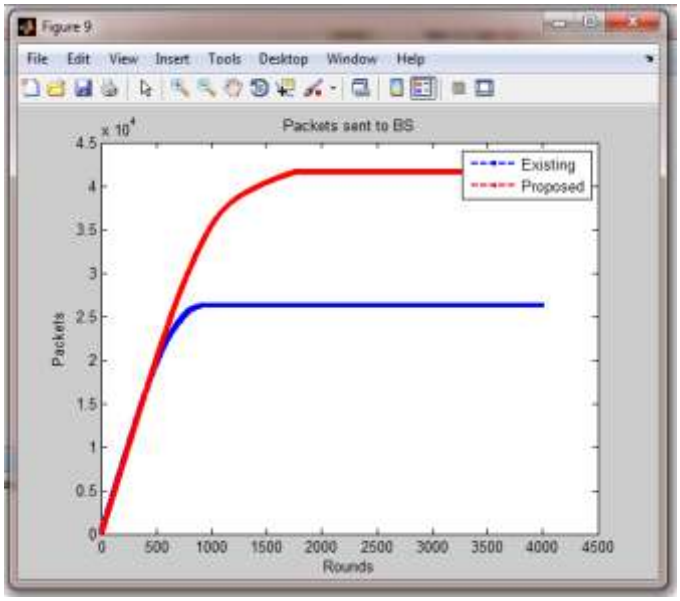

Fig 4. packet send to BS Vs Rounds

Energy Consumption:-

Fig.5 is showing the graph of energy consumption .X-axis is representing the number of rounds and Y-axis is representing the energy . From this figure, Observing there is more energy consumed in the existing but lesser ion the case of proposed system.

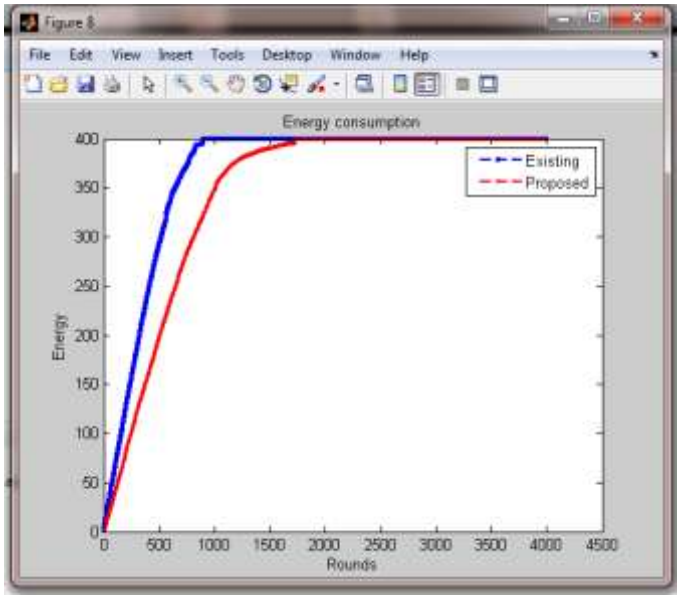

Fig 5. Energy Consumption Vs Rounds

VI. CONCLUSION

In this paper, we have studied the Non-dominated Sorting Genetic Algorithm is a Multiple Objective Optimization (MOO) algorithm and is an instance of an Evolutionary Algorithm from the field of Evolutionary Computation and PSO algorithm which is best for solving the path problem. The parameters can be chosen self-adaptively in PSO which enhances the performance of network. But this work has not taken into account the utilization of 3D WSNs, which are becoming major area of research in these days. Therefore in near future work we will extend the planned technique for 3D WSNs environment.

VII. REFERENCES

[1]Akyildiz.I,F,Su.w,Sankarasubramaniam,Y,Cayirci.E,(2002) "Wire less Sensor Networks: A Survey," Computer Networks (IJCSIT) vol.38,pp. 393-422.

[2] Xu.Wang, Qian Liyan, Wu. Jianjun, Liu ad Tian.(2010) "An energy and distance based clustering protocol for wireless sensor networks." In Novel Algorithms and Techniques in Telecommunications and Networking, (Springer) vol.1,pp. 409-412. Netherlands.

[3] Li. Xunbo, Na. Li, Liang.Chen, Yan.Shen, Zhenlin. Wang. (2010) "An improved LEACH for clustering protocols in wireless sensor networks." In Measuring Technology and Mechatronics Automation (ICMTMA), vol. 1, pp. 496-499. IEEE.

[4] N. Reddy, Sekhar. Goutham, Citare. Neeranjan, and Sampalli. Srinivas.(2013) "Deployment of multiple base-stations in clustering protocols of wireless sensor networks (WSNs)." In Advances in Computing, Communications and Informatics (ICACCI),vol.2, pp. 1003-1006. IEEE.

[5] Rani.S et al. (2014) " Energy efficient protocol for densely deployed homogeneous network", in: Issues and Challenges in Intelligent Computing Techniques (ICICT),vol.2, pp.292–298, IEEE.

[6] B.A. Bakr, and L. Lilien, (2011) "LEACH-SM: A protocol for extending wireless sensor network lifetime by management of spare nodes", In Modeling and Optimization in Mobile, Ad Hoc and Wireless Networks (WiOpt), pp. 375-375.

[7] S. Basagni,, A. Carosi, , E. Melachrinoudis,, C. Petrioli,. and Z.M Wang,. (2007) "Controlled sink mobility for prolonging wireless sensor networks lifetime",(Springer) vol. 14 (6), pp. 831-858.

[8] M.I Khan, W.N Gansterer, and G. Haring, (2013) "Static vs. mobile sink: The influence of basic parameters on energy efficiency in wireless sensor networks", (IEEE) vol. 36, pp. 965-978.

[9] Kaur. Jaspinder, Saini. Varsha (2016) "A New Approach for Energy Efficient Linear Cluster Handling Protocol In WSN " (ijcsis), Vol. 14 No.3.

[10] Chakraborthy. Prithwish, Das Swagatam, Abraham Ajith, Gourab Ghosh Roy Vaclav Snapseland (2011) " On convergence of Multi-objective particle swarm optimizer" IEEE , vol.1 No.3.

[11] Janson. Stefan and Middendorf .Martin (2005) " A hierarchical particle swarm optimizer and its Adaptive variants .(IEEE),vol.1