

# Non Dominated Sorting Genetic Algorithm Based Energy Aware Clustering Protocol

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**Abstract:** Energy conservation is defined as an ill posed problem in wireless sensor networks. Many protocols have been proposed improve the energy conservation. But, it has been found that the actual most of the existing methods has got neglected very first debris difficulty with particle swarm optimization based protocols. As inadequately selected debris bring about poor results. Genetic algorithm based protocols would not ensure that the world global optimized final results however wealthy for the mutation and also crossover operators. . The use of the Non dominated sorted genetic algorithm (NSGA) is ignored to efficiently elect the inter cluster data aggregation path selection. Therefore, in order to remove these issues NSGA based inter cluster data aggregations proposed in this work Principle betterment has become produced by changing the actual the particle swarm optimization with NSGA based optimization technique for energy efficient routing. Also, the actual utilization of the compressive stinking additionally raises the functionality further. A compressive stinking makes use of details union to eradicate well not required details via sensor nodes. Ultimately, comparison research show that the proposed technique significantly reduce the energy consumption and therefore improve the network lifetime.

**Keywords:** WSN, sensor, area monitoring, Health care monitoring, Air pollution monitoring, Landslide detection.

## 1.1 INTRODUCTION

Wireless Sensor Network is a mix of minor light weight Wireless sensors with computing components. These sensors are less expensive in cost, with restricted energy storage and processing capacities. Wireless sensor organize comprise of expansive number of these sensor hubs (normally hundreds or thousands of hubs). These kinds of systems are exceedingly conveyed and sent in threatening environments. With the extending mass of total populace particularly the old individuals who are touchier to infections, requires a far reaching human services framework. A WSN is created with "nodes" by fewer to many hundred or more than hundred, where every single node is attached to a single (sometime more than one) sensor. This kind of sensor network nodes have normally various types: a radio transceiver using the interior antenna as well as connection with exterior antenna, electronic digital outlet intended for interfacing wonderful detectors along with an energy source, normally a power supply energy as well as an inserted type of power consumption. A sensor node could fluctuate in dimensions from a shoebox right down to the dimension of the feed of airborne dirt and dust, even though operating "motes" of real microscopic measurements haven't still possible to generate. The price of sensor nodes are changing according to the starting range of several to 100's of dollars as well as according to the complexness of the individual sensor nodes. Size & expense difficulties for sensor nodes output in related to difficulties for sources like as energy, memory space and speed as well as communication bandwidth. This topology from the Wireless Sensor Networks may different from the star network in a modern multi-hop wsn.

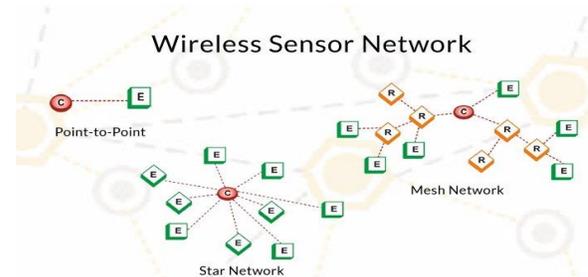


Fig :1. Wireless Sensor Network

## 1.2 SENSOR

In the broadest classification, sensor is usually a system, element or even subsystem whose function is to find activities or may be modifications in natural environment as well as send information to other electronic devices, generally a computer processor. A new sensor is every time use with combination of other electronic devices, whether as easy as a light or as difficult for a computer. Sensors are utilized in every day like touch-sensitive techniques. Lift, control keys (use in robot) as well as lights which usually dim or even brighten up simply by touching the control key, furthermore lots of applications that uses touch sensitive techniques. Using improvements inside micro machinery along

## 1.3 APPLICATION AREAS IN WIRELESS SENSOR NETWORKS

### 1.3.1 Area monitoring

The actual WSN is definitely implemented over an area in which several different locations are going to be monitored. Some sort of military services are the good examples that are using sensors devices for enemy action or intrusion.

### 1.3.2 Health care monitoring

The actual sensor networks in health applications can easily represent by various kinds: applicable, wearable, & also environment embedded system. The applicable healthcare devices are those devices which are usually put inside our body. Wearable tools are applied on our body surface or just at closeness on the user. Environment embedded system use sensor inside the environment.

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### 1.3.3 Environmental/Earth sensing

There are several uses with supervising the environmental friendly parameters, some environmental parameters are given below. They'll show an additional problem in several environments as well as decreased power supply.

#### 1.3.3.1 Air pollution monitoring

WSNs are already implemented in various metropolitan areas to evaluate the actual content level of harmful unwanted gases intended for citizens. It may makes benefit for the ad-hoc wireless links instead of physical links; this will also make sure that mobile is use for take readings in several areas.

#### 1.3.3.2 Forest fire detection

Some sort of system connected with Sensor Nodes may be fitted inside the forest to help discover while a fire place possesses started. The actual nodes could be designed with sensors to determine temperature, moisture as well as gases which are generated by fire. 13.3.3 Landslide detection A landslide discovery program utilizes of a WSN to be able to discover the small activities of soil & modification of several parameters which can happen just before or maybe within a landslide. As a result the data collected idea is quite able to understand .

#### 1.3.3.4 Water quality monitoring

It is require investigating the quality of water consists of investigating drinking water attributes with wetlands, dams, oceans, rivers & reserve water below ground. The utilization of various wireless distributed sensors allows the development of better water quality as well as provides the permanent deployment of monitoring area, inside areas of complicated access it has no need of manual data retrieval.

#### 1.3.3.5 Natural disaster prevention

WSNs may efficiently take action for preventing the effects of natural destruction, such as floods. Wireless nodes have efficiently used inside the rivers in which variation in the water levels must be examined in specific time.

## 1.4 DATA AGGREGATION TREE TECHNIQUES

Within common WSNs, sensor node vertisementssss are likely to be resource-constrained in addition to battery-limited. Just to save sources and energy, files must be aggregated to counteract too much to handle number of website traffic in the network. There's been comprehensive give attention to files aggregation underlying nodes within warning networks. The objective of files aggregation is the fact that it gets rid of unnecessary files tyranny in addition to improves the timeframe of their time within wireless warning network. Info aggregation will be the task of only 1 or even many sensors. The compiled data needs to be aggregated simply by sensor to relieve problem just before these are typically routed to platform stop and also sink. The wireless sensor community has consisted several a types of node:

**1.4.1 Regular sensor node. Sensor info packet by means of the planet and send towards the aggregator node s.**

**1.4.2The aggregator nodes**

collect info through multiple alarms from community, aggregates the info packet with a couple aggregation features for instance quantity, typical, matter, optimum min just after sensor node sends aggregated info for you to top aggregator node and the drain node 1.4.3The sink node provides this query. It might be the beds base station or perhaps from time to time the additional customer possessing authorization to speak while using the network. Files transmission among sensor node hydrates, aggregators with the drain utilizes great deal of energy inside mobile sensor network. previously consist of a couple of products, the first you are info aggregation unit and second is not for info aggregation style of sensor node sensor rnode hydrates 1, 2, 3,4,5,6 will be typical node hydrates that collect info packet and report towards the top node hydrates wherever sensor node hydrates 7, 8 will be aggregators that execute sensing and aggregating combined exactly the same time. In this particular aggregation unit, 4 info boxes went through the community and an individual info packet is actually carried in the direction of basic station (sink) and various not for info aggregation unit additionally 4 info packet went throughout the community along with the the many four info boxes will be transported to the beds base station (sink), means by using info aggregation process, the level of info packet transmission is actually lessened and in addition spend less energy. By looking into making utilization of information aggregation, improves. this time period of mobile sensor / probe network. Drain include the info packet in a energy-efficient fashion together with lowest info latency. It's really important in an effort to produce energy-efficient data-aggregation algorithms so as that community life time is actually enhanced. There are lots of types of information aggregation standards inside WSN: 1.4.4 Tree based routing protocols:- In energy-constrained sensor networks of enormous size, it can be inefficient for sensors to deliver the information straight away on the way to the descend. Tree base routing protocols based advance tree based advance. In tree based routing protocols-based approach, whole network is divided into many tree base routing protocols. Each node tree based routing protocols possesses a tree based routing protocols-head sensor node is certainly selected among tree based routing protocols members. Tree based routing protocols-head does the role of aggregator and aggregate data received from tree based routing protocols members locally after sensor node transmit to BS (sink). Recently, several tree based routing protocols-based network organization and data-aggregation protocols have been completely proposed for WSNs. The tree based routing protocols brain might connect together with the kitchen sink straight by way of very long vary attacks or variable clicking by way of other tree based routing protocols heads.

#### 1.4.5 Tree-Based Approach:

The tree based structured techniques critical aggregation by simply develop a great aggregation tree. The shrub can be bare minimum spanning shrub, kitchen sink node viewed as to become basic and source node deemed as leaves. Circulation of info commence with keep node and closes with BS (sink).

## 2. LITERATURE SURVEY

C Pu, et al.(2019)[1]Versatile specially appointed system (MANET) is helpless against security assaults due to the mutual radio medium and absence of concentrated coordination. Since most multi-bounce steering conventions verifiably accept agreeable directing and are not initially intended for security assaults, MANET has been tested by differing forswearing of-administration assaults that regularly meddle with the convention and hinder on-going correspondences. Derui Ding et al.(2018) [2] Digital physical frameworks (CPSs), which are an essential of calculation, organizing, and physical procedures, assume an undeniably significant job in basic foundation, government and regular daily existence. Because of physical limitations, installed PCs and systems may offer ascent to some extra security vulnerabilities, which results in the misfortunes of the gigantic monetary advantages or confusion of public activity. Kumar et al. (2017) [3] recommended a new method of authenticating a sensor node predicated on a cryptographic hash function. It detects Sybil nodes in order that they are isolated and any kind of Sybil attack is avoided. This method executes well in conditions of energy and memory space utilization in comparison with previous methods. Singh R et al. (2016) [4]discussed a variety of systems for treating along with Sybil attack. Included in this are Sales message authorization, TDOA approach, Haphazard pass word comparability approach, Local community RSS primarily based strategy, SYBILSECURE method, Ancestral formula, Ancestral formula two-hop announcements strategy, P2DAP strategy. Raghu Vamsi et al. (2015)[5]recommended your node-centric tactic Successive Review (SADSA) to get the Sybil episodes. It truly does work with more than once, by using, study array and study validation [4]. Your simulator success that this advisable tactic provides compact connecting, making value that is formidable having obtained Sybil precise by making use of incredibly small inappropriate beneficial and inappropriate adverse rates. Wei Shi et al. (2015) [6] encouraged a light-weight a diagnosis process predicated with LEACH-RSSI-l'd. (LRD). Simply by analyzing an RSSI-ID dinner kitchen tables a Sybil intrusion might be found with good acknowledgement charge and also exactness. R. Amuthavalli et al. (2014)[7]well-advised the important RPC algorithm formula which usually registers a real training course by means of looking at almost every node could be a new testable node or simply a Sybil node and in addition redirects the outcome pretty securely. Becoming really an excellent and in addition, appropriate approach, . Hussain et al. (2013) [8] discussed that a leader node that administrate a cluster is called CH, that collects information from nodes attached to it and send data either directly to base station or through other cluster head i.e. by inter-cluster. Cluster head plays important role in the network. Selection of CH can be done using various parameters i.e. location, mobility, battery, throughput etc. Shi et al. (2012) [9] discussed that in LEACH-C algorithm, CHs selection is done randomly. In selection process that node is elected as CH which has energy greater than the given threshold i.e. average energy of all nodes. In it CHs are elected using basic LEACH. A model is created for CH energy consumption. While building a model two factors retransmission and acknowledgement are considered.

Therefore, using the NSGA based optimistic inter cluster data aggregation based optimistic path selection is the main motivation of this research work.

## 3 Gaps in literature:

The review has shown that the most of the existing technique has neglected the following issues.

1. The performance of the particle swarm optimization depends upon the initial particles; poorly selected particles lead poor results.
2. The genetic algorithm does not guarantee the global optimized results but rich because of its mutation and crossover operators.
3. The use of the NSGA is ignored to efficiently elect the inter cluster data aggregation path selection.

## 4. PROPOSED ALGORITHM

### 4.1 Non-dominated Sorting Genetic Algorithm II (NSGA-II)

Is usually a popular non-domination dependent inherited criteria with regard to multi-objective optimization. It offers proven much better functionality versus Strength Pareto Evolutionary Algorithm formula (SPEA) [108] and Pareto Archived Advancement System (PAES) [109], with regard to convergence and range of your purchased Pareto entry. NSGA-II depends on to become a inhabitants that will consists of and Take arbitrary remedies (chromosomes). Inside each and every era, individuals with in NSGA-II are usually categorized within many non-dominated fronts with a position criteria initial (non-dominated sorting). After that, man or women remedies usually are picked readily available non-dominated fronts through determining the excitedly pushing distance. A excitedly pushing length measures the length concerning the consumer remedies and all of those other remedies in the population. In case 2 man or women remedies have been in the same non-dominated entry, the perfect solution having a larger value of excitedly pushing length will likely be selected. A excitedly pushing length calculations is usually familiar with maintain the range among the non-dominated remedies in the in the future level of your run in an effort to get a full distribute connected with solutions. Thereafter, the criteria can be applied the standard cross-over and polynomial providers to blend the current inhabitants and it is a planting season developed while following generation. Eventually, the best people with regard to non-dominance and range usually are picked because the solutions. A measure of your NSGA-II criteria usually are presented within Algorithm formula (2)

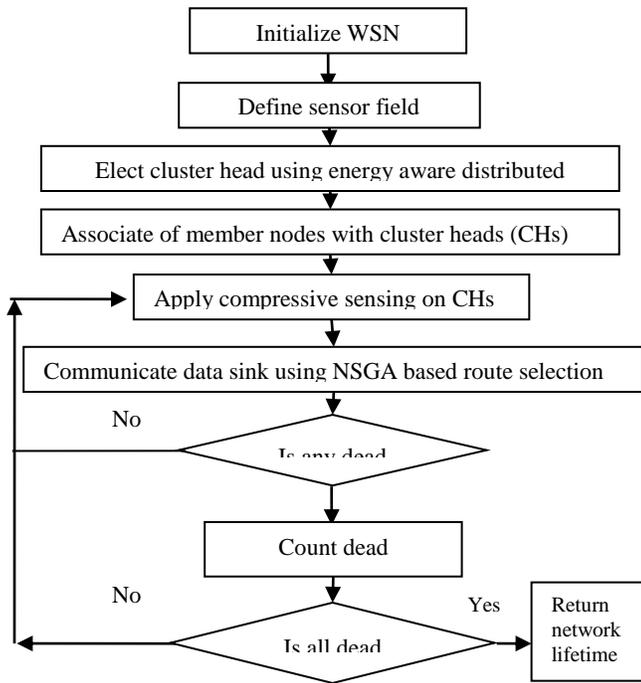


Fig 7: Flowchart of the Proposed Technique

Algorithm 2: The main steps of the NSGA-II

- 1 Create a new random population associated with d Crop up chromosomes (candidate solutions)
- 2 when ending problem is not found accomplish
3. Study the multi-objective health for each chromosome in the population.
4. Get ranking population by simply following techniques:
- 5 begin
- 6 Get ranking population utilizing Protocol (3).
- 7 Calculate your populating long distance Utilizing Protocol (4).
- 8 ending
- 9 Select two father or mother chromosomes coming from a population in line with the Populating Selection owner described by Protocol (5).
- 10 Which has cross-over likelihood, cross-over the parents to build completely new offspring? (Children). When no cross-over had been executed, may be the specific copy associated with parents.
- 11 Which has mutation likelihood, mutate completely new at each gene?
- 12 Spot completely new offspring throughout the new population.
- 13 finish
- 14 Comeback your placed of the non-dominated Pareto-optimal solutions throughout present-day population.

Algorithm 3: Non-dominated Sorting

- 1 Allow get ranking number,  $r = 0$
- 2 while human population is not really empty Accomplish
- 3  $r = r + 1$
- 4 Obtain the non-dominated men and women from society W based on the dentition Connected with domination.
- 5 Assign get ranking r to those individuals.
- 6 Remove these folks from society P.
- 7 end

Algorithm 4: Crowding together length calculation

- 1 Permit  $d_i = 0$  for my partner and  $i = 1; 2; :::; Z$ .
- 2 For each and every goal function  $f_k, e = 1; 2; :::; M$ , kind the population ascending.
- 3 Permits  $d_1 = dZ = INF$ .
- 4 for l = 2 for you to (Z1) complete
- 5 | set  $d_j = d_j + (f_{kj} + 1 - f_{kj}1)$ .
- 6 finish

5.1 RESULTS AND DISCUSSIONS

The proposed algorithm is tested on various stages. The algorithm is applied using various performance indices like Cluster head, base station. . data packet remaining, First dead time.

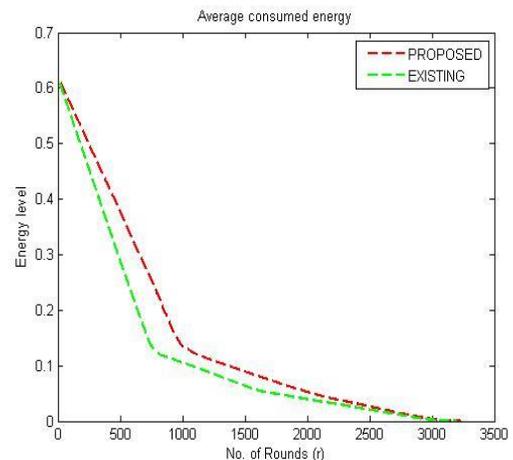
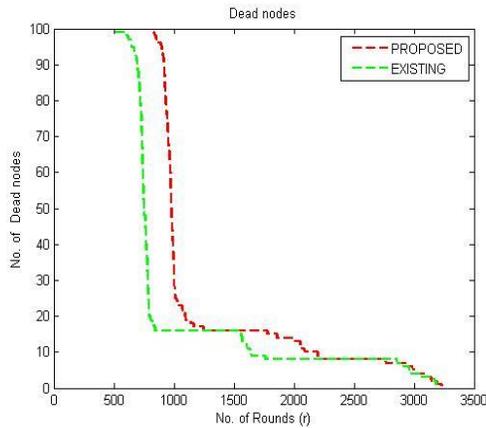


Fig: 1. Average consumed energy

In fig: 1 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in Average consumed energy with the usage of proposed method over existing method.



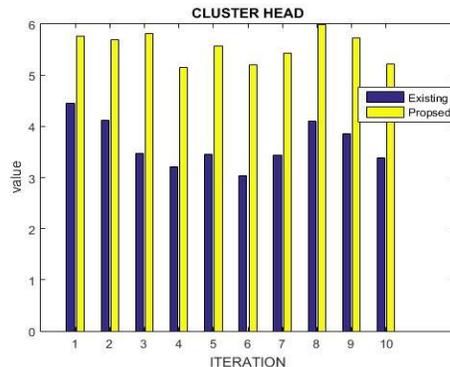
**Fig: 2. Dead nodes**

In fig:2 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in Dead nodes with the usage of proposed method over existing method.

1. CLUSTER HEAD: cluster head is shown below in the comparison Table 1. As cluster head should be decreased therefore the proposed algorithm can be displaying better results as compared with the available methods as bunch go can be decreased in every case.

**Table: 1. Cluster head**

S.NO	EXISTING	PROPOSED
1	4.4473	5.7723
2	4.1157	5.6945
3	3.4654	5.8108
4	3.2063	5.1578
5	3.4530	5.5691
6	3.0424	5.2011
7	3.4437	5.4279
8	4.1102	5.9886
9	3.8501	5.7332
10	3.3860	5.2178



**Fig: 3. Cluster head**

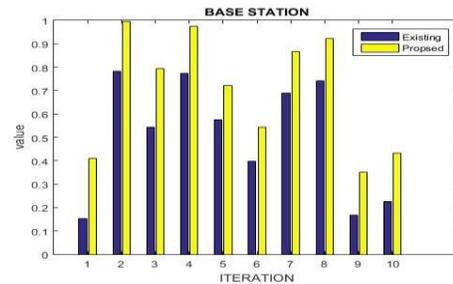
In fig: 3 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in Cluster head with the usage of proposed method over existing method.

2. BASE STATION: cluster head is shown below in the comparison Table 2. base station should

be decreased therefore the proposed algorithm can be displaying better results as compared with the available methods as bunch go can be decreased in every case.

**Table: 2. base station**

ITERATION	EXISTING	PROPOSED
1	0.1530	0.4102
2	0.7826	0.9959
3	0.5430	0.7945
4	0.7735	0.9745
5	0.5755	0.7224
6	0.3980	0.5444
7	0.6888	0.8679
8	0.7428	0.9239
9	0.1688	0.3501
10	0.2271	0.4322



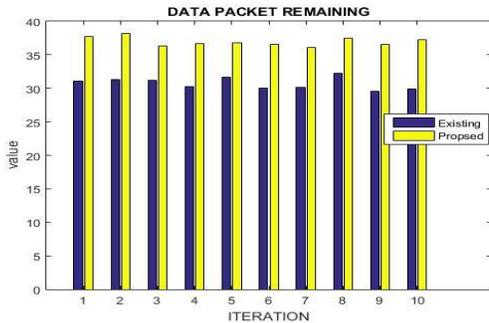
**Fig:4. base station**

In fig: 4 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in base station with the usage of proposed method over existing method.

3. DATA PACKET REMAINING: cluster head is shown below in the comparison Table 3. As data packet remaining should be decreased therefore the proposed algorithm can be displaying better results as compared with the available methods as bunch go can be decreased in every case.

**Table: 3. data packet remaining**

ITERATION	EXISTING	PROPOSED
1	31.0388	37.7796
2	31.3664	38.1555
3	31.2408	36.3060
4	30.2923	36.6745
5	31.6373	36.8503
6	30.0805	36.5116
7	30.2018	36.0601
8	32.1988	37.4509
9	29.5402	36.5411
10	29.9083	37.2146



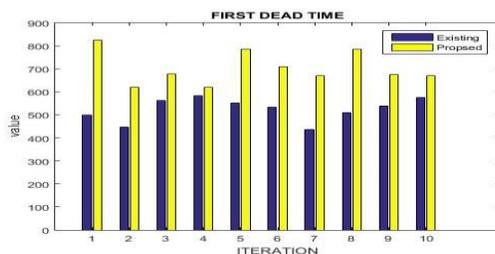
**Fig.5.** data packet remaining

In fig: 5 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in data packet remaining with the usage of proposed method over existing method.

4. FIRST DEAD TIME: cluster head is shown below in the comparison Table 1. First dead time should be decreased therefore the proposed algorithm can be displaying better results as compared with the available methods as bunch go can be decreased in every case.

**Table: 4.** First dead time

ITERATION	EXISTING	PROPOSED
1	501	824
2	447	620
3	564	679
4	584	621
5	553	787
6	535	709
7	436	670
8	511	786
9	538	676
10	577	671



**Fig.6.** First dead time

In fig: 6 blue lines represent the existing values and yellow lines represent the proposed values. It's clear from the graph that there's decrease in First dead time with the usage of proposed method over existing method.

## CONCLUSION:

It has been found that the most of the existing techniques has neglected initial particles issues with particle swarm optimization based protocols. As the wrong way decided on particles bring about poor results. The genetic algorithm based protocols doesn't ensure the global optimized final

results but loaded due to the mutation in addition to crossover operators. The by using the Non dominated sorted genetic algorithm (NSGA) is ignored to efficiently elect the inter cluster data aggregation path selection. Therefore, to be able to take out these issues NSGA baseliner bunch data proposed recommended in this particular work. Basic principle development may be performed by changing a particle swarm optimization with NSGA based optimization technique for energy efficient routing. In addition, a utilization of the compressive smell furthermore raises the overall performance further. Your compressive smell employs data combination to eliminate a tautology data out of sensor nodes. Finally, to evaluate the effectiveness of the proposed technique further the effect of the scalability of number of nodes has also been considered. Overall comparative analysis reveal that the proposed protocol outperforms existing protocols.

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