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Lifetime Improvement in WSN Using Dynamic Clustering Based on Residual Energy and Direct Transmission

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ABSTRACT: Wireless sensor network is a field of networking that has been used for sensing information from environment. In WSN the sensor nodes are attached to a battery for sensing information. Each node utilizes three types of energy during its lifetime over the network. Due to deployment of WSN in unreachable area energy is main constraint for network to be cost effective. The major issue is network lifetime that must be increased so that network performs for long duration of time and provide cost effective for an organization. To overcome this issue in the proposed paper a novel approach that divides network into clusters and use direct communication for sink node that are in communication range. On the basis of this approach we can state that proposed model have better network lifetime than previous approaches.

KEYWORDS: WSN, Energy consumption in WSN, Application of WSN, chaining, Pegasus, clustering and cluster head selection.

I. INTRODUCTION

1.1 INTRODUCTION TO WSN

Wireless sensor networking is a rising technology that has primarily distorted the way, people observes their atmosphere. As an outcome, WSNs is a rapidly growing research area and is being used in very large number of applications. The exploitation of large scales of wireless sensor network becomes possible by the advances in progress of highly integrated and energy efficient electronic devices. These are mostly due to their small size. They are also featured with self-organizing and self-healing power. Three basic parts of a sensor node can be seen as:

1. A sensing subsystem that is used for data capturing from the real world.
2. A subsystem for processing that is used for local data processing and storage.
3. A subsystem consisting of wireless communication to be used to for data receiving and transmission. Existing optimal schemes, which can later be used for revocation purpose.

1.2 TYPES OF WSN

1.2.1 Structured WSN: Structured WSN is a type of WSN that has been simulated on simulation tool before deployment and various evaluations and parameters has been analyzed for better performance of the network. All the drawbacks of WSN can be analyzed and can be modified as per requirement so that network can be outperforming.

1.2.2 Unstructured WSN: In this type of network nodes are deployed at random position in particular area of sensing. This type of network has been deployed in such regions where human attraction is not possible like border areas, Antarctica like places, deep sea areas and war zones. Sensor nodes are cheap and intelligent in such a way that these can easily communicate with other sensor nodes by transmitting radio signals and these are able to form an ad-hoc network so that communication between nodes can easily be done.

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1.3 CLUSTERING PARAMETERS

In the process of clustering in WSN various parameters have been used so that effective clustering can be done. In this process various parameters that are responsible for efficient clustering are illustrated below.

- **Number of clusters (cluster count)**: In most recent probabilistic and randomized clustering algorithms the CH selection and formation process leads naturally to variable number of clusters.
- **Intra cluster communication**: In some initial clustering approaches the communication between a sensor and its designated CH is assumed to be direct (one-hop communication).
- **Nodes and CH mobility**: In the process of clustering when nodes and the cluster head are stable then it is easy to manage clustering in static wireless sensor network. Inter cluster and intra cluster communication in static nodes are easy.
- **Nodes types and roles**: There are two different types of networks, one is homogenous that having same properties for all the nodes and second is heterogeneous network in which some extra resources are provided to some nodes.
- **Cluster formation methodology:** In the process of cluster formation various approaches are used.
- **Overlapping**: Overlapping in clustering is major issue in WSN. Various routing protocols are prone to over lapping concept that causes various issues in routing.

1.4ENERGY CONSERVATION IN WSN

Energy is the main factor that is considered for development and deployment of WSN in various applications.Senor nodes functionality has been divided into three different classes that are sensing of information from the sensed area, processing of sensed information and transmission of sensed information to base station or cluster head. Cluster head is responsible for data aggregation and processing of information. Using compression information is transmitted to sink node. Large amount of energy is dissipated in transmission and receiving process whereas in sensing a negligible amount of energy is dissipated. Various sensor nodes are adaptable for restriction of direct communication to different locations in which large amount of energy is consumed. LEACH protocol reduces energy consumption by utilizing local data aggregation at cluster level and global communication has been reduced that results reduction in network overhead.

1.5APPLICATIONS OF WSN

- **Process Management:**The major applications of WSN are monitoring that has been used for sensing information from different area of sensor network. WSN has been widely used for movement sensing at border areas.
- **Health care monitoring:**WSN are widely used in health care procedure so that human body information can be used for data processing. Health monitoring sensors are mainly of two types that are implanted sensor or wearable sensors.
- **Air pollution monitoring:** In tough environment conditions, sensing WSN are deployed in cities having high traffic. Air pollution sensing sensors are deployed to sense the harmful gasses present in the air.
- **Forest fire detection:** In forest areas WSN are used for sensing information about fire. The sensor nodes that are capable of sensing temperature, humidity and gasses concentration has been deployed in forests areas.

II. REVIEW OF LITERATURE

ZhengwangYeet al [1]In this paper, a security fault-tolerant routing is presented for multi-layer non-uniform clustered wireless sensor networks to improve the security reliability of network operation and data transmission. First, we establish the multi-layer non-uniform clustered network topology, which can effectively avoid the intercluster load imbalance; clustering can effectively reduce the network energy consumption and improve the network reliability. In the cluster head selection process, the trust model and the fuzzy logic are utilized to evaluate the qualification of sensors to become a cluster head.

Tanevski, P.et al [2]The sensor nodes are operated at the minimum voltage & these nodes are energy efficient. The battery used here is often high. The commercial DC-DC converter is used in the modified circuit & the super capacitor. According to this paper it is impossible to increase the lifetime of battery in WSN. The DC-DC conversion in the super capacitor charge discharge efficiency have analyzed & measured. This paper is a specification of a module needed b/w the module and the battery & the sensor node. This paper also aims at setting foundations for future development of an energy-optimization module for ultra-low power wireless sensor nodes.

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Bojna, S. et al [3]In this paper author proposed a technique for the reduction of the consumption of energy through the procedure between the packets sending in WSN. It used the Genetic Algorithm. The particular kind of energy function is used to fulfill the customization of genetic algorithm. The observation has to be done carefully for the space of optimization. The minimum energy found with 99.9% precision of error, memory, space, CPU consumption is shown here.

Sivasankar,P.Tet al [4] WSN is consisted with large number of tiny particle. The sensor network is suit here & it is used to support the facile applying nature. The performance & structural feature of CC2420 is introduced in this paper & the key point of WSN is also described in this paper. The huge application in design is based on CC2420 in WSN with low cost energy consumption.

Elhabyan, RS.Et al [5] Today the very important & efficient technology is WSN. In the sensor network to start the secure communication is very difficult. In WSN it is identified that it is the clone attack prone in WSN. Later the adversary replicates the reprogrammed node & spread throughout the n/w to take the control. There is some solution which is available for this. In the WSN control the problems which are connected energy & memory demanding in any WSN protocols. The drawback of the lightweight, fast, efficient & mobile agent based security solution.

Deshpande, V.Vet al [6] The energy of sensor node is a scarce in WSN. The lifetime of WSN was used to decrease the consumption of energy in WSN. When the sensor network is divided in to the groups then it increased the lifetime of the node in a easy way which is called the cluster with node with huge energy node which was the leader. All the inter cluster communication take place due to the cluster head. The level of energy was found at the predefined point of time & by the whole sensor network. Any fault in the cluster head provides the communication to the halt.

III. METHODOLOGY

3.1 INITIALIZATION OF WSN

This is the first phase of WSN for sensing information from the environment. In this phase various parameters have been initialized for deployment of sensor nodes. In this phase area of sensing, nodes location, link layer type, queue type, queue length and routing protocol has been defined.

3.2 CLUSTER FORMATION

In this phase clustering in WSN has been done to divide whole network into different clusters. In the process of clustering nodes has been divided into clusters on the basis of nodes properties.

3.3 SELECTION OF CLUSTER HEAD

After division of system into different groups choices of cluster head have been done. Nodes inside a cluster will transmit information to other head of group. Determination of group head has been done on the premise of vitality accessible to nodes in a system.

3.4 ENERGY CALCULATION OF NODE

In WSN node have energy to sense information and transmit information from source to destination. The nodes available in network consume energy in sensing, data aggregation, transmission and receiving energy.

E = Energy given to a node, E_r = Energy Dissipated in receiving data, E_t = Energy Dissipated in Transmission, E_{da} = Energy dissipated during data collection, E_{res}= Remaining Energy.

$$E_{res}= E-(E_r+ (E_t+ E_{da})*distance^2) \quad (1)$$

If the nodes are not in the communication range then the residual energy has been accounted on the basis of equation (2)

$$E_{res}= E-(E_r+ (E_t+ E_{da})*distance^4) \quad (2)$$

2. DATA TRANSMISSION USING ROUTING PROTOCOL

Sensing nodes available in the network transmit sensing information to cluster head using routing protocol routes. In the proposed work dynamic route selection approach has been used for transmission of information from single node to

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cluster head. Sensor Nodes can communicate directly with cluster head or utilized intermediate nodes for transmission of information

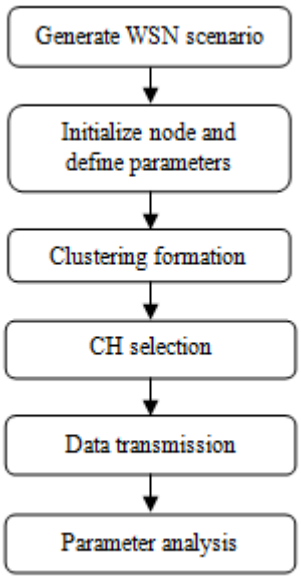

Fig.1: Flow work

Figure3.1 represents flow of the proposed work that must be carried out for achievement of desired objectives. In this flow various steps have been explained that must be followed by the user for development of congestion control wireless sensor network. In the proposed work wireless scenario has been designed by using different simulation parameters that are used for sensing and transmitting information. Antenna, MAC, LL, QUEUE and routing protocol has been defined for generation of wireless sensor network scenario. After generation of wireless sensor network nodes have been deployed at different locations in the sensing area for sensing the information. These nodes are provided with a battery source for lifetime of the nodes so that data can be sensed and transmitted over the network to the base station.

IV. RESULTS

In the process of WSN various nodes are utilized for sensing information and data transmission to base station and for processing of sensed information. Nodes have been deployed in the region for sensing information so that information can be aggregated and used for transmission for meaning full purposes. In the process of data transmission, nodes have been powered to performance various operations. On the basis of these different operations nodes are deployed over the network so that various parameters can be analyzed and performance for the proposed work can be measured.

Table 1: Simulation parameters Setup

PARAMETER	DESCRIPTION
Area	100 * 100
Number of nodes	100
MAC Type	8.02/11
Receiving Energy	$5 * 10^{-8}$
Transmission Energy	$5 * 10^{-8}$
Data Aggregation Energy	$5 * 10^{-9}$
Initial Energy	0.2 Jules
No. Of Rounds	2000
Energy Model	ENERGY Model

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Table 1 defines various simulation parameters that are necessary for simulation of the proposed work. These parameters are utilized for initialization of the simulation setup. In the WSN 100 nodes are deployed in the network that are used for sensing information and transmitting information to 100th node that acts as a base station (sink node) for the proposed work.

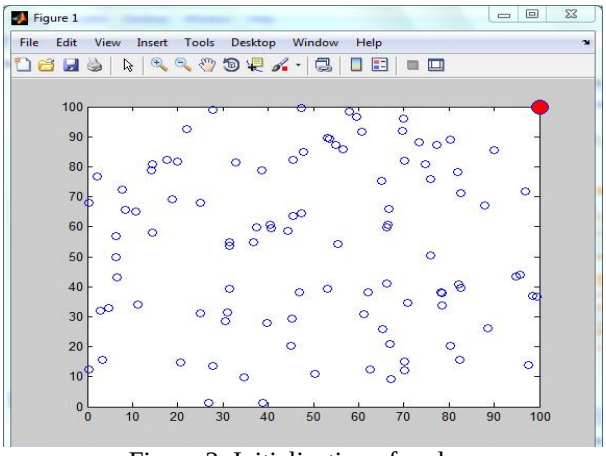

Figure 2: Initialization of nodes

This scenario is used to represent the initialization of nodes. The nodes have been deployed over the network at different locations so that nodes can easily sense information from the environment and transmit this information to base station so that decision can be developed on the basis of information. In WSN 100 nodes are deployed for sensing information, out of which 100thnode acts as base station (sink node) and collects information from the sensing nodes.

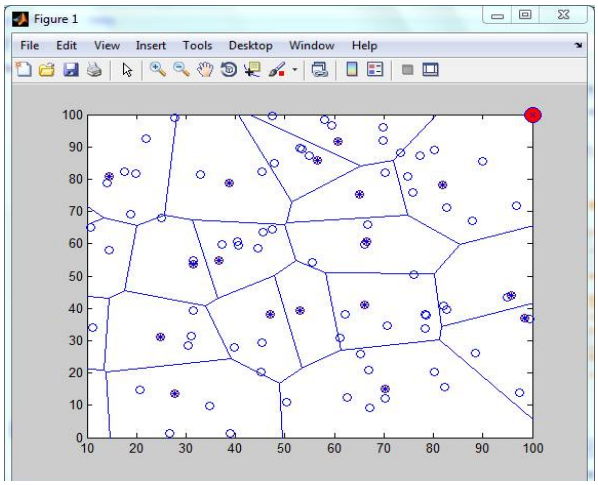

Figure 3: Initialization of cluster head & base station

Figure 4.2 represents cluster division done in the network based on proposed clustering protocol. In this protocol network is divided into different layers and on the basis of ratio of residual energy of node to the total energy of cluster, a function value has been computed that is used for selection of cluster heads. On the basis of probabilistic function and residual energy based function cluster heads areselected for all the rounds.

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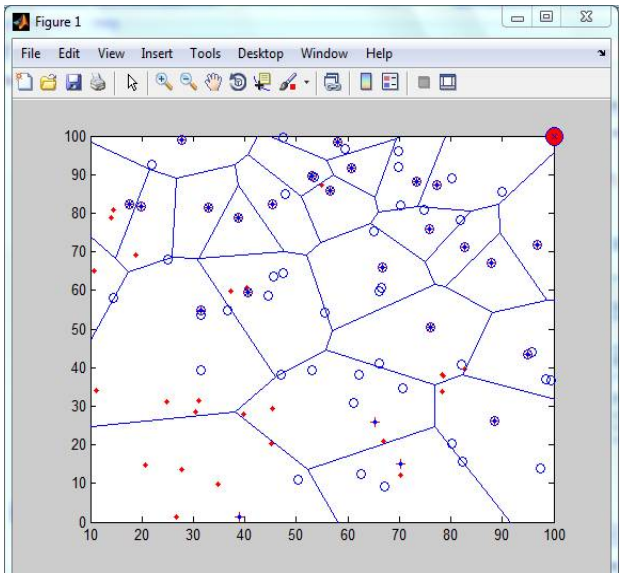

Figure 4: Transmission of data

Figure4 represents selection of cluster heads in the network for data collection and transmitting to base station. After selection, all the nodes within a cluster start communicating with CH on the basis of minimum distance from the sensing node. All the nodes within the cluster transmit information to belonged cluster head and cluster head further transmit information to base station via other cluster heads.

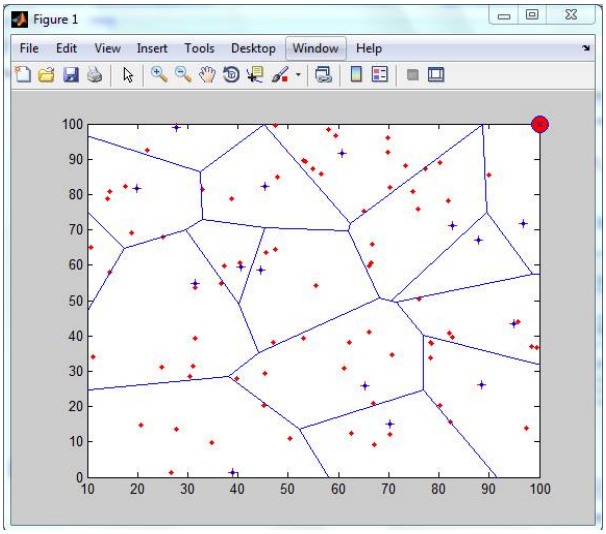

Figure 5: Routing for route selection

Figure 4.4 represents node state in the network after utilization of all the amount of the energy. In the process of sensing and data transmission, nodes have consumed small amount of the energy so that data can be transmitted over network and sensed. This figure represents status of the nodes in WSN after consumption of all the amount of energy.

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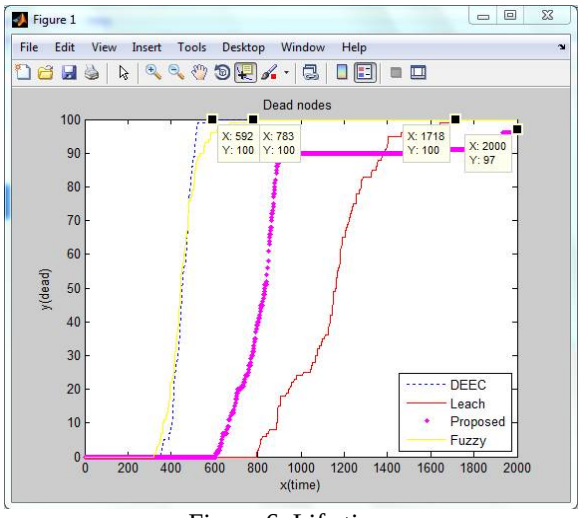

Figure 6: Life time

Network lifetime that has been simulated on the basis of different approaches has been represented in the proposed work. Energy has been consumed in various purposes of sensing and data transmission. In the proposed work simulation has been done for 2000 rounds using 0.2 Joules of energy.
In this proposed work, proposed method has been compared with leach, DEEC and fuzzy based WSN. On the basis of network lifetime parameter comparison proposed approach provides better network lifetime over the other approaches. This has been presented that DEEC, Fuzzy and Leach has been stable for 592 rounds, 783 rounds and 1718 rounds respectively. Whereas in the proposed protocol network lifetime is goes over 2000 rounds.

V. CONCLUSION& FUTURE SCOPE

WSN is the emerging field of communication for transmission of sensing information from the sensing environment using different sensor nodes. Sensor nodes transmit information to the base station so that valuable information can be used for decision making process. Due to transmission of the messages over a single node by all the nodes data congestion may occur that results data loss. In the proposed work cluster head selection has been done so that data can be divided in the network. On the basis of dynamic clustering the major advantage is that in the network each node get the chance to become a cluster head and energy of all the nodes is consumed in predict manner. We can easily predict from the results that proposed approach provides much better results than previous approaches that had been used before.

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