A Schedule based Local Monitoring Approach in Wireless Sensor Networks

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ABSTRACT - *To monitor critical events in infrastructure less area such as fire detection in forest, gas monitoring in coal mines sensor network has been employed .To prolong the lifetime of the network, some sleep scheduling methods are used. The sensor network can be divided into number of groups based on some criteria, each group consists of a node capable of monitoring its group is called local monitoring node. When a critical event occurs the alarm message and event information is transmitted to the concerned local monitoring node and that is again transmitted to the center node*

I. INTRODUCTION

A wireless sensor network consists of battery powered wireless devices, that are capable of monitoring environmental conditions such as vibration, temperature, motion, pollution, sound, light, pressure, noise etc., and critical events such as forest fire, gas leakage etc., The WSN may consists of hundred, even thousand of nodes, the sensor node collects information from environment and send it to main node. Since there is wide diversity of WSN application requirements, a general-purpose WSN design cannot fulfill the needs of applications. Many network parameters such as sensing range, transmission range, adoptability, energy efficient, scalability, mobility, heterogeneity, application knowledge, usability, QOS, real time support, security, context awareness and node density need to be considered carefully at the design stage of the network, according to specific applications. Each node in WSN is attached with one or more sensor, which is a wireless communication device, processor and energy source is usually a battery. Sleeep scheduling methodology is implemented to make the sensor nodes to work for long time without recharging the batteries. This may cause transmission delay because, the nodes in the network should wait until the receiver nodes are active and ready to receive the event information .In critical event monitoring ,most of the time only small number of packets need to be transmitted ,so the transmission delay is an important issue. Level by level offset schedule was proposed.(i.e) the packet from node a to node c can be sent through node b with minimum delay. In this paper we propose Local monitoring approach, which is introduced to minimize the broadcasting delay.

II. EXISTING WORK

- When a critical event occurs, an alarm and event information is transmitted along one of the traffic path to a center node
- Then it is immediately broadcast by that center node along another path to all nodes in the network.

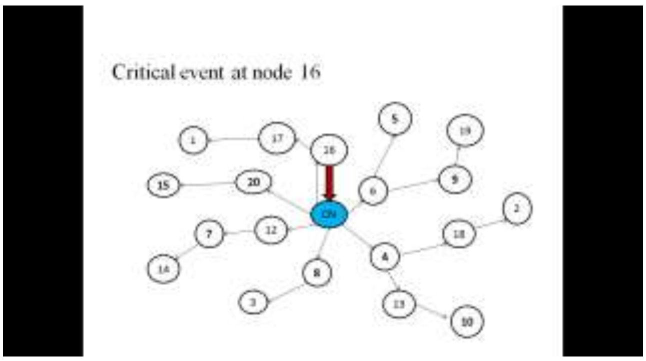

Fig 1. Packet transmission to center node

The critical event occurred at the node 16, then immediately it broadcast the information to the center node CN. It may cause transmission delay because the entire sensor network is depends on the single center node, It also implements sleep scheduling where the energy consumption is also comparatively high.

III. PROBLEM DESCRIPTION

The critical event information should be transmitted to the entire sensor network. Each node is capable of detecting a critical event and generating an alarm message. The alarm message and event information should be transmitted to the entire network with less transmission delay. Also analyze the energy consumption of sensor nodes with the proposed scheme in WSN. Since the energy consumption is mainly due to the idle listening when there is no critical event most of the time, it is reasonable for us to approximatively calculate the energy consumption according to the length of wake-up duration in a duty cycle.To reduce the broadcasting delay and energy Consumption in the existing system with the help of Local Monitoring Approach.

IV. PROPOSED WORK

To reduce the broadcasting delay the proposed method include two paths

1).Any node that detects critical event sends alarm and event information to the center node through local monitoring node along determined path according to level by level offset schedule.

2).The center node transmits the alarm and event information through local monitoring node to the entire network along another determined path according to level by level offset schedule. The traffic paths from nodes to the center node through local monitoring node is uplink and the traffic path from the center node through local monitoring node to other node is downlink.

To minimize the delay,

1).Breadth first search is implemented for uplink.

2).Colored connected dominant set is implemented for downlink.

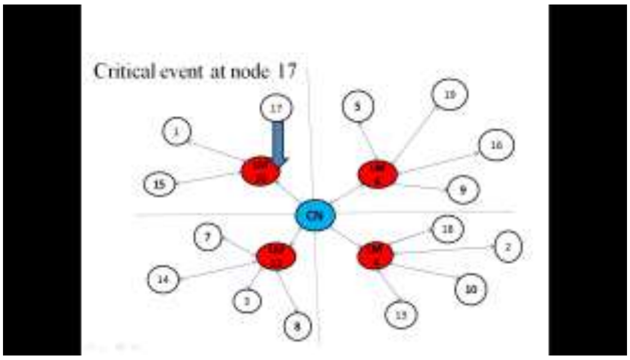

Fig 2.Packet transmission to center node

The entire network is divided into 4 groups. Each and every group is having a local monitoring node. Here the critical event occurred at the node 17. The information is immediately broadcast to the Local Monitoring Node LM. Through the local monitoring node the critical event information is sent to the center node CN.

A. SLEEP SCHEDULING

Some of the application fields include tracking, monitoring, surveillance, building automation, military applications, and agriculture, among others. Designing of any application, one of the main objectives is to keep the WSN alive and functional as long as possible. Sleep scheduling is introduced to minimize the energy consumption, making all nodes to sleep, sensor nodes are equipped with passive event detection capabilities that allow a node to detect an event even when the wireless communication module in the network is in sleep mode. When sensor node detects the event, the radio module is immediately woken up and is ready to send an alarm message to the Local Monitoring node in the group, in turn that sends to the Center Node.

B. LOCAL MONITORING APPROACH

Local monitoring is a collaborative detection strategy where a node monitors the control traffic going in and out of its neighbors. Lot of techniques have been introduced that uses the framework of local monitoring approach to achieve specific tasks such as intrusion detection, building trust and reputation among nodes, protecting against the control, data traffic attacks, and building secured with routing protocols. Eventhough the local monitoring approach has been explained and demonstrated as a powerful technique for enhancing security of WSNs, it results in a high energy and cost since it requires the monitoring nodes to be constantly awake to oversee the happening network activity.

In local monitoring approach, sensor nodes are divided into number of groups based on some criteria. Each group consists of local monitoring nodes. All the nodes in the group belongs to the local monitoring node. The local monitoring nodes are under the control of the center node. When a node in group detects a critical event, It is immediately transmitted to the local monitoring node from there the alarm message and event information is transmitted to the center node through one channel, Again the alarm message and event information is transmitted to all the other nodes in the network through other channel, This is known as level by level offset schedule.(i.e)the two possible traffic path is made. The node just needs to be awake for T time ,where T is the minimum time needed by a node to transmit alarm packet.

The nodes in the network are maintained in three states to establish Sleep wake scheduling that are

Active state -Nodes are in routing process

Ideal state -Nodes are in ready state

Sleeping state -Node in slow sleeping state by reducing its transmission range, wake up once it gets the wake signal from authorized node.

C. WAKEUP PATTERNS

After the nodes are initiated and the path is established, the wakeup patterns is required for sensor nodes to wakeup and receive alarm packet to achieve minimum delay for both of the two traffic paths.

Two level by level offset schedules:-

1).Sensor nodes use BFS algorithm wakeup level by level scheduling according to the distance to center node.

2).Sensor nodes use CCDS wakeup level by level scheduling according to the distance to all other nodes.

Hence, when an alarm packet is originated it is forwarded to the center node along a path in the BFS, then the center node immediately broadcasts it along the paths in the CCDS.

Time slots should be arranged at different positions, so that two traffic paths can work separately.

Time slot assignment:-

1).All nodes obtain slots for uplink traffic according to hops and sequence number of duty cycle.

2). All nodes obtain slots for downlink traffic according to hops and sequence number of duty cycle

V. METHODOLOGY

Distributed network has multiple nodes and services messages, and each node is a shared resource.

A. ROUTING

There may be different paths from the source to the destination. Therefore, message routing is an important topic. The performance of the network affected by the routing scheme are throughput (quantity of service) and average packet delay (quality of service). Routing schemes should also be avoided for both deadlock and livelock. Routing methods can be fixed (i.e. pre-planned), adaptive, centralized, distributed, broadcast, etc. The simplest routing scheme is the token ring. Which is a very simple topology that is straightforward fixed protocol results in very good reliability and precomputable QoS. A token passes continuously around a ring topology. When a node need to transmit, it captures the token and attaches the message to it. As the token passes through the network, the destination reads the header, and captures the message sent. It also attaches a 'message received' signal to the token, which is then received by the original source node that sent the message. Then, the token is released so that it can accept further messages. The token ring topology is a completely decentralized scheme that effectively uses TDMA in the proces. Though this scheme is very reliable, one can see that it results in a waste of network capacity. In this ring topology token must pass once around the ring for each message. Therefore, there are various modifications of this scheme later, including using several tokens, etc.

Fixed routing schemes uses Routing Tables that has the information about the next node to be routed to, given the current message location and the destination node. Routing tables are very large for larger networks, and cannot take into account of real-time effects such as failed links, nodes with backed up queues, or congested links.

Adaptive routing schemes is different from the fixed routing schemes. It depends on the current network status also it can take the account of various performance measures, including cost of transmission over a given link, congestion of a given link, reliability of a path, way of transmission and time of transmission. These can also account for link or node failures in the network setup.

B. SENSOR NETWORK SETUP

To contribute to a more systematic understanding and treatment of sensor deployment issues, the existing literature on deployment experience and present a classification of common problems encountered during deployment of sensor networks. A wireless network that is temporarily installed along the side of the actual sensor network during the deployment process.

The following are the parameters considered during sensor network formation

- **Transmission range**: The nodes communication depends on the transmission range. The nodes are placed nearly close to each other thus gets better link for transmitting the data.
- **Local information system**: Nodes are grouped under specific features like battery power, processing capability, bandwidth, memory etc. so according to these features, the nodes are partitioned using the driver methods.
- **Mobility**: Mobility in the sensor network refers to the node movement procedure. Network deployment depends upon how much area each node can cover originally, i.e. range of the network node and how much time the mobiles node will take to collect information from the static nodes. First determine the distance between two nodes. Extra hardware is used to determine the distance by time difference of arrival sound and radio waves. In range free scheme, distance is determined using hop count technique.

VI. ROUTING PROTOCOL DESIGN

The function of routing is to route packets between networks that are attached to it using an apt protocol. A routing protocol is a protocol that specifies the rules for routers to communicate the information with each other in the network, transmitting the information, enables them to select routes between any two nodes on a computer network, the choice of the routing is being done by the routing algorithms. The characteristics of routing protocols include the manner in which they has to avoid routing loops, in such manner they select the preferred routes in the network, using information about hop costs, the time, delay and many factors. Each router in the networks a prior knowledge about the network. A routing protocol shares this information throughout the network, first by sharing it to the neighbors. In this way, routers gain knowledge of the entire topology of the network to proceed further. Design a Routing protocol named as ELMO (Energy aware local monitoring protocol), which is going to implement in OSI layer that need to get and deliver the messages from other layers. The routing protocol is implemented in the GloMoSim simulator of the layered architecture.

To configure some attributes which is supported to execute the routing protocols like Number of nodes, Mobility, Mac protocol, Simulation time, Band width, Transmission range etc.. by setting these kinds of attributes the routing protocol can be executed with layers interaction.

C. PERFORMANCE EVALUATIONS

The following are the parameters for performance evaluations

- **Packet arrival rate**: The ratio of the number of received data packets by the destination node to the number of total data packets sent by the source node.
- **Average end-to-end delay**: The average time elapsed for delivering a data packet from source node to the destination node within a successful transmission.

- **Communication overhead**: The average number of transmitted control bytes per second, from source node to the destination node including both the data packet header and the control packets.

- **Energy consumption**: The energy consumed by the entire network, including transmission energy consumption for both the data and control packets from the source node to the destination node.

D. SIMULATION

GLOMOSIM is the global mobile information system simulator. GLOMOSIM simulator can be implemented with thousand nodes linked by heterogeneous communication. GloMoSim is a simulation library for wireless network Systems built using the Parsec simulation environment. GloMoSim has been designed and built with simulating very large network models that can have a million nodes using parallel simulation reduce execution times of the simulation model. Most of the network systems adopt a layered approach that is similar to the OSI seven layer network architecture. Simple APIs are defined between different simulation layers that allows the correct integration of models developed at different layers that can also be used by different people. GloMoSim is designed using layered approach with standard APIs between layers of the network. The layered design benefits from the features of modular development, such that the layers as well as the protocols and models at different layers are treated as independent modules and can be modified or replaced without affecting other layers. The modular design allows people to develop and implement new protocols at different layers such that the design conforms with the standard API used between the layers.

E. RESULTS

The proposed technique has been simulated and results are shown in the figure 3-5.

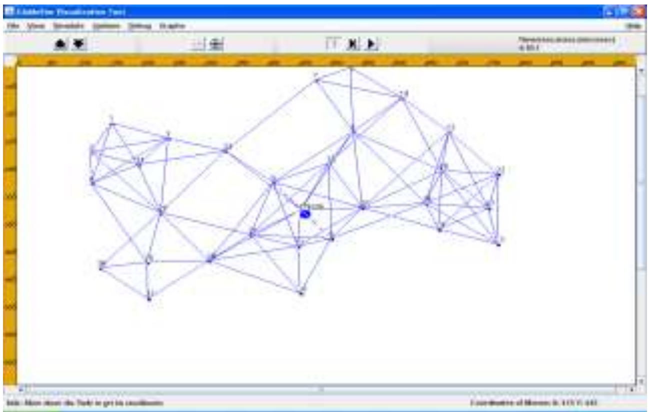

Fig 3.Framework Structure for Routing

Nodes connected each other (blue lines) in terms of neighbour extraction and initialization of center node (CN). The above screen describes about the framework structure for routing with respect to center node. Blue line presents the possible connectivity among the nodes towards the center nodes through neighbour nodes i.e mulitihop routing.

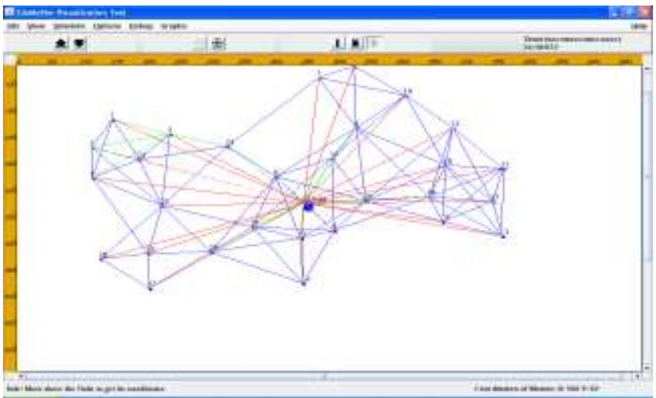

Fig 4. Routing structure of routing protocol

Above figure describes about the routing structure of routing protocol. This structure explains about the nodes placement according to the center node monitoring area. So Red color line - Center node makes possible connection path with each nodes. Green color line – Path establishment through multiple normal nodes (Multihop routing path) towards the center node for forwarding alarm packet via the path.

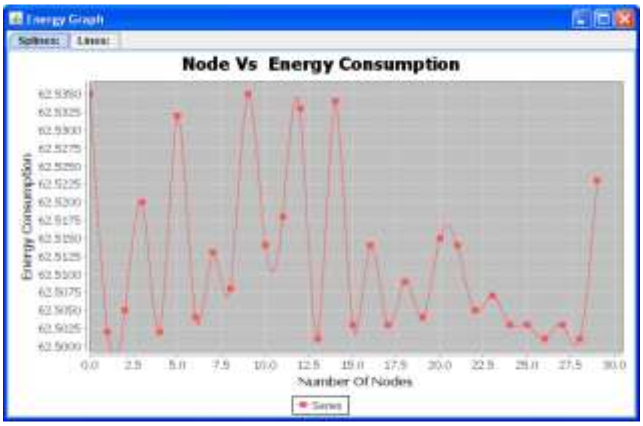

Fig 5.Energy Consumption

This graph represents the energy consumption mega watt hour performance metric for routing protocol. Consider x axis as no of nodes and y axis as energy consumption according to the values plot the graph and at average energy consumption occur in range of 62.5 thus we need to reduce it in our proposed work

VII. CONCLUSION

The proposed scheme could essentially decrease the delay of alarm broadcasting from any node in WSN. Presented the mechanisms of monitoring a wireless sensor networks, for the following reasons: topology control (connectivity and the coverage), and the security in wireless sensor networks. Theoretical analysis and conducted simulations will show that the broadcasting delay and the energy consumption of the proposed scheme is much lower than that of existing methods. Finally, it will demonstrate the effectiveness of the approach and algorithms with satisfactory results obtained through simulation.

REFERENCES

1) Peng Guo,Tao Jiang and Kui Zhang,"Sleep Scheduling for Critical Event Monitoring in Wireless Sensor networks", Wireless networks, VOL. 23, NO. 2, FEB 2012

2) N. Bouabdallah, M.E. Rivero-Angeles, and B. Sericola, "Continuous Monitoring Using Event-Driven Reporting for Cluster-Based Wireless Sensor Networks," IEEE Trans. Vehicular Technology, vol. 58, no. 7, pp. 3460-3479, Sept. 2009.

3) M.I. Brownfield, K. Mehrjoo, A.S. Fayez, and N.J. Davis IV., "Wireless Sensor Network Energy-Adaptive Mac Protocol," Proc. Third IEEE Consumer Comm. and Networking Conf., pp. 778-782, Jan. 2006.

4) . Zheng, S. Radhakrishnan, and V. Sarangan, "PMAC: AnAdaptive Energy-Efficient MAC Protocol for Wireless Sensor Networks," Proc. 19th IEEE Int'l Parallel and Distributed Processing Symp., pp. 224-231, Apr. 2005.

5) S.C. Ergen and P. Varaiya, "TDMA Scheduling Algorithms for Wireless Sensor Networks," Wireless Networks, vol. 16, no. 4, pp. 985-997, 2010.

6) G. Lu, B. Krishnamachari, and C. Raghavendra, "An Adaptive Energy-Efficient and Low-Latency MAC for Data Gathering in Wireless Sensor Networks," Proc. 18th IEEE Int'l Parallel and Distributed Processing Symp., pp. 224-230, Apr. 2004.

7) A. Keshavarzian, H. Lee, and L. Venkatraman, "Wakeup Scheduling in Wireless Sensor Networks," Proc. Seventh ACM Int'l Conf. Mobile Ad Hoc Networking and Computing, pp. 322-333, May 2006.

8) G. Lu, N. Sadagopan, B. Krishnamachari, and A. Goel, "Delay Efficient Sleep Scheduling in Wireless Sensor Networks," Proc. 24th IEEE Int'l Conf. Computer Comm., pp. 2470-2481, Mar. 2005.

9) N.A. Vasanthi and S.A., "Energy Efficient Sleep Schedule for Achieving Minimum Latency in Query Based Sensor Networks," Proc. IEEE Int'l Conf. Sensor Networks, Ubiquitous, and Trustworthy Computing, pp. 214-219, June 2006.

10) N.A. Vasanthi and S. Annadurai, "AWS: Asynchronous Wakeup Schedule to Minimize Latency in Wireless Sensor Networks," Proc. IEEE Int'l Conf. Sensor Networks, Ubiquitous, and Trustworthy Computing, pp. 144-151, June 2006.

11) Y. Sun, O. Gurewitz, S. Du, L. Tang, and D.B. Johnson, "ADB: An Efficient Multihop Broadcast Protocol Based on Asynchronous Duty-Cycling in Wireless Sensor Networks," Proc. Seventh ACM Conf. Embedded Networked Sensor Systems, pp. 43-56, Nov. 2009.

12) Y. Sun, S. Du, O. Gurewitz, and D.B. Johnson, "DW-MAC: A Low Latency, Energy Efficient Demand-Wakeup MAC Protocol for Wireless Sensor Networks," Proc. Ninth ACM Int'l Conf. Mobile Ad Hoc Networking and Computing, pp. 53-62, 2008.

13) S.C.-H. Huang, P.-J. Wan, X. Jia, H. Du, and W. Shang, "Minimum-Latency Broadcast Scheduling in Wireless Ad Hoc Networks," Proc. 26th IEEE Int'l Conf. Computer Comm., pp. 733- 739, May 2007.

14) J. Silva, J. Shamberger, M.J. Ammer, C. Guo, S. Li, R. Shah, T. Tuan, M. Sheets, J.M. Rabaey, B. Nikolic, A. Sangiovanni-Vincentelli, and P. Wright, "Design Methodology for Picoradio Networks," Proc. Conf. Design Automation and Test in Europe, pp. 314-323, 2001.

15) Y. Huang and W. Lee, "A Cooperative Intrusion Detection System for Ad Hoc Networks," Proc. First ACM Workshop Security of Ad Hoc and Sensor Networks, pp. 135-147, 2003.