International Innovative Research Journal of Engineering and Technology (IIRJET)
Melange Publications
Volume 1, Issue No. 1

Multi Critical Event Monitoring in WSN using Sleep Scheduling

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***Abstract*--A wireless sensor network (WSN) is a wireless network using sensors to cooperatively monitor physical or environmental conditions. The project focuses on critical event monitoring in wireless sensor networks. When a critical event is detected, the alarm packet should be broadcast to the entire network as soon as possible. Broadcasting delay is an important issue for the application of the event monitoring. To minimize the broadcasting delay, it is needed to minimize the time wasted for waiting during the broadcasting. Here a novel sleep scheduling method is proposed to reduce the delay of alarm broadcasting from any sensor node in WSNs. As the alarm message may be originated by any possible node, there are two phases for the alarm broadcasting. First, when a node detects a critical event, it originates an alarm message and quickly transmits it to a center node along a predetermined path with a level-by-level offset way. Next, it is immediately broadcast by the center node along another path without collision. The upper bound of the broadcasting delay is only 3D + 2L, where D is the maximum hop of nodes to the center node, L is the length of sleeping duty cycle.**

I. INTRODUCTION

A sensor network is an infrastructure comprised of sensing (measuring), computing, and communication elements that gives an administrator the ability to instrument, observe, and react to events and phenomena in a specified environment. Network(ed) sensor systems are seen by observers as an important technology that will experience major deployment in the next few years for a plethora of applications. There are four basic components in a sensor network: (1) an assembly of distributed or localized sensors; (2) an interconnecting network (usually, but not always, wireless-based); (3) a central point of information clustering; and (4) a set of computing resources at the central point (or beyond) to handle data correlation, event trending, status querying, and data mining. A sensor, is a type of transducer that converts energy in the physical world into electrical energy that can be passed to a computing system or controller. AWSN consists of densely distributed nodes that support sensing, signal processing, embedded computing, and connectivity; sensors are logically linked by self organizing means. WNs typically transmit information to collecting (monitoring) stations that aggregate some or all of the information. The capabilities of sensor nodes in a WSN can vary widely, that is, simple sensor nodes may monitor a single physical phenomenon, while more complex devices may combine many different sensing techniques.

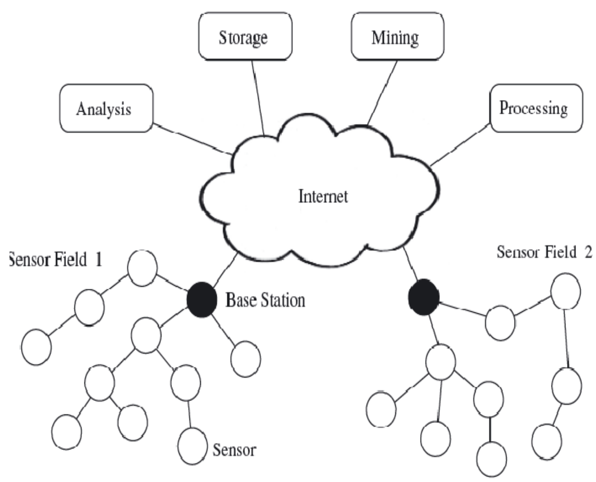


Fig 1 Wireless Sensor Network

The miniaturization of computing and sensing technologies enables the development of tiny, low- power, and inexpensive sensors, actuators, and controllers. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth.

II. SLEEP SCHEDULING FOR EVENT MONITORING

The proposed system concern with the energy reduction and delay minimization of the packet in the time bounded environment. The system shall be proposed with a method called sleep scheduling mechanism for the broadcasted traffic path. When an event occurs, an alarm message should be broadcast to the entire network as soon as possible. we propose a novel sleep scheduling method to reduce the delay of alarm broadcasting from any sensor node in WSNs. The center node broadcasts the alarm message to the other nodes along another path. a special wake up pattern is designed in which the node needs to be awake for no more than the minimum time needed.

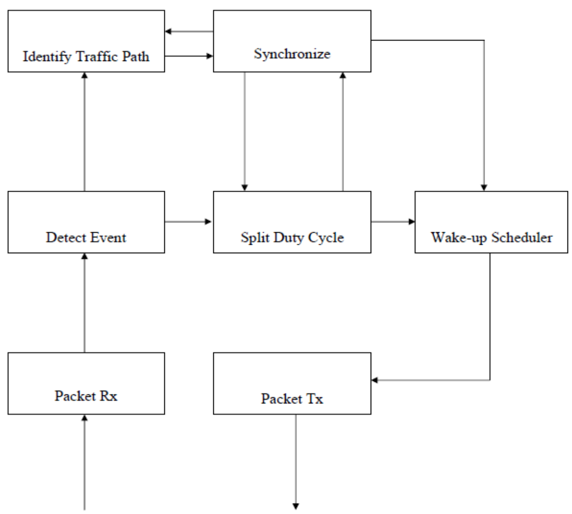


Fig 2: Block Diagram

The figure shows the overall design of critical event monitoring in WSN using a noval sleep scheduling method. When a packet is received by a node it first perform the event detection. The event detect module received the packet and based on the event of the packet, the information shall be unpacked by the lower protocol layers and detect whether the received packed is a critical packet or non critical packet. The critical packet information shall be identified by the priority of the received packet.

Next the traffic path will be identified from the central node or sink node to all the source nodes. Each nodes having the copy of the traffic path table with the source address and based on the available information each node instance may traverse the packet from the sink to sources as well source to sink.

With respect to source to sink or central node, all the source nodes shall unicast the packets and central node to all sources shall be a broadcasted manner. Synchronization keeps the time slots for the access from the sources to central or sink node and sink node to the source .Each time slot gains all nodes shall unicast the packets and alternate time slots sink shall respond back.

Time is partitioned into time slots. The length of each slot is about the minimum time needed by sensor nodes to transmit or receive a packet. The length of each duty cycle is T=L* ד i.e., there are L slots in each duty cycle. The proposed wakeup pattern is needed for sensor nodes to wake-up and receive alarm packet to achieve the minimum delay for the traffic path. The packet is then transmitted to the next node by using this sleep scheduling method.

2.1 Advantages of Proposed System

The broadcasting delay will be minimum, As the delay is only a linear combination of hops and duty cycle, it could be very small even in large scale WSNs.

- The broadcasting delay is independent of the length of the duty cycle, but it increases linearly with the number of the hops.
- The broadcasting delay is independent of the density of nodes.
- The energy consumption is very low as nodes wake up for only one slot in the duty cycle during the monitoring.

III. THE PROPOSED SCHEDULING METHOD

3.1 Basic Idea

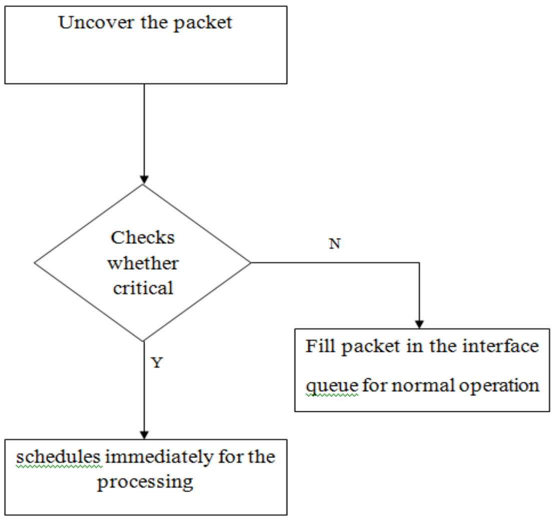
It is known that the alarm could be originated by any node which detects a critical event in the WSN. To essentially reduce the broadcasting delay, the proposed scheduling method includes two phases: 1) any node which detects a critical event sends an alarm packet to the center node 2) the center node broadcasts the alarm packet to the entire network .

We define the traffic paths from nodes to the center node as uplink and define the traffic path from the center node to other nodes as downlink, respectively. Each node needs to wake up properly for both of the two traffics.

3.2 Event Detection

Event Detection Module this module is responsible for detecting the reception of the packet at the physical modeled interface for the post processing of the packet. The event detect module received the packet from the Rx Handler. Based on the event of the packet, the information shall be unpacked by the lower protocol layers and determine whether the received packed is a critical packet or non critical packet.

The critical packet information shall be identified by the priority of the received packet. The Rx handler unpacks the packet and checks the received packet is an highly valid critical packet by checking critical field of the packet is set to 0.The packet with 0 indicate higher priority. if it is set to 0, then it immediately sends an event to the Event handler about the packet and it is schedules immediately for the processing otherwise It will fill the packet in the interface queue for normal operation.



3.3 Traffic Path Identification

The traffic path identification is responsible for the identification of the traffic path from the central node or sink node to all the source nodes. Each nodes having the copy of the traffic path table with the source address to identify the next hop to move and to detect whether the available traffic path is in active state or not. Based on the available information each node instance may traverse the packet from the sink to sources as well as from source to sink. With respect to source to sink or central node ,all the source nodes shall unicast the packets and with respect to central node to all sources the packet shall be send in a broadcasted manner.

3.4 Wake-up Module

The synchronization process will keeps the time slots for the access from the sources to central or sink node and sink node to the source. Time slot gains all nodes shall unicast the packets and in alternate time slots sink shall respond back. Time is partitioned into time slots. The length of each slot is about the minimum time needed by sensor nodes to transmit or receive a packet, which is denoted as ד The length of each duty cycle is T=L* ד , i.e., there are L slots in each duty cycle. After all nodes get the traffic paths, the proposed wake-up pattern is needed for sensor nodes to wake-up and receive alarm packet to achieve the minimum delay for both of the uplink and downlink traffic paths

IV. Conclusion

The project proposes a novel sleeping scheme for critical event monitoring in WSNs. The proposed sleeping scheme could essentially decrease the delay of alarm broadcasting from any node in WSN. The upper bound of the delay is 3D + 2L, which is just a linear combination of hops and duty cycle. Moreover, the alarm broadcasting delay is independent of the density of nodes in WSN. Theoretical analysis and conducted simulations showed that the broadcasting delay and the energy consumption of the proposed scheme is much lower than that of existing methods.

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