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DECISIVE EVENT DETECTION AND MONITORING USING NOVEL SLEEP SCHEDULING IN WSN

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***Abstract*—** In wireless sensor networks during an unexpected event it monitoring only a small number of packets at the time of transmission. When an unexpected event is detected, the alarm packet should be broadcast to the entire network as soon as possible. Therefore, distribution delay is an important issue for the application of the unexpected event monitoring. To prolong the network lifetime, some sleep scheduling methods are always employed in WSNs, resulting in significant distribution delay, especially in large scale WSNs. A novel sleep scheduling method to be proposed, it is based on the step-by-step offset schedule, to achieve a low distribution delay in wireless sensor networks (WSNs). There are two phases set for the alarm distribution. Firstly, when a node detects an unexpected event, it originates an alarm message and quickly transmits it to a middle node along a pre-determined path with a step-by-step offset way. Then, the middle node distribute the alarm message to the other nodes along another path without any collision. Through designing a unique wake-up pattern, the two possible traffics could be both carried by a node. An on demand distance vector routing and distance vector routing protocol is established in one of the traffic direction to reduce the distributing delay during the alarm distributing .The IMC algorithm is established to eliminate the collision during distributing in WSN.

***Keywords*—**Energy Efficient, Sleep Scheduling, Decisive event, Sensor Network

I.INTRODUCTION

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass the data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity.

Monitoring is a common application of WSNs. The WSN is deployed over a region where some phenomenon is to be monitored. This can be applied in the field of military where they use sensors to detect enemy intrusion. When the sensors detect the event being monitored, the event is reported to one of the base stations, which then takes appropriate action. Similarly, wireless sensor networks can use a range of sensors to detect the presence of vehicles ranging from motorcycles to train, cars. The term Environmental Sensor Networks, has evolved to cover many applications of WSNs to earth science research. This includes sensing volcanoes, oceans, glaciers, forests, etc.

As sensor nodes for event monitoring are expected to work for a long time without recharging the batteries, sleep scheduling method is always used during the monitoring process. Recently, many sleep schedules for event monitoring have been designed. However, most of them focus on minimizing the energy consumption. Actually, in the decisive event monitoring, only a small number of packets need to be transmitted during most of the time. When a decisive event is detected, the alarm packet should be broadcast to the entire network as soon as possible. Therefore, distributing delay is an important issue for the application of the decisive event monitoring. Here, unauthorized user enter into the network (or) misbehavior nodes in network that node is a decisive node these event are detected by the any sensor node in WSN. The detected node originate the alarm packet and it will send to the throughout network as soon as possible. The alarm distributing is based on the level-by-level offset schedule.

In view of wake-up patterns, most sleep scheduling schemes can be categorized into two kinds:

- Synchronous wake-up pattern.
- Asynchronous wake-up pattern.

In synchronous wake-up pattern, all the nodes in the network wake up at the same time

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according to a simple periodic pattern with a fixed period and an asynchronous wake-up pattern.

Christo Ananth et al. [5] discussed about Reconstruction of Objects with VSN. By this object reconstruction with feature distribution scheme, efficient processing has to be done on the images received from nodes to reconstruct the image and respond to user query. Object matching methods form the foundation of many state- of-the-art algorithms. Therefore, this feature distribution scheme can be directly applied to several state-of- the-art matching methods with little or no adaptation. The future challenge lies in mapping state-of-the-art matching and reconstruction methods to such a distributed framework. The reconstructed scenes can be converted into a video file format to be displayed as a video, when the user submits the query. This work can be brought into real time by implementing the code on the server side/mobile phone and communicate with several nodes to collect images/objects. This work can be tested in real time with user query results.

It is still a challenge for us to apply the level-by-level offset to alarm distributing in the decisive event monitoring. First, the order of nodes wake-up should conform to the traffic direction. If the traffic flow is in the reverse direction, the delay in each hop will be as large as the length of the whole duty cycle. Second, the level-by-level offset employed by the packet distributing could cause a serious collision. Finally, the transmission failure due to some unreliable wireless links may cause the retransmission during the next duty cycle, which also results in large delay equaling the whole duty cycle.

GOAL OF THE PROJECT

A novel sleep scheduling method is used to reduce the delay of alarm distributing from any sensor node in WSN. It is still based on the level-by-level offset schedule to achieve a low distributing delay. As the alarm messages originated by any possible node, here to design a two determined traffic paths for the transmission of alarm message:

- Any node which detects a decisive event sends an alarm packet to the center node along a predetermined path according to level-by-level offset schedule.
- The center node broadcasts the alarm packet to the entire network also according to level-by-level offset schedule.

Through designing a special wake-up pattern, the two possible traffics could be both carried by a node, and the node just needs to be awake for no more than τ time in each duty cycle, where τ is the minimum time needed by a node to transmit an alarm packet. To eliminate the collision in distributing, a Colored Connected Dominant Set (CCDS) in the WSN via the IMC algorithm is proposed. If any link or node failure in downlink path during transmission of packet, an On Demand distance Vector Routing Protocol is proposed to establish the best path and broadcast the alarm message to entire nodes in network.

Characteristics of the proposed sleep scheduling scheme are:

- The upper bound of the distributing delay is 3D + 2L, where D is the maximum hop of nodes to the center node, and L is the length of duty cycle, the unit is the size of time slot. As the delay is only a linear combination of hops and duty cycle, it could be very small even in large scale WSNs.
- The distributing delay is independent of the length of the duty cycle, but it increases linearly with the number of the hops.
- The distributing 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.

II. PROBLEM DEFINITION

- **Event detection:**

The decisive event monitoring in a WSN, sensor nodes are usually equipped with passive event detection capabilities that allow a node to detect an event even when its wireless communication module is in sleep mode. Upon the detection of an event by the sensor, the radio module of the sensor node is immediately woken up and is ready to send an alarm message.

- **Slot and duty cycle:**

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 τ.Duty cycling is a widely used

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mechanism in wireless sensor networks (WSNs) to reduce energy consumption due to idle listening, but this mechanism also introduces additional latency in packet delivery.

- **Network topology:**

This method assumes the network topology is steady and denotes it as a graph G. To obtain the topology of network, it is needed to collect lists of neighbors of all nodes. When sensor nodes are turned on after the deployment, each node transmits packets randomly in each time slot with probability. In this work we assume that the sensor network deployment is dense enough such that every node has few neighbors with highly reliable links.

- **Synchronization:**

Time of sensor nodes in the proposed scheme is assumed to be locally synchronous, which can be implemented and maintained with periodical beacon distributing from the center node. None of the discussion about sleep scheduling would be relevant if there were not some mechanism to provide time synchronization in the sensor network. However, techniques capable of providing micro-second level synchronization have been developed for sensor networks

III.RELATED WORK

TDMA Scheduling Algorithm

Algorithms for scheduling TDMA transmissions in multi-hop networks usually determine the smallest length conflict-free assignment of slots in which each link or node is activated at least once. This is based on the assumption that there are many independent point-to-point flows in the network. In sensor networks however often data are transferred from the sensor nodes to a few central data collectors. The scheduling problem is therefore to determine the smallest length conflict-free assignment of slots during which the packets generated at each node reach the destination. The conflicting node transmissions are determined based on an interference graph, which may be different from connectivity graph due to the broadcast nature of wireless transmissions. We show that this problem is NP-complete.

Here to propose two centralized heuristic algorithms: one based on direct scheduling of the nodes or node-based scheduling, which is adapted from classical multi-hop scheduling algorithms for general ad hoc networks, and the other based on scheduling the levels in the routing tree before scheduling the nodes or level-based scheduling, which is a novel scheduling algorithm for many-to-one communication in sensor networks. The performance of these algorithms depends on the distribution of the nodes across the levels. We then propose a distributed algorithm based on the distributed coloring of the nodes, that increases the delay by a factor of 10---70 over centralized algorithms for 1000 nodes. We also obtain upper bound for these schedules as a function of the total number of packets generated in the network.

The main task in designing a TDMA schedule is to allocate time slots depending on the topology and the node packet generation rates. A good schedule not only avoids collisions by silencing the interferers of every receiver node in each time slot but also minimizes the number of time slots hence the latency: The larger latency may require a higher data rate (and hence higher energy consumption) to satisfy a deadline. We therefore try to find a TDMA schedule that minimizes the number of time slots.

TDMA algorithms consider either one-hop or multi-hop scheduling. The former are for networks in which the nodes are one hop away from the base station, and allocate time slots in the reverse channel depending on allocation request and deadline of the nodes. Because the base station is the common receiver of the transmissions, only one node can transmit in a slot. In some sensor networks however direct transmission from all sensor nodes to the base station may not be feasible nor power efficient.

Multi-hop TDMA scheduling is more challenging than one-hop scheduling because spatial reuse of a time slot may be possible: More than one node can transmit at the same time slot if the receivers are in non-conflicting parts of the network. There are two types of conflicts, namely, primary conflict and secondary conflict. A primary conflict occurs when a node transmits and receives at the same time slot or receives more than one transmission destined to it at the same time slot. A secondary conflict occurs when a node, an intended receiver of a particular transmission, is also within the transmission range of another transmission intended for other nodes.

The scheduling problem is difficult because many subsets of non-conflicting nodes are candidates for each time slot, and the subset selected for transmission in one slot affects the number of transmissions in the next time slot, as some schedulable nodes may not have any packets to transmit because of the subset selected in the previous slot. We consider a network comprising a single access point (AP) and several sensor nodes

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that periodically generate data, possibly at different rates, for transfer to the AP. Links are assumed to be bidirectional. This is required for proper functioning of network protocols such as distributed Bellman-Ford algorithms. [3]

TDMA protocols are more power efficient since nodes in the network can enter inactive states until the allocated time slots. They also eliminate collisions and bound the delay. In TDMA during the transmission it will consume more energy and conflicting the nodes. The common scheduling problem in multi-hop networks employing a TDMA MAC protocol is to determine the smallest length conflict-free assignment of slots where each link or node is activated at least once.

Energy-Adaptive Gateway Mac Protocol

Wireless Sensor Networks (WSNs) provide a valuable capability to autonomously monitor remote activities. The limited resources challenge WSN medium access control (MAC) layer designers to adequately support network services while conserving limited battery power. This technique presents an energy adaptive WSN MAC protocol, Gateway MAC (GMAC), which implements a new cluster-centric paradigm to effectively distribute cluster energy resources and extend network lifetime. G-MAC's centralized cluster management function offers significant energy savings by leveraging the advantages of both contention and contention-free protocols.

A centralized gateway node collects all transmission requirements during a contention period and then schedules the distributions during a reservation-based, contention-free period. With minimal overhead, the gateway duties are efficiently rotated based upon available resources to distribute the increased network management energy requirements among all of the nodes. an energy-adaptive MAC protocol, Gateway MAC (G-MAC), which implements a new cluster-centric paradigm to effectively distribute cluster energy resources and extend network lifetime.

The G-MAC protocol's innovative architecture is motivated by the necessity for resource-challenged WSN mote sensor platforms to minimize the time radios spend in both the idle and the receive modes. G-MAC provides effective network control mechanisms to maximize sleep durations, minimize idle listening, and limit the amount of cluster control traffic overhead. G-MAC dynamically rotates point coordination duties among all the nodes to distribute the management energy costs, to allow other nodes to sleep longer, and to extend the network's lifetime.

G-MAC achieves significant energy savings in both heavy- and light density traffic environments by performing all required traffic scheduling operations while most of the nodes are sleeping.[1] Idle listening occurs when a device listens to an inactive medium. Contention-based WSN MAC protocols attempt to synchronize network traffic so that transmissions begin only in predetermined time slots.

The internetwork sender and gateway exchange an RTS-CTS data- ACK message sequence for immediate collection. The gateway must limit the amount of inter-network messages it stores due to limited memory capacity. After all transactions are complete, the gateway attempts to forward all traffic out of the cluster and then transitions to sleep. The distribution period begins with all nodes waking up and receiving the gateway traffic indication message (GTIM). G-MAC periodically elects a new gateway node to equally distribute the energy requirements among all of the nodes using the resource adaptive voluntary election (RAVE) scheme.

The G-MAC protocol's innovative architecture is motivated by the necessity for resource-challenged WSN mote sensor platforms to minimize the time radios spend in both the idle and the receive modes. Research shows that wireless platform transceivers expend a significant amount of energy receiving on an idle channel , and many of the WSN mote platform radios expend more energy in receive than in transmit mode. G-MAC provides effective network control mechanisms to maximize sleep durations, minimize idle listening, and limit the amount of cluster control traffic overhead.

In this protocol, a frame collision occurs when a node sends a message which collides or overlaps in time with another message. Single-channel radios cannot simultaneously receive while in transmit mode .Therefore, the message sender's only indication of a collision is the failure of the receiver to return an acknowledgement (ACK) for the message.

Concentrating the transmissions into a smaller active period reduces idle listening, but it also increases the probability of collisions. Receiving and discarding messages intended for other nodes, or message overhearing, is commonly employed in non-energy constrained networks to increase throughput and high delay.

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Event-Driven Reporting for Cluster-Based Wireless Sensor Networks.

Continuous-monitoring applications are an important class of wireless sensor network (WSN) applications. These applications require periodic refreshed data information at the sink nodes. To date, this entails the need for the sensor nodes to continuously transmit in a periodic fashion to the sink nodes, which may lead to excessive energy consumption. In this technique, we show that continuous monitoring does not necessarily imply continuous reporting. Instead, we demonstrate that we can achieve continuous monitoring using an event-driven reporting approach. Building on this idea, we propose two new mechanisms that enable energy conservation in continuous-monitoring WSNs.

The first mechanism can augment any existing protocol, whereas the second mechanism is conceived for cluster-based WSNs. With both mechanisms, sensor nodes only transmit information whenever they sense relevant data. To evaluate the efficiency of these proposals, the basic unscheduled transmission model and three well-known cluster-based protocols are used as baseline examples. In particular, new analytical models for conventional cluster-based systems and for techniques approach-enabled systems are complemented by simulations to present a quantified perspective of the potential benefits of the proposed reporting technique. We prove that significant energy conservation can be achieved using this reporting approach [2].

In this work, we focus on the class of continuous monitoring applications where the final user requires the most recent values sensed by the sensor nodes. Hence, each sensor node periodically produces data information and reports to one or several sink nodes. This typically implies that sensor nodes continuously transmit the information regardless of whether they have relevant data or not. By relevant data we refer to data that contains different information from the previous data information transmitted by the same sensor. We emphasize the difference in terms of goals and produced traffic between CM-EDR applications and classical event detection driven (EDD) applications.
A. Network Model In this analysis, we consider different variations of CSMA protocol to arbitrate the access to the medium among the sensor nodes at the cluster formation phase. Specifically, the NP-CSMA,1P-CSMA and CSMA/CA variations are considered along with different back off policies are investigated.

In view of this, we propose two schemes that perform intelligent reporting of the data information to the sink nodes by avoiding the transmission of extra and non relevant data information. In such application, it may happen that sensors have very similar reading during long periods of time and it would not be energy-efficient for sensors to continuously send the same value to the sink node. The network lifetime would be greatly increased by programming the sensors to transmit only when they have sensed a change in the temperature compared to the last transmitted information. In doing so, the end user would have a refresh value of the temperature in the supervised area even if the sensors are not transmitting continuously in a periodic fashion. The final user would have exactly the same information gathered by the WSN as with the classical continuous monitoring applications, but while the sensors only transmit when there is relevant data.

The main contributions of this work are summarized as follows:

- First, an in-depth comparison between cluster-based and unscheduled architectures is realized in order to explore the main interest of WSN clustering.
- To achieve this, we consider various contention-based MAC protocols. As a second main contribution of this work, two mechanisms based on the CM-EDR philosophy are proposed to conserve energy in continuous-monitoring WSNs. The first mechanism can augment any existing protocol, whereas the second is conceived for cluster-based WSNs. With both mechanisms, sensors only transmit the data whenever an event occurs. Moreover, with the second mechanism, if a CH has not received data from any of the cluster members (CMs) during a certain number of consecutive slots, then the CH goes to sleep for a predefined period of time which is advertised to all CMs.

Continuous monitoring applications are an important class of wireless sensor application. These application require periodic refreshed data information at the sink nodes. To date, this entails the need of the sensor nodes to transmit continuously in periodic fashion to the sink nodes, which may lead to excessive energy consumption.

IV. PROPOSED SYSTEM

It is known that the alarm could be originated by any node which detects a decisive event in the

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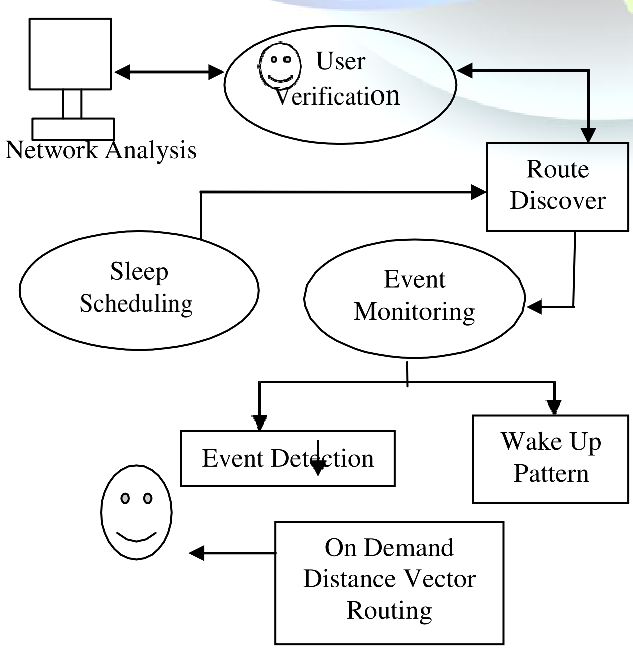
WSN. To essentially reduce the distributing delay, the proposed scheduling method includes two phases: 1) any node which detects a decisive event sends an alarm packet to the center node along a predetermined path according to level-by-level offset schedule 2) the center node broadcasts the alarm packet to the entire network also according to level-by-level offset schedule.

Here to 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. Therefore, the proposed scheduling scheme should contain two parts: 1) establish the two traffic paths in the WSN; 2) calculate the wake-up parameters (e.g., time slot and channel) for all nodes to handle all possible traffics. To minimize the broadcast delay, establish a breadth first search (BFS) tree for the uplink traffic and a colored connected dominant set for the downlink traffic, respectively. Through designing a special wake-up pattern, the two possible traffics could be both carried by a node.

To eliminate the collision in distributing, a Colored Connected Dominant Set (CCDS) in the WSN via the IMC algorithm is established. Each node transmits or receives packets in a specific channel according to the color assigned. if any node failure or transmission failure during alarm distributing in downlink traffic ,an on demand distance vector routing protocol is established to route and wakeup the nodes for distributing the alarm messages through reducing the distributing delay.

SYSTEM ARCHITECTURE



MODULES

The following modules are used in this project,

1) Route Discovery and maintenance
2) Event Monitoring
   i. Event Detection.
   ii. Wakeup Pattern
3) ODVR and DVR
4) Throughput Analysis

ROUTE DISCOVERY AND MAINTENANCE

In the Route discovery when a source node wants to transmit a message, it floods a query into the network to discover the route to the destination. This discovery packet is called the Route Request (RREQ) packet and the mechanism is called Route Discovery. The destination replies with a Route Reply (RREP) packet. As a result, the source finds the route to the destination. Here route will be predetermined before packet transmits. The BFS and CCDS are used to determine the path for transmit the packet.

Each node computes its energy level and position in the networks. This information is used in sleep scheduling, route update, and event reporting. Furthermore, the sink node divides the network into different regions. The sink node sends message to all the nodes in the network. The sink node first propagates a beacon message with transmission power TP_1. The node receiving this message will mark its region status as region 1 and will go to sleep state. Next, the sink node again propagates a control message with transmission power TP_2.

A novel sleep scheduling method to reduce the delay of alarm distributing from any sensor node in WSNs. Specifically, 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.

To minimize the broadcast delay, we establish a Breadth First Search (BFS) tree for the uplink traffic and a Colored Connected Dominant Set for the downlink traffic. In route discovery, there are two routes to be established for transmitting an alarm packet. The BFS algorithm is used to select a best path for transmission of alarm message from nodes to the center node and CCDS is establish to select path, while transmitting a packet from the center node to all other nodes in network.

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EVENT MONITORING

In this event monitoring, the event are detected and traffic flow to be analyzed. The sensor nodes for event monitoring are expected to work for a long time without recharging the batteries, sleep scheduling method is employed.

i. Event Detection

For the decisive event monitoring in a WSN, sensor nodes are usually equipped with passive event detection capabilities that allow a node to detect an event even when its wireless communication module is in sleep mode. In event detection the sensor node is detect the event, when the unauthorized user or intruder entered into the network, These event is called as a decisive event. If any node detect the unauthorized user or intruder in the network that node should be originate the alarm message and it will broadcast to the entire network based on predefined path with level-by-level offset way.

There are two phases for alarm distributing,1) any node which detects a decisive event sends an alarm packet to the center node along a predetermined path according to level-by-level offset schedule 2) the center node broadcasts the alarm packet to the entire network also according to level-by-level offset schedule.

ii. Wakeup Pattern

After all nodes get the traffic paths, sending channels and receiving channels with the BFS and CCDS, 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 two traffic paths. There are two traffic paths for the alarm dissemination, 1) sensor nodes on paths in the BFS wake up level-by-level according to the hop distances to the center node; 2) after the center node wakes up, the nodes in the CCDS will go on to wake up level-by-level according to the hop distances in the CCDS. This pattern is derived from the previous one by shifting the wakeup pattern of the nodes in even levels by T/2.

To eliminate the collision in distributing of alarm message, a Colored Connected Dominant Set (CCDS) in the WSN via the IMC (Iterative Minimal Covering) algorithm is established. Each node transmits or receives packets in a specific channel according to the color assigned. In traffic analysis the even-odd wakeup pattern are used to wake-up the nodes both of the uplink and downlink.

ODVR AND DVR

In the on-demand routing protocol for wireless multi-hop networks, that is able to find the shortest path between two nodes. One thing need to be mentioned is that the shortest path is in the delay graph, not the original network. Each real node will present 2K nodes in the delay graph and the (k − 1)2 links among them. In order to support broadcast, one awake slot is reserved every M slots for all nodes for local updates or route message forwarding. The larger M, the longer route setup latency but more energy efficient. The smaller M, the shorter route setup latency but more energy wastage. Distance-vector routing protocols have less computational complexity and message overhead. If any link or node failure in the downlink traffic i.e. center node to other node, the on demand distance vector routing protocol is established for routing the packet and the nodes are wakeup to receive an alarm message in these path. After the transmission of alarm message all the nodes are go to the sleep state.

THROUGHPUT ANALYSIS

To obtain the result of distributing delay in the network, a mobile Micas node carried by a person is used for results collection. Each node records the time when it receives the alarm and sends its record to the mobile node when the mobile node inquires it. The alarm is originated by an arbitrary node selected in the network, The duty cycle is set to be 1*s*.

In throughput analysis 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 decisive 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. First set the size of the time slot to be the minimum time for sensor nodes to transmit an alarm packet, 2 ms. when an alarm transmission fails between two adjacent nodes with the proposed scheme, the sender node has to retransmit the alarm after 2 duty cycles.

IV. CONCLUSION

It is aims to detect the decisive events occurring in a wireless sensor network using sleep scheduling technique. It is plan to done by the predetermining the route and wakeup the nodes about the decisive event. It is analyzed that the existing system are not much effective for bidirectional action and event detection. The implementation process has been initiated and it is expected to detect maximum decisive event with minimum delay.

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