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Research Article

Energy Efficient Scheduling Algorithm for Structural Health Building Monitoring System(Shbm) to Increase the Battery Lifetime

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Abstract: A structural health building monitoring system is invented, achieved and attempted using Wireless Sensor Networks .Ambient vibration of the structure is audited and is implemented to identify the health status of the structure. With WSN, low cost monitoring is possible without intruding with the action of the structure. In this cluster head is heavily loaded since it gathers information from all other member nodes and integrate then and forward to sink either directly or through intermediate other cluster head. I near future cluster head drain and we need to select another cluster head via re clustering. The re clustering also led to energy loss to select the cluster head based on weight age value.WSN consumes less power and it is used to track slow targets .WSNs covers only small distance. WSN has high failure rate and we have to plant excessive nodes. Hence redundant nodes dissipate more power. To avoid this, sleep mode and scheduling algorithm is used in this paper. The objective of the paper is to design a scheduling algorithm to trace data with target rate. The proposed scheme is a kind of an adaptive/Cyclic on–off scheduling scheme in where sensors nodes use only local information to make scheduling decisions.
Keywords: wireless sensor networks, Cyclic on/off, adaptive on /off-scheduling

1. Introduction

The wireless sensor network is the popular field in research field. It is the self-configured and infrastructural less networks that observing or analyzing environmental statuses such as heat, noise, pressure, vibration, or pollution and send these data collectively through the network. In this wireless sensor network, network lifespan is an important aspect for assessing sensor networks in an application-specific way. In particular the nodes availability, sensor coverage and connectivity are an important factors to consider in the situation of improving lifetime of network. . Energy consumption mainly depends on the types of application used. This leads to the deployment of WSN networks into hostile network. Batteries are more important in sensor. Data transmission consumes most of the energy in the networks. Using of energy efficient routing algorithms is much needed in the network for energy conservation. Many researches are done for improving energy efficient in the networks. These researches are mainly based on enhancement of data acquisition techniques which literally starts from the basic layer called physical layer. A new wireless network called wireless transmitter/receiver signal module [9, 10]is used as an alternative for short range data communication. It is lower in cost and it only spends little amount of energy thus makes it as energy efficient.

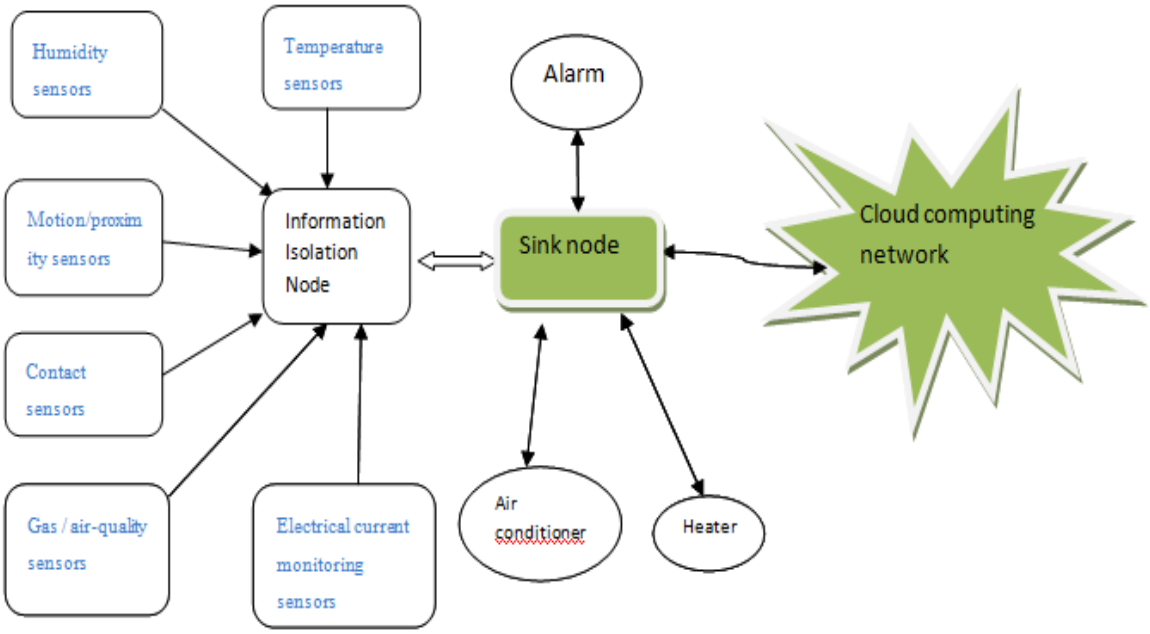
2. Structural Health Monitoring

The Structural Health Monitoring (SHM) is defined as a process of implementing a damage detection and characterization of engineering structures strategy. The SHM process involves the analysis of a system by using the parameters such as: time using periodically sampled dynamic

response, amusements from an array of sensors, the extraction of damage sensitive headlining from these assessments, and the analytical investigation of these features to determine the current state of system health. In the long term SHM, the output of the process periodically updates the information

regarding the capacity of the construction to perform its motivated function in light of the inevitable aging and degradation resulting from operational environments. After the events that are taken place such as earthquakes or blast loading, SHM is used for rapid condition screening and developing in an objective to provide it in near real time with reliable information regarding the integrity of the structure. Therefore, the advantage of the SHM is enhancing day by day. A structural health building monitoring system is invented, achieved and attempted using Wireless Sensor Networks (Mohammed Najeeb & Vrinda Gupta 2014). Ambient vibration of the structure is

audited and is implemented to identify the health status of the structure. With WSN, low cost monitoring is possible without intruding with the action of the structure.



3. Structural Health Building monitoring issues

The SHM problems are stated in the context of a statistical arrangement recognition paradigm and these are stated below,

- Operational analysis
- Dataprocurement and Cleansing
- Feature Extraction and Data Compression and
- Statistical Model Evolution for Feature Discrimination.

When this paradigm is applied to the data in the real world structures, it quickly becomes apparent. The ability to disinfect constricts, distribute, and fuse data to report for operational and environmental variability is a key implementation problem. The represented methods can be implemented through hardware or software and, in general, some combinations of these two approaches will be used. This concept is widely applied through various forms of infrastructures, especially as countries all over the world enter a greater period of construction of various infrastructures ranging from bridges to skyscrapers. Especially when damages to the structures are concerned, it is important to note that there are stages of increasing difficulty that require, namely:

- Detecting the existence of the damage on the structure
- locating the damage
- Detecting the categories of damage
- Evaluating the harshness of the damage

4. Advantages of SHM

Reduction of inspection costs, enhancing nature in research, understanding the behavior of structures under dynamic loads with better possibility, seismic protection, examination in real or near real-time of the structural response and the evolution of damage, so that it is possible to generate post-earthquake scenarios and support recovery operations are the important asset associated with the deployment of SHM.

5. Proposed Model

There are four steps are applied sequentially in the overall WSN application. The steps are, 1. Investigated Node deployment, 2. Clustering and classification, 3. Shortest path route creation, and 4. Cyclic on-off scheduling. The below figure- 1 is showed the overall flow of the proposed framework.

1. Investigated Node Deployment
2. Clustering and Classification
3. Shortest Path Route Creation
4. Cyclic on/off scheduling

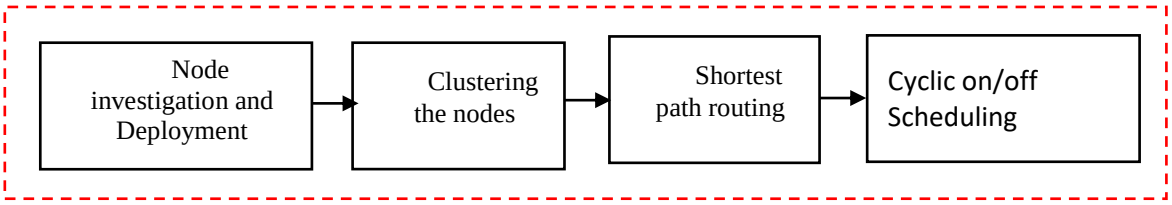


Figure-1. Overall Functional Flow of the Proposed Framework

6. Node investigation

1. Deployment methods

Recent technological advancements made lot easier for deploying WSN nodes in different application scenarios. Methods of WSN deployment are highly specified to its applications. Deterministic deployment and random deployment are various types of deployment [4]. In deterministic deployment, the environment is known and the sensor nodes are relatively known. In deterministic deployment the abstract is known and the mathematical model is transformed into linear problem but not a static optimization problem. Random deployment method is often an economical model but it doesn't guarantee full coverage of the network. Many redundant nodes need to be applied in order to cover wide area of coverage. Full coverage is difficult in all environmental conditions [6]. In such cases, increasing sensor nodes is the only option. Many coverage problems occur while using traditional deployment methods. A new algorithm is proposed by Mohammed Abo-Zahhad et al. 2005 [7] for multi objective immune algorithm. This method is used for covering all the network coverage problems and improves its network coverage and energy efficiency. On comparing with other deployments, this multi objective immune algorithm is used for sealing all the problems.

2. Clustering and Classification:

Using K-hops clustering optimization used for addressing the problem of energy consumption in Wireless Sensor Networks. In hierarchical networks, the clustering size is an important factor. Depending on the cluster size, small size usually shows less computationally effective. For optimization of network, intra-cluster communication is used. But this type of communication consumes more power and less efficiency. For example, if two sensor nodes are placed far away from each other, but one of the nodes is closer to the base station, then the energy consumed by the nearer node to the base station than the node which is located far away. For data relaying, a multi-hop node is used as an intermediate. By doing so, the energy consumed us highly reduced. Computer complexity is considered when designing cluster based model with the uneven data traffic in each clusters. While the data is being transmitted, the size of cluster not accurate, it is randomly deployed. In some cases, the cluster size is almost equal to the total number nodes present. Energy is consumed more in some cases where number of clusters is equal to the sensory nodes. The life of cluster node is comparatively lower from other sensor nodes located nearly in base stations. Uneven computational traffic is occurred while using such techniques. The communication delay between clusters from the base station is occurred often.

3. Shortest Path Route Creation:

Energy efficient shortest path algorithm is used to find the shortest path for all nodes while communication. It consists of two types of tables, they are Distance table and Sequence table. Distance table and sequential table are used to find the shortest distance between two nodes. This protocol creates the table size N (Number of Nodes) with updates inn period of time O (N3). The energy consumption is reduced by avoiding the packet flooding. If the next path of node traversal is shorter than the current node path, then the next path is iterated or updated. This algorithm uses matrix of length D0 as input. Matrix D0 contains its length, where the edge between nodes I and j are corresponding coordinates.

4. cyclic on/off scheduling:-

4.1 Transmitter Section

Block Diagram consist of

1. Sensor
2. Power Supply

3. Embedded Microcontroller
4. wireless Transmitter

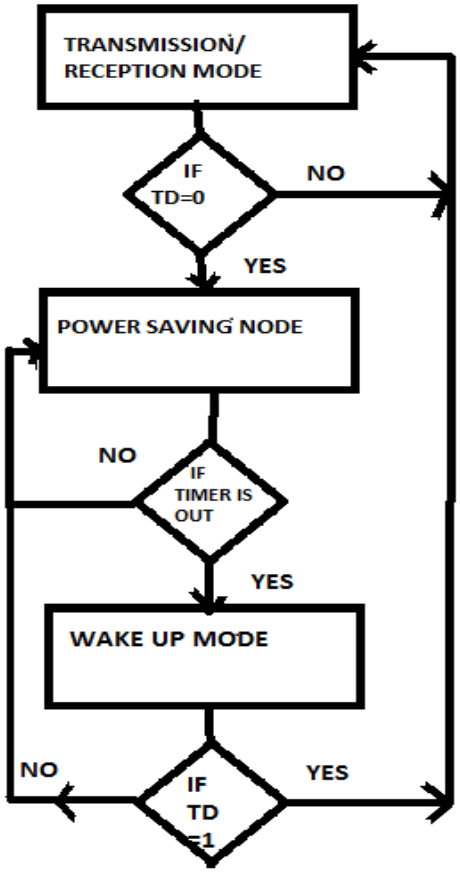
A power supply 5v is given as input voltage to the microcontroller. The sensor elements are used. It is located at different location and which covers the wireless transmitter/receiver signal module. Thus it senses the signal whenever the signal level is higher than the threshold value fixed it is activated. It gives signal to microcontroller. Thus Embedded microcontroller is connected to three ports by sensor. The crystal oscillator in microcontroller generated a clock frequency of 20MHz. Depending upon the threshold the port is activated and output of microcontroller is given to the level converter – MAX232. It acts as an interface between the microcontroller and wireless transmitter/receiver signal module to work in different level voltage. Thus wireless transmitter/receiver signal module transmitter transmits the signal in binary format.

4.2 Receiver Block Diagram

We have a wireless transmitter/receiver signal module device and a PC. The wireless transmitter/receiver signal module is used here to receive the coded signal from wireless transmitter/receiver signal module. The signal from zigbee device is given to PC to display the details of the sensor.To initialize the scheme, each sensor node will be put into the power saving mode for a random sleep duration. A timer that is implemented on each node will be used for the countdown of the sleep duration. At the end of the sleep duration, a sensor node will put itself into the Wake up mode. A wireless sensor node in the Wake-up mode will monitor the wireless communication channel during the communication period. By monitoring the channel, a node can collect the target detection results of its active neighbors.

A wireless sensor node in transmit/receive node will trace the target, if the target is captured the target detection result is 1,otherwise it is 0.After this, the sensor node will broadcast its target detection result to all the neighbors during its communication period. A sensor node which has ‘0 ‘Target detection result may switch to Power saving node.

4.3. Algorithm for proposed system



TD=Target Detection result

Fig 2 flow chart for proposed algorithm

The Proposed system has three modes. The modes are transmission/reception mode, power saving mode, and wake up mode.

In the transmission/reception mode all the three components will enter into active state and do their operations. In the power saving mode all the three components will enter into sleep mode.In the wake-up mode wireless transmitter/receiver signal module and embedded microcontroller will listen the medium, whether it is free or not.

4.3.1 Scheduling algorithm

Step1: initially the system enters into the power saving mode & kick the watch dog timer **Step2:** it will wait until the watch dog timer expires

Step 3: when timer expires it will enter into wake up mode to check the medium is free or not if its free it will starts its transmission / reception.

Step4: check the target detection value if (TD==0) means goto power saving mode and repeat the cyclic process from step1.

Step5: if (TD==1) it will enter into transmission and reception mode.

Step6: After transmitting or receiving the non real time data it performs self-evaluation and again it will checks the target detection value to continue to transmit or receive data or it will enter into power saving mode.

Step7: if (TD==1) means go to step 5 and repeat the process (i.e. Transmission/ reception mode)

Step 8: if (TD==0) means go to step1 and repeat the process (i.e. power saving mode)

Cyclic on/off scheduling is used in between transmission /reception mode and wake up mode.

Adaptive on/off scheduling is used in between transmission /reception mode and power saving mode.

7. Results and Discussion

The above explained QoS parameters are calculated and compared with the Scheduling algorithm and given here. Each QoS parameters computed at each stage of the simulation with different number of nodes with a greater number of iterations (50 rounds to 200 rounds). The results obtained from IACO is compared with the Scheduling algorithm, where scheduling focused on increasing the battery lifetime ,. Initially the packet delivery ratio is calculated. The total number of packets received at the destination node is calculated in various rounds, and the best result is given in Figure-5. From the result it is identified by using the scheduling algorithm it has received more number of packets , in this clustering method vanish the data loss. Also, cluster heads are responsible for data transmission.

Next, the packet delivery ratio is calculated in the experiment and the corresponding result is given in Figure-6. From the figure, it is identified that scheduling algorithm provides very good PDR than CC and it is given in the same. Also, the PDR increasing for the increasing number of rounds.

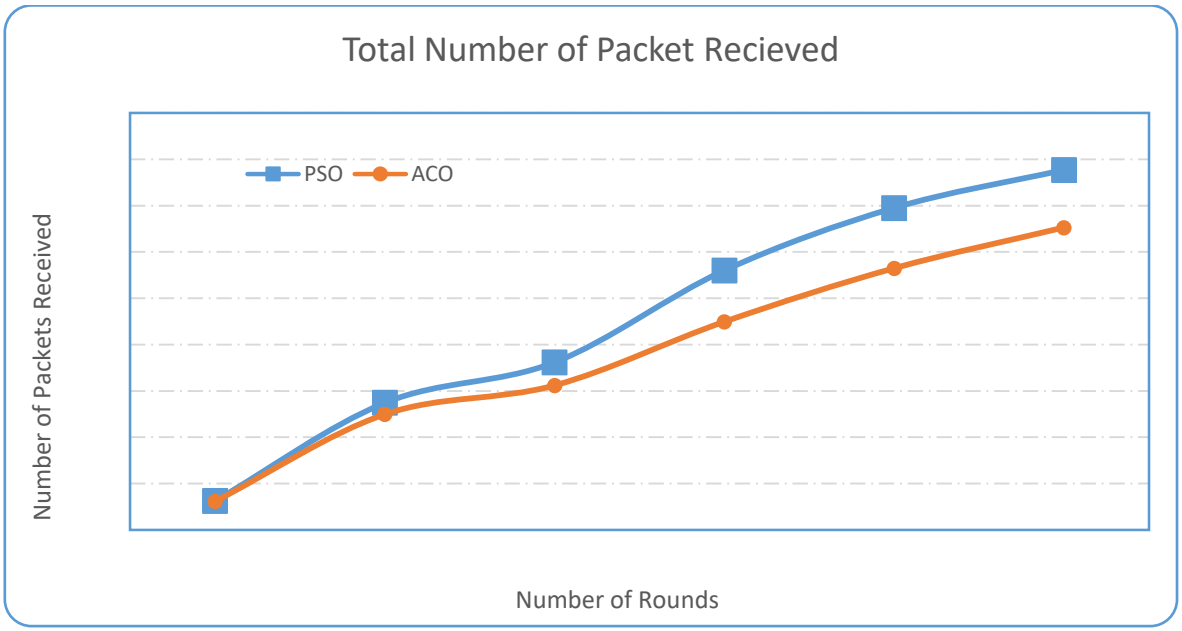


Figure-3: Number of Packets received

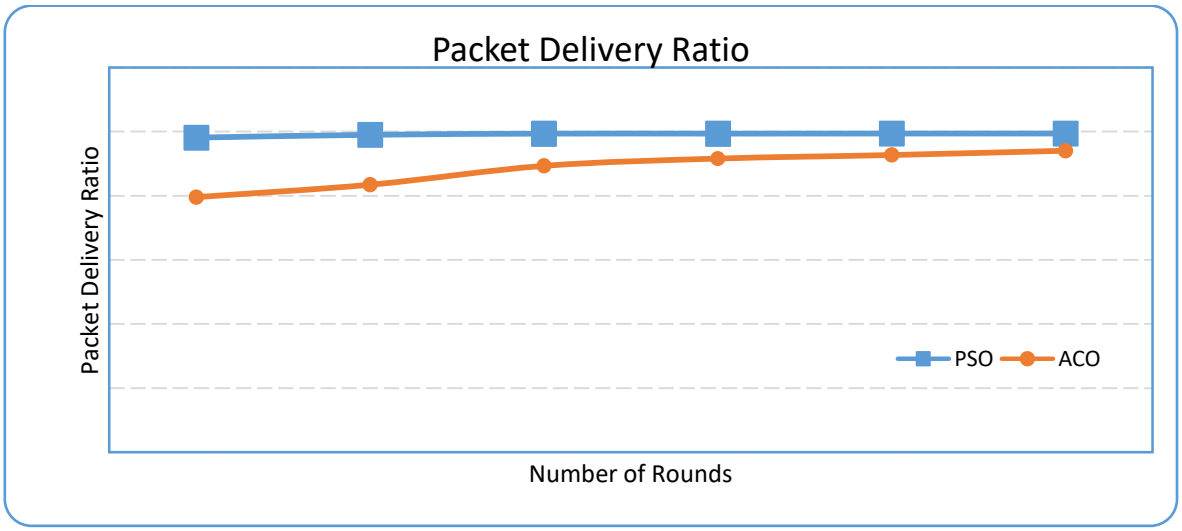


Figure-4: Packet delivery ratio

8. Conclusion:

In our proposed system it has three modes of operation which configures the master and slave nodes to operate in transmission/reception mode, wakeup mode and power saving mode. The scheduling algorithm used in our system which makes our system to be operated in low power and increases the efficiency of battery lifetime The performance of the system depends on the number of nodes. Our proposed concept can be implemented in Structural health Building monitoring applications. Thus we reduced the power consumption by using scheduling algorithm and three modes of configuration .The current drawn by the system is

- TmX current: 45 mA
- RX current: 50 mA

Power down current <10 μ A

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