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Data Aware Aggregation Technique for Environmental Monitoring in Wireless Sensor Networks

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Abstract

Objectives: In WSN, several sensor nodes are used which having sensing and communication capabilities. It considers energy awareness as essential. **Methods:** In this method, using average data aggregation can be effectively reduced the energy consuming. Each device node used to sense the information about environmental conditions and finally data will be sent to the destination. In this proposed work, it generates the similar data by recognizing sensors which are in the similar location using Average Data Aggregation and send it to the destination. **Finding:** In this result, other than showing average aggregated value for similar data in case of any abnormal environmental condition it directly shows such abnormal reading in the base station. **Improvements/Applications:** Therefore, it eliminates redundant data and minimizes the data transmission and performs load balancing.

Keywords: Data aggregation, Nodes, Sensors, Wireless Sensor Network

1. Introduction

At the present time, the applications of Wireless Sensor Networks are varied like pollution monitoring, detective work fires in the forest, health observation with the utilization of advanced machines, and in environmental surveillance etc[1]. Many cheap devices with limited energy, calculation and memory assets are gathered to form sensor network[2]. Sensing and communicating with neighbor nodes are the important activity of the sensor nodes. Sometimes, through wired networks nodes may be connected to each other, but oftentimes a sensor group is an absolutely wireless form. In WSNs, nodes normally have not many or no movements at all. Losing of energy resources is the main cause for this failure to happen and because of this because power is a crucial part in sensor networks[3]. The most important concern of every industry is environmental monitoring and maintenance without any disasters. But in past few years, many disasters are held in various industries because of not proper maintaining environment[4]. So the efficient monitoring system is required to prevent these disasters in industries. The industrial environment proctoring system is based on embedded networking, to measure the industrial database continuously by using sensor node for avoiding the hazardous situation[5]. Commonly the destination of all packets in a sensor network is the base station called sink. Some applications have the ability to converse to the sink directly and it leads to limited network dimensionality and high energy power consumption due to a wide range of communication. Hence, in many scenarios, each node communicates with the base station via neighbors; and thus, they need to know which neighbor can forward their packets to the sink efficiently[6]. Physical parameters report about one another to the base station via networked architecture. Physical input acquires by the sensors which act as a front end in the wireless node and it produces electrical output which sends to the processor for data preprocessing[7]. The node mechanism is commonly motorized by a power

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source like a battery. Hence using data aggregation, the grouping of nodes with similar data readings are performed and it could bring additional merits such as even more efficient data compression. In this paper, it produces the similar data by identify sensors which are in the similar location using Average Data Aggregation, and send it to the destination[8]. After that showing, in case of any abnormal environmental condition it directly shows such abnormal reading in the base station. In the existing system, it performs aggregation only for the nearby sensor nodes which having similar reading and then send to base station. Directed Diffusion method with on-demand data query mechanism, base station asks for a specific data collection to the sensor node using flooding mechanism that applies attribute value pair for data and querying. Directed Diffusion provides data-centric, energy efficient, data aggregation within the network and it does not have any require maintaining global network topology. This protocol consists of 3 types of message namely Advertise, Request, and Data message. The main function of using spin protocol is to avoid losing of data packets. In this algorithm, Advertise message cannot assure for the data packet delivery. It will send data packets only if neighbor node interest in the particular data. The specifically interested neighbor node can get the data packets only after sending the request message. Energy aware routing to find out minimal paths as a replacement for many alternative paths for energy saving, and thereby on each path it performs minimum energy utilization to enhance the network. It contains data communication phase, set-up phase, and route maintenance phase. However, pathway rehabilitation on solo path might happen to complicated[9]. It uses aggregation and data spreading; this protocol also employs data aggregation to save transmission energy[10]. It focuses the industrial monitoring of disputes and intimates some of the solutions for remote monitoring which basically depends on the system hardware, protocols, system architecture, and software. Here mainly discourse about the radio technologies and cross-layer design for industrial remote monitoring[11]. To provide efficient and reliable network process for monitoring, the system design must follow the techniques of low cost, scalable architectures and efficient protocols, resource efficient design, data fusion & localized processing, self-configuration & self-organization, time synchronization, adaptive network operation, fault tolerance & reliability, application specific design and secure design and the lifetime of the wireless monitoring system depends on the battery capacity[12]. It provides better and efficient techniques of node placement in wireless sensor network[13]. Here mainly differentiate the issues and strategic of the node placement and the strategies are classified into the static and dynamic process at the time of deployment of the wireless communication. In mobility, the node placement depends on the deployment methodology, optimization objective, and node's part in WSN[14].

2. Proposed System

In our proposed work, first the sensor node randomly deployed in the sensing field after that have chosen two types of sensor node like temperature and humidity. Figure 1 shows the architecture of sensor node is given, Here, the entire sensor node sends their data to the receiver node, after this process, receiver node synchronized every node values with its threshold value. If suppose compared values is nearer to threshold value means that satisfy the similarity the data will be aggregated, after that the average aggregation of similar readings on the region of that node is obtained. In case higher than the threshold value means aggregated data directly forward to the sink. If this condition is satisfied, then the data will be accumulated in the base station. In this result, other than showing average aggregated value for similar data in case of any abnormal environmental condition it directly shows such abnormal reading in the base station. Figure 2 shows inside this box IR indicates Individual Reading, AR indicates average aggregated reading and #AR indicates a quantity of node whose readings were aggregated. Hence assume threshold 25 to 35, the edges ((A, B), (B, C), (A, C)) satisfied the similarity threshold found similarity relation. For example, the temperature reading is taken for aggregation. The hard edges specify neighbors that satisfy the similarity reading threshold. The dashed edges indicate purely without similarity.

AvgR (A) = 28+1*26+1*30+1/3 = 28

AvgR (B) = 26+1*28+1*30+1/3 = 28

AvgR (C) = 30+1*26+1*28+1/3 = 28

In this result, other than showing average aggregated value for similar data in case of any abnormal environmental condition it directly shows such abnormal reading in the base station. Sensor node D is not satisfied with neighbor node so it takes abnormal value. In this method, finally to identify the temperature and humidity sensor value where the reading will be high. Wireless

sensor node can be a gathering of data organizing not a permanent system while not the help of any organized infrastructure or centralized administration. In such means that surroundings attributable to the bound range of each nodes wireless transmission, it's going to be wanted for one device node to request the assistance of another sensor node in transmittal a data to its sink node usually the base station. In this system called HCEAR: Hop Count Energy Aware Routing algorithm that makes uses of multipath alternately to prolong the life period of the network. This results in significant energy savings for the energy-constrained sensors.

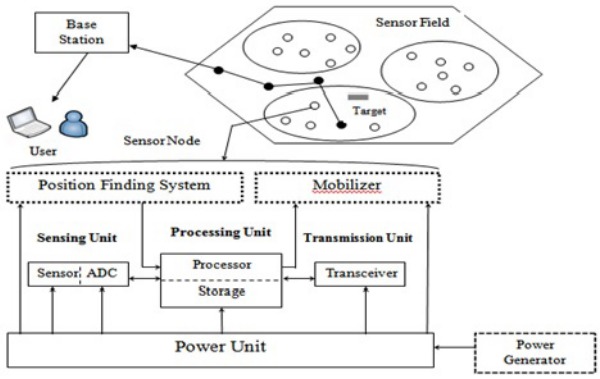

Figure 1. Architecture of sensor node.

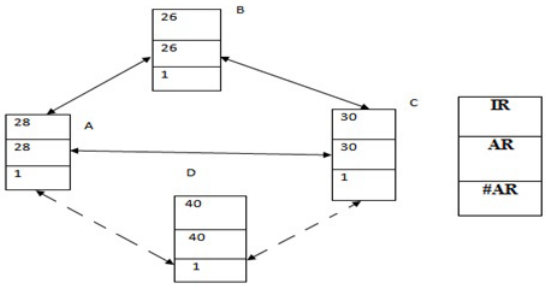

Figure 2. Average data aggregation.

3. Simulation Results

To implement the simulation part, first have to construct of 'n' variety of nodes. This system is enforced to sensor node creation and greater fifteen nodes organized in a particular distance. Wireless node deployed in near region. Finally, the received the data then acknowledge to the transmitter. Sensor nodes are deployed in 500m × 500m area. The simulation parameters Table 1 are as follows.

Table 1. Simulation parameters

Number of sensor nodes	15
Simulation Time	5[s]
Network Area	500x500[m]
Initial Energy	90
Transmission Range	70[m]

3.1 Node Creation

Number of nodes deployed in a particular region to find source and destination. Figure 3 shows hundreds of nodes can be used due to scalability.

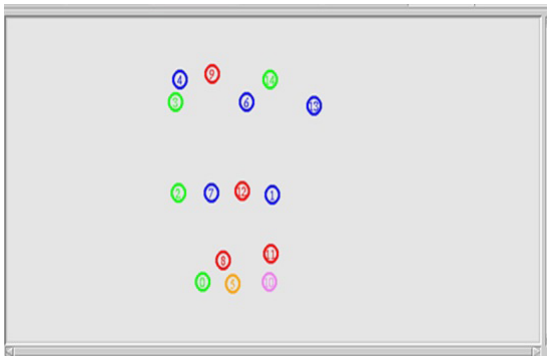

Figure 3. Node creation.

3.2 Data Transmission

Figure 4 shows that different sensor nodes can sense the information and afterward transmitted to the base station. Multipath directing was utilized to improve the reliability of WSNs. Hop Count Energy Aware Routing algorithm that makes uses of multipath alternately to prolong the life period of network. This results in significant energy savings for the energy constrained sensors.

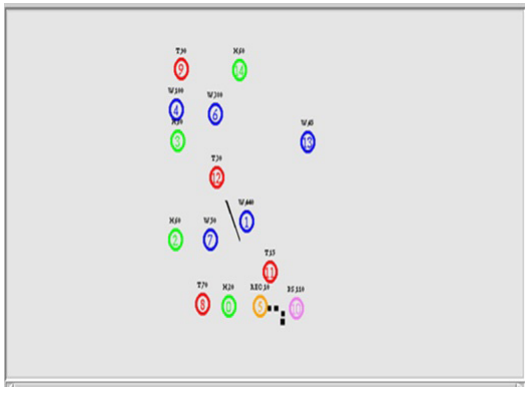

Figure 4. Data transmission.

3.3 Data Aggregation

Figure 5 shows data aggregation is that the method grouping information from multiple sensor elements that information amalgamated and transmitted to sink node. The most important motive of data collection technique purpose for power well-organized and also network period of time is improved. Figure 6 shows that normal data send to base station and Figure 7 shows that abnormal data send to base station. Figure 8 shows that energy consumption.

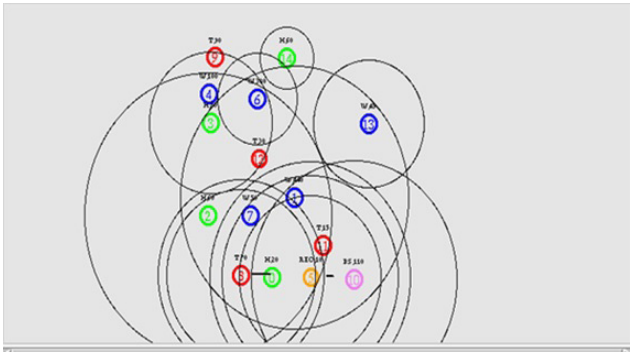

Figure 5. Data aggregation.

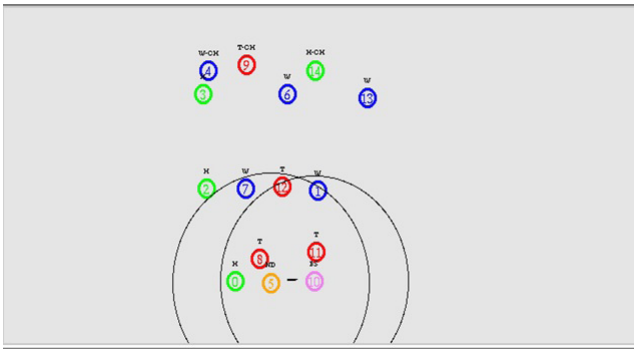

Figure 6. Normal data send to base station.

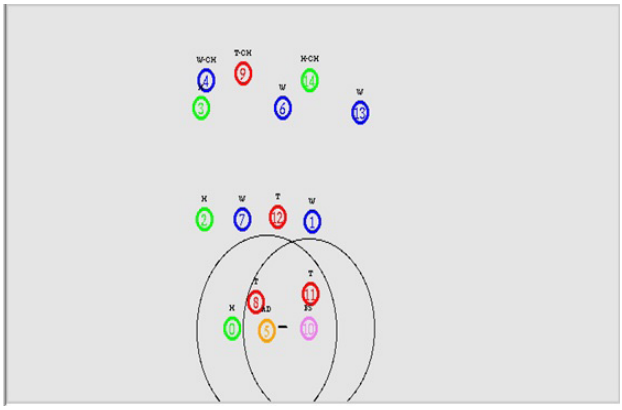

Figure 7. Abnormal data send to base station.

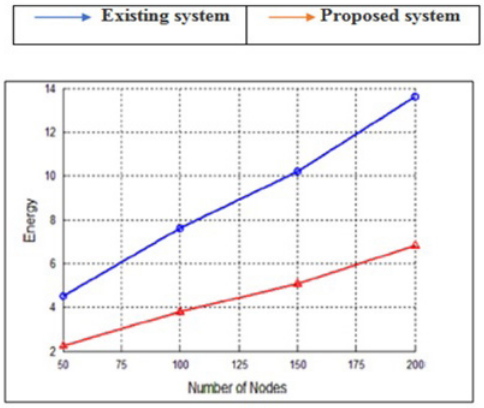

Figure 8. Energy consumption with data aggregation.

4. Conclusion

In this method, each device node used to sense the information about environmental conditions and then data will be sending to the destination. It generates the similar data by recognizing sensors which are in the similar location using Average Data Aggregation and send it to the destination. In this result, other than showing average aggregated value for similar data in case of any abnormal environmental condition it directly shows such abnormal reading in the base station. Therefore, it eliminates redundant data and minimizes the data transmission and performs load balancing. Experiments show that the proposed method has excellent performance.

5. Acknowledgement

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