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Full Coverage Deployment in Wireless Sensor Network

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Abstract

In wireless sensor network very less work has been done on deployment. As we know in random deployment we can't achieve the maximum coverage in communication which result in short life time of the battery. So in this paper we discuss few benefit of the Uniform deployment in which we can achieve the full coverage with uniformity. In this paper we can achieve the maximum efficiency and increase lifetime time of the sensors which result in the long battery life which is the back bone of any Wireless Sensor Network for Remote Sensing like in Oceanographic, Glacier study and Metrological Department for weather study which are nearly inaccessible regions.

1. Introduction

Wireless sensor networks (WSNs) are composed of large number of sensor nodes that have capability of sensing, data processing and communication functionalities. The nodes are usually accoutered with power-strained batteries, which are often difficult, extravagant and even impossible to be restored once the nodes are deployed. Therefore energy aliveness becomes the key research challenge for sensor network protocols. The energy consumed by a node depends on its state. Each node could be in one of four states: transmit, receive, idle (when the node keeps listening to the medium even when no messages are being transmitted) and finally sleep state (where the radio module is switched off: no communication is possible). Recent research showed that accurate energy savings can be achieved by scheduling node's activities in high-density WSNs. Specifically, some nodes are scheduled to sleep whereas the remaining ones provide continuous monitoring. The main issue here is how to minimize the number of active nodes in order to maximize the network lifetime.

Sensing coverage is also a significant issue for sensor networks and is viewed as one of the critical measures of the supervision quality provided by a WSN. Sensor deployment is important in WSNs, as it not only determines the cost for creating the network but also affects how well a region is supervised by sensors. One frequently used method to decrease the undesirable energy consumption is to implement an energy-efficient configuration protocol where sensors operate under a well-defined activating schedule, that is, some unnecessary sensors switch to off mode or low-power listening mode. The coverage problem in WSNs is how one can be sure that the deployment of active sensors provides the necessary coverage level and how to determine the minimum number of active sensors required and their locations in the interested area to ensure desirable coverage. Regarding sensors activating or deployment control problem, some work have been investigated how some sensors can be arranged to go to sleeping modes to elongate the network lifetime while maintaining desirable coverage of sensing field. On the other hand how these active sensors can be selected to maintain the desirable coverage of sensing field. And provide a near-optimal grid-based sensor placement algorithm to achieve the complete coverage. In this method, the interested area is divided into grid points uniformly. If one grid point can be detected by at least one sensor, the grid point is covered. The coverage of the area is defined as the ratio of detected grid points to the total grid points. A coverage-preserving node scheduling scheme is presented which determine when a node should be turned off and when it should be rescheduled to turn on again. How to find the minimal and maximal baring path that takes the duration that an object is monitored by sensors and is addressed and proposes a probe-based density control algorithm to put some nodes in a sensor dense area to a snooze mode to ensure a long-lived, robust sensing coverage.

2. Related Work

This section reconsiders the studies that are closest to the proposal. Maximizing the lifetime of a static WSN by ensuring the complete sensing area coverage is a challenge. Several works can be found in the literature considering only one property, for example: focus on maintaining the nodes with the highest remaining energy awake; and giving priority to keep the node with a better coverage active. In the method described, each node decides whether to enter sleep mode or not. Each node is autonomous and its periodical decisions are based only on the neighborhood coverage information. In order to eliminate blind points, the algorithm uses a random back off mechanism to avoid the simultaneous decisions. This work does not introduce sleeping priorities between the nodes with a low remaining energy, which can decrease the lifetime of WSN. A random one, based on individual decisions, and another one based on coordinated decisions between nodes. Both mechanisms calculate a delay to send messages. In the random mechanism, nodes are randomly turned off and the activation and deactivation periods are also randomly chosen. Thus, the network is a collection of independent on and off sensors, not guaranteeing coverage and losing energy saving opportunities as related in. The Coordinated decision mechanism requires synchronization between the nodes. Each node must calculate and control its own delay and exchange information with its neighbors to advertise its position and residual energy. The node with the lowest residual energy enters sleep state first. The ERGS algorithm, proposed in, considers a static and homogeneous WSN synchronized by rounds. Each round must determine their energy level, position, coverage area, and neighborhood and advertise this information with their neighbors. After, this each node calculates its eligibility to go to sleep mode. If an eligible node cannot go to sleep mode, it sends a message warning its neighbors. Upon receiving such a message, nodes must recalculate their eligibility. Thus in ERGS, nodes send one-hop advertising messages to their neighbors at the beginning of each round and also if an eligible node cannot enter sleep mode. Note that it is mandatory that all nodes send advertising messages to its neighbors at the beginning of each round. Moreover, an inconsistency can be generated if a node does not receive any confirmation about the inactivity of one of its eligible neighbors, losing energy saving opportunities. It is obvious that the energy advertise mechanism directly affects the energy consumption. Thus, this paper proposes a method to save energy in WSN without using energy level advertise messages.

3. Algorithm

The objectives of the thesis work are to cover full coverage area of the field and to achieve it following steps are summarized below:

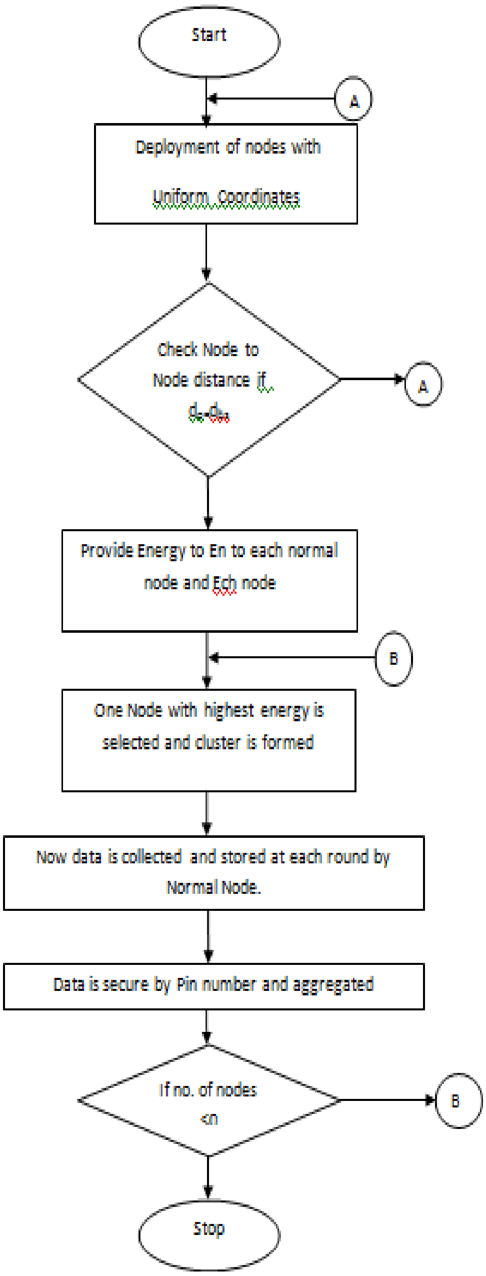
- Dynamic sleeping time control by determining the number of active, idle and sleep nodes in a particular network which will reduce the energy consumption.

- Full Coverage Deployment in the network area and forming the square uniform deployment of it and after that energy is assigned to that grid sensors and clusters are formed accordingly.

❖ Increasing Lifetime of the network by placing less nodes in active mode and more in sleep mode.

❖ Data aggregation at each round of sensing which will give us the total number of alive nodes remained at the end after each sensing node and we will also get the average energy of System after each round.

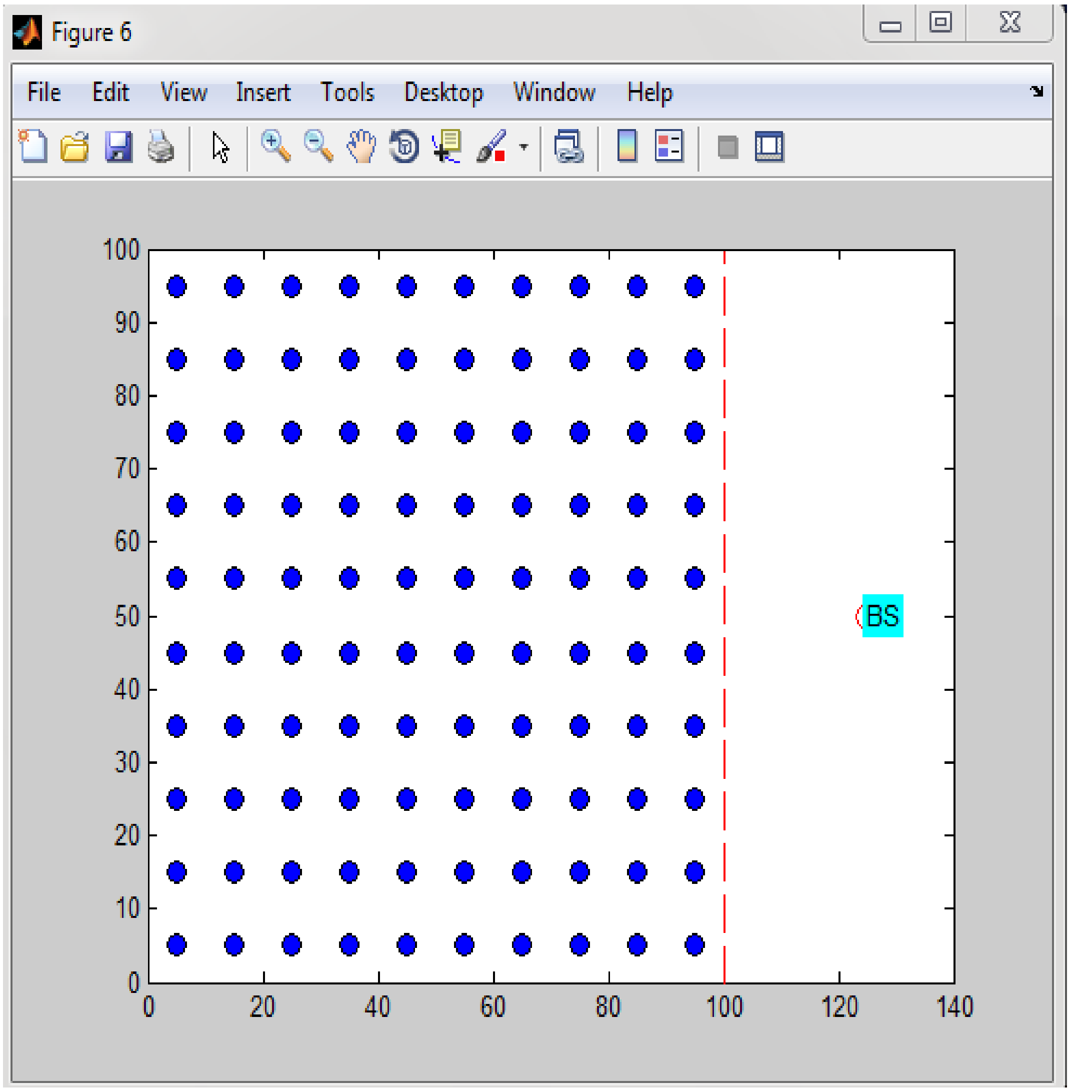
Flow Chart:



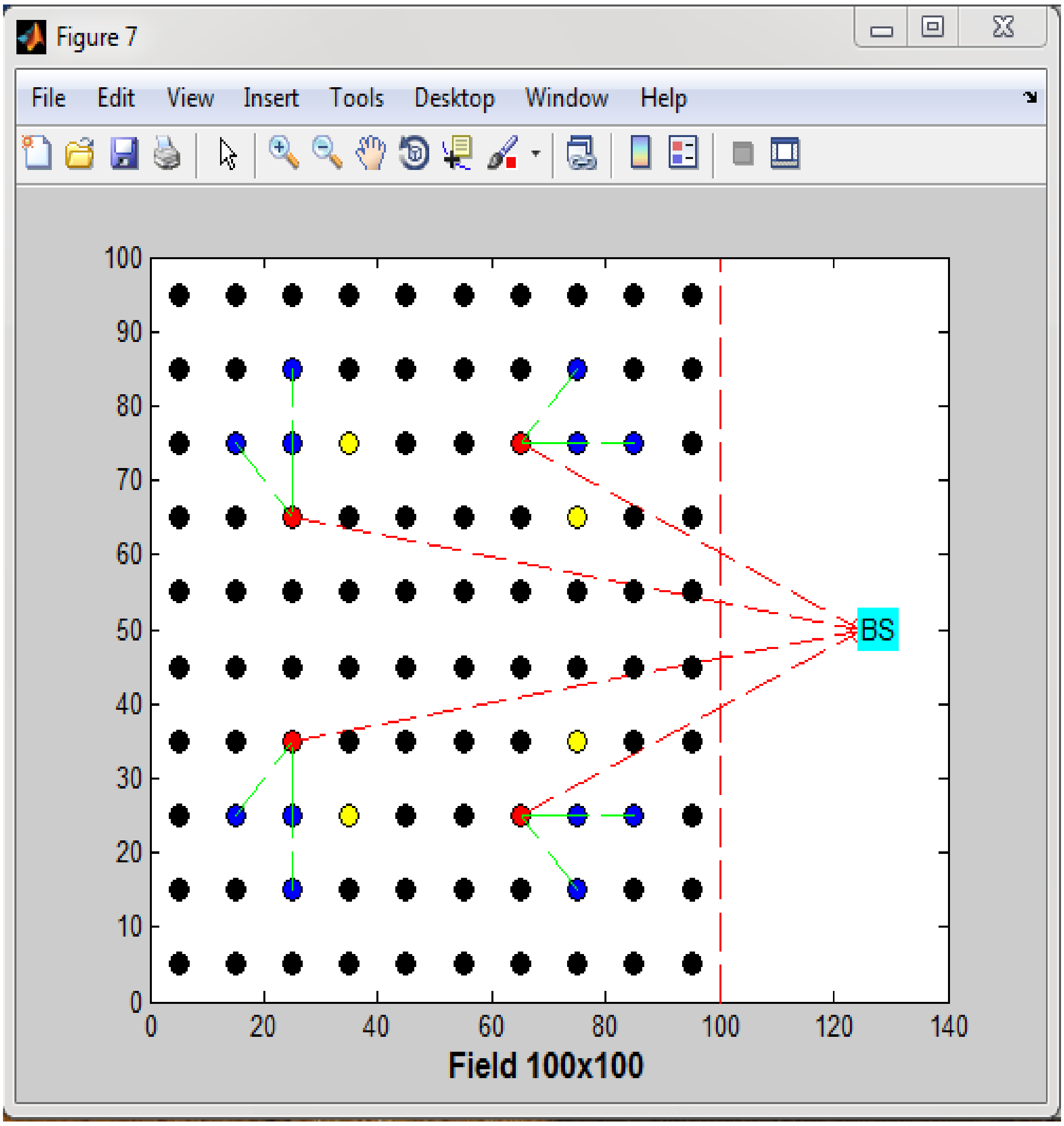
4. Results

Following steps and processes are evolved which lead to advance development of network:

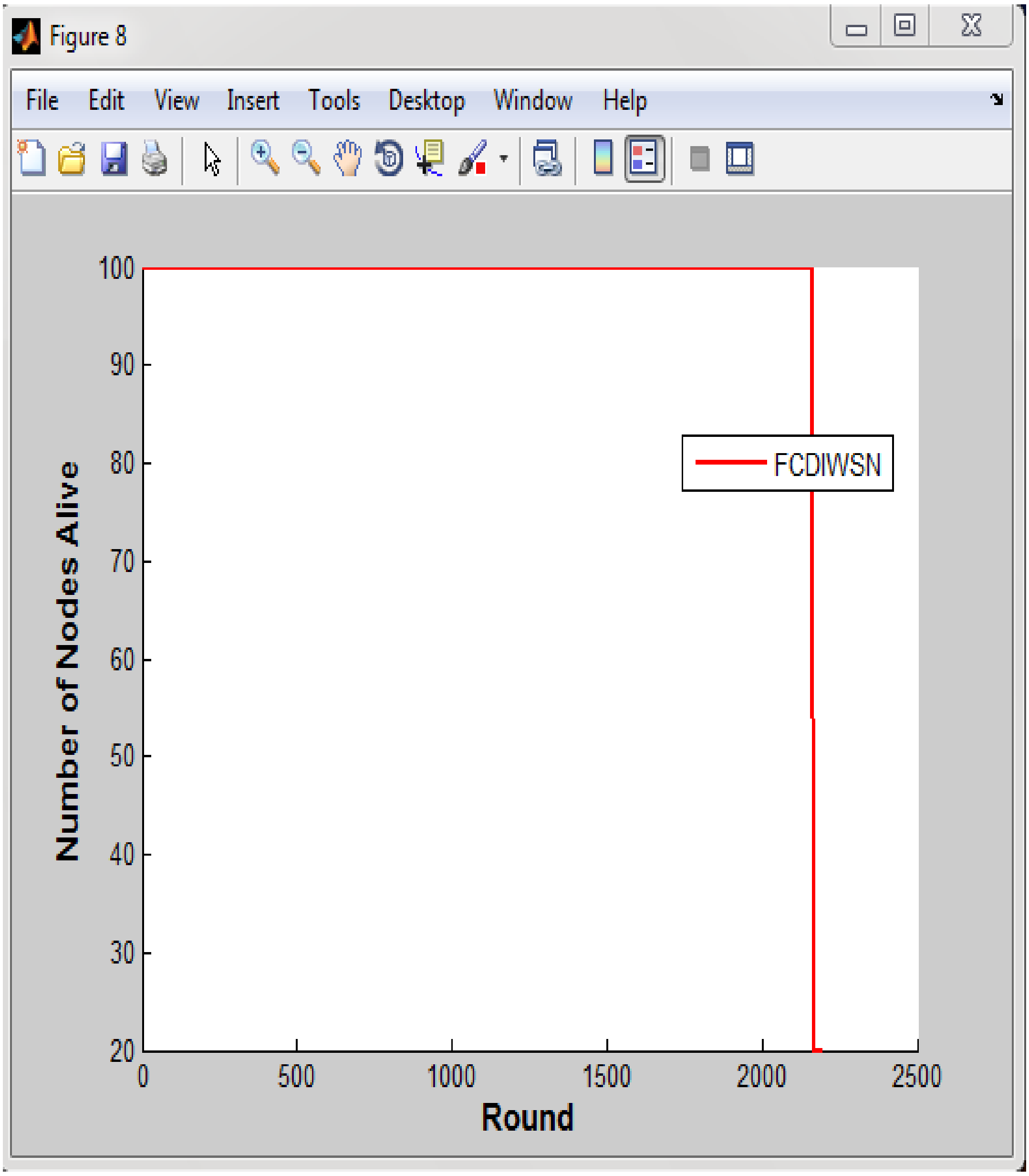
i. **Uniform deployment:** In this the sensors are deployed uniformly in an area let us say we deploy 100 such sensors in uniform area of (100,100) in some particular area.



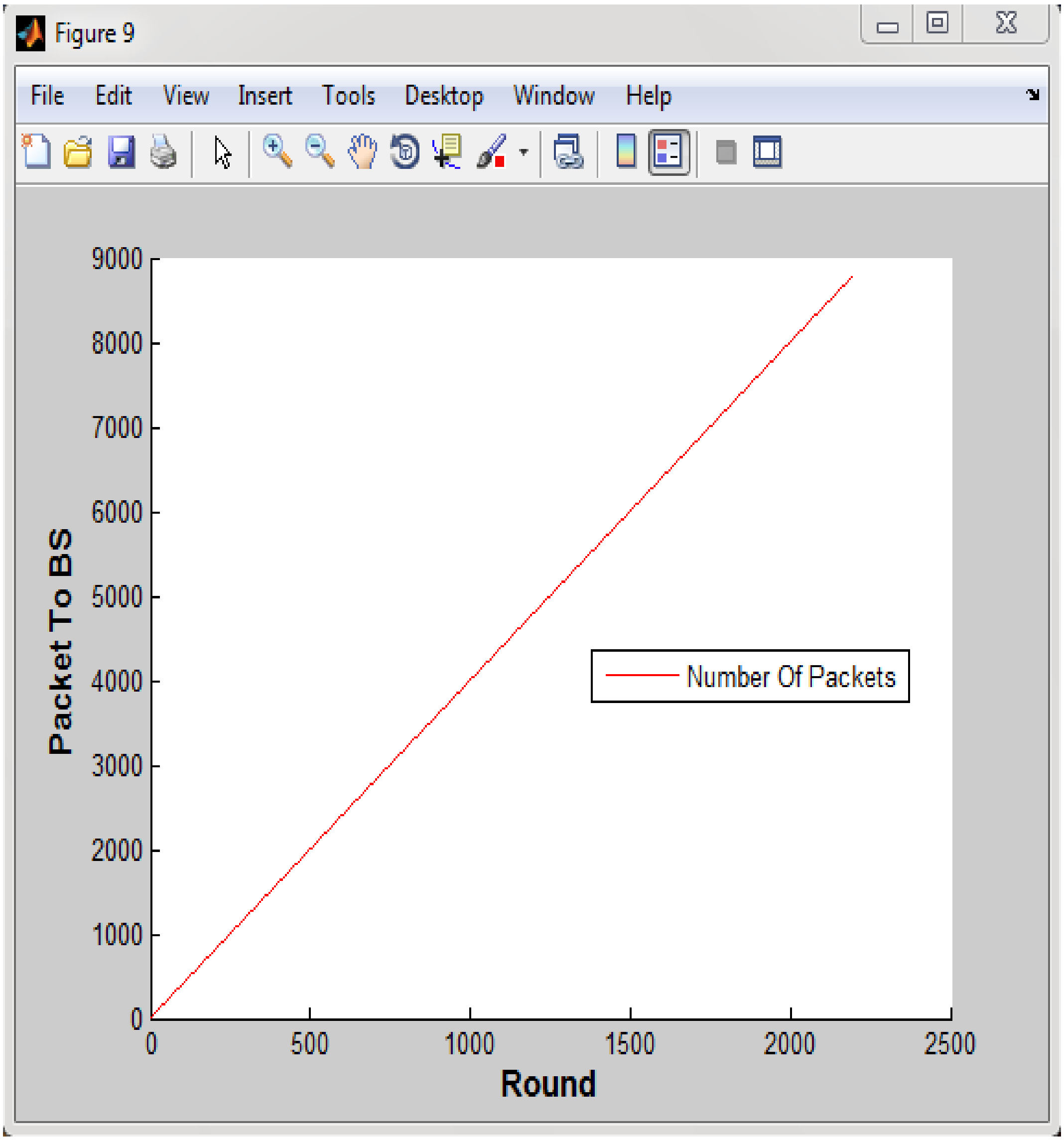
ii. Uniformly Deployed Sensor Cluster Filed: In this the use of uniform deployed sensor is that each sensor gets equal energy from the cluster head and will become dead at same time which will save energy of the system by doing this. In this figure the red dots denotes the cluster head, yellow one denotes sleep nodes and blue one are the alive nodes. We have kept some nodes alive so that the information is not completely stopped and the link is maintained between the nodes and the BS. The figure below shows us in more detail.



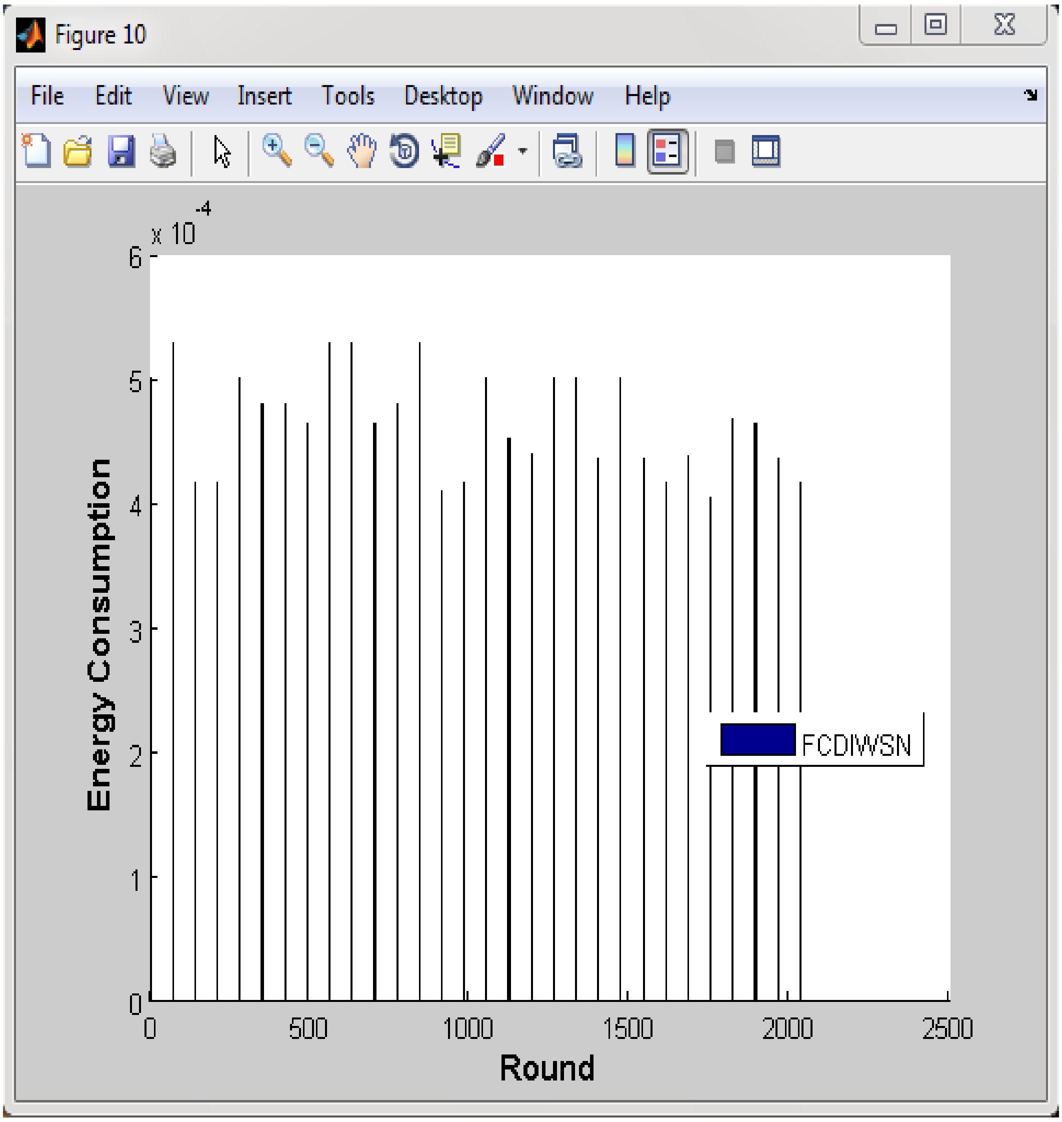
iii. **Alive Nodes at each Round:** In this we get the number of alive nodes at the end of each round that is there is sudden fall in the alive nodes on same time this is because we have provided same amount of energy to each nodes from the cluster head and that's is why they go to dead state at same amount of time thus saving energy of system and when compared to that of randomly deployed sensor graph in which the alive nodes decreases at low rate and consumes lot of time so this graph shows us the lifetime enhancement of the system .



iv. Packets formed at each round: It depicts that firstly the packet size was less and then increases as the rounds are increasing in the uniformly deployed sensor area. And when compared with the graph of random deployment it shows that in uniform deployment the packet send are in frequent manner without any breakage in the graph but in the random graph the packets send are in intervals that consume lot of energy and time of system.



v. **Energy consumed:** It shows the Total Energy consumed at each round. In this the total energy which is dissipated is in random manner i.e. sometimes the consumption is less and sometimes it's more but not completely gone to end, the energy is saved in this as we can see when compared with the random deployment system there the energy goes on reducing as the rounds increases.



5. Conclusion

The finest way to reduce the energy of nodes in a static and homogeneous WSN is by switching most of them to sleep mode. However, it may imply a new problem that is full sensing area coverage. The correct way to decide the set of nodes to switch off, all approaches found in the literature must assure that all nodes have up-to-date information about their neighbors and this information is exchanged between the nodes in fixed time slots through messages. However, this process spends a huge amount of energy. So to reduce the energy consumption and increasing the lifetime of static and homogeneous WSNs, a new algorithm is proposed *i.e.*, unadvertised energy saving method which eliminates the energy level advertisement messages. Mathematical proofs prove that this ensures a full coverage of the interest area while saving energy. Although, it was demonstrated that the least case for energy savings in this is to preserve more energy than all other methods. Future scope includes the simulation and possible implementation of the proposed algorithm.

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