Critical event based energy efficient WSN

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ABSTRACT: Wireless sensor networks (WSN) are widely used to sense and measure physical conditions for different purposes and within different regions. However due to the limited lifetime of the sensor’s energy source, many efforts are made to design energy efficient WSN. As a result, many techniques were presented in the literature such as power adaptation, sleep and wake-up, and scheduling in order to enhance WSN lifetime. These techniques were presented separately and shown to achieve some gain in terms of energy efficiency. In this paper, we focus on critical event monitoring in wireless sensor network, where only a small number of packets need to be transmitted most of the time. When a critical event occurs, an alarm message should be broadcast to the entire network as soon as possible.


I. INTRODUCTION

Wireless sensor networks (WSN) are widely used to sense and measure physical conditions for different purposes and within different regions. However due to the limited lifetime of the Sensor’s energy source, many efforts are made to design energy Efficient WSN. As a result, many techniques were presented in the literature such as power adaptation, sleep and wake-up, and scheduling in order to enhance WSN lifetime. These techniques were presented separately and shown to achieve some gain in terms of energy efficiency. In this paper, we Present an energy efficient cross layer design for WSN that we named “Critical event-Based Sensing” (CEBS) scheme. The CEBS design is a task based sensing scheme that not only prevents wasting power in unnecessary signalling, but also utilizes several techniques for achieving reliable and energy efficient WSN.

In critical applications, such as fire detection and gas monitoring in industry, Wireless Sensor Network are deployed in wide range of areas, with a large number of sensor node detecting and reporting some information of urgencies to the base station. As there may be no communication infrastructure, users are usually equipped with communicating device to communicate with sensor node. When a critical event (E.g. A Gas leak or fire) occurs in the monitoring area and is detected by a sensor node, an alarm needs to be broadcast to other nodes as soon as possible which is shown in fig.1 as an example. Then sensor node can warn users near by to take some response to the event.

Fig. No.1 Critical Event Monitoring with WSN.
As sensor node for event monitoring are expected to work for a long time without recharging their batteries, sleep scheduling method is always use during the monitoring process. Obviously sleep scheduling could cause transmission delay because sensor node should wait until receiver node are active and ready to receive the message the delay could be significant as the network scale increases. Therefore, a delay-efficient sleep scheduling methods need to be designed to ensure low broadcasting delay form any node in WSN.

Recently, many sleep schedules for event monitoring have been designed [1] [2] [3] [4]. However most of them focus on minimizing the energy consumption. Actually in the critical event monitoring, only a small number of packets need to be transmitted most of the time. When a critical event is detected, the alarm packet should be broadcast to entire network as soon as possible therefore, broadcasting delay is an important issue for the application of the critical event monitoring.

To minimize the broadcasting delay, it is needed to minimize time wasted for a waiting during the broadcasting the ideal scenario is the destination node wake up immediately when the source node obtain the broadcasting packet. Here, the broadcasting delay is the definitely minimum. Based on these idea a level by level offset schedule was proposed in [5].

As shown in fig.2, the packet can be deliver from node A to node C via node B with minimum delay hence it is possible to achieve low transmission delay level by level offset schedule in multi-hop WSNs [6] [7] [8] [9]. However it is still a challenge for us to apply the level by level offset to alarm broadcasting the critical event monitoring. first the order of nodes wake up should conform to the traffic direction. if the traffic flow is in the reverse direction as shown in fig.2 the delay in each in each hop will be as large as the length of the whole duty cycle, which also results in large delay equaling the whole duty cycle.

II. LITERATURE SURVEY

1.Sleep scheduling for critical event monitoring.
This paper discusses the Task based sensing. Many applications in WSN have redundant data, which means that the data does not change very fast. A task is characterized by different parameters: type of sensing, number of sensing operations, period of sensing and the intended nodes (nodes required to sense data). So sending the same data again and again results in Wastage of Network energy which in turn reduces network life time.

2.A Green Task-Based Sensing
Author: Abdullah Alhalafi Lokman Sboui,Assistant Professor
Year: IEEE 2016
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3.An Energy-Efficient MAC Protocol for WSN
Author: Wei Ye, John Heidemann, Deborah Estrin
Year: IEEE 2014
This paper proposes S-MAC, a medium-access control (MAC) protocol designed for wireless sensor networks. Wireless sensor networks use battery-operated computing and sensing devices. energy conservation and self-configuration are primary goals, while per-node fairness and latency are less
important. S-MAC uses three novel techniques to reduce energy consumption and support self-
configuration. To reduce energy consumption in listening to an idle channel, nodes periodically sleep.

III. DESIGN REQUIREMENT
A. Hardware
- GAS: MQ6 sensor
- Temperature sensor: LM35
- RF Module
- GSM
- ARM7-LPC2138
- LCD 16*2
B. Software
- Compiler: KEIL3
- Programming Language: Embedded C
- Programming Platform: Flash Magic

IV. BLOCK DIAGRAM
Description of block diagram:
Here we are reconfiguring the WSN using RF module. Here we are considering 1 Base station and 2 user structure. In this network we are using the Critical Event Monitoring Protocol. Initially the WSN network has 1 Base station (PC) and of 2 sensor user nodes. In the WSN the PC is the master and the other two are sensor nodes. The communication between the base station and the sensor nodes is based on wireless protocol. At the base station GSM is connected to PC, whenever critical event occurs then through GSM module message will be send to the authorized person.

Here we are implementing the Task based sensing. Many applications in WSN have redundant data, which means that the data does not change very fast. A task is characterized by different parameters: type of sensing, number of sensing operations, period of sensing and the intended nodes (nodes required to sense data). So sending the same data again and again results in Wastage of Network energy which in turn reduces network life time.

So, here in our paper we will send the data whenever the sensor crosses a threshold /Set point. That means whenever a new data is present, then only the slave will send the data frame in response. This results in less number of Communication frame, which increases the Network efficiency.

V. METHODOLOGY

![System Flow Chart](image)

- ARM7-LPC2138
  The LPC2138 Microcontroller are based on a 16/32 bit ARM7TDMI-S CPU with real emulation and embedded trace support, that combine the microcontroller with 32,64,128,256,512 KB of embedded high speed flash memory. A 128 bit wide memory interface and a unique accelerator architecture enable 32 bit code execution at maximum clock rate. For critical size applications, the alternative 13 bit thumb mode reduces code by more than 30% with minimal performance penalty.
- GAS: MQ6 sensor

![MQ6 Sensor](image)
The MQ-6 can detect gas concentrations anywhere from 200 to 10000 ppm. This sensor has a high sensitivity and fast response time. The sensor’s output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

**FEATURES**
1. Good sensitivity to Combustible gas in wide range
2. High sensitivity to Propane, Butane and LPG
3. Long life and low cost

**APPLICATION**
1. Domestic gas leakage detector
2. Industrial Combustible gas detector

- Temperature sensor: LM35

![LM35 Temperature Sensor](image)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in °C Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of 1/4 °C at room temperature and ±3/4 °C over a full 55 to 150 °C temperature range.

- RF Module

![RF Module](image)

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This RF module comprises of an RF Transmitter and an RF Receiver. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin 4. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.
This means the module supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900 MHz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850 MHz band (the band is either 850 MHz or 1900 MHz). Canada operates primarily on 1900 MHz band.

VI. RESULTS

Simulation Result

VII. CONCLUSION

We present an energy efficient cross layer design for WSN we named “critical event-based sensing (CEBS)” Scheme. This Design allows the WSN to sense the data from all sensor to take desired action. Due to task based sensing battery life of slaves increases and traffic is minimized by avoiding unnecessary data transmission.
VIII. FUTURE SCOPE

This system can be enhanced with more features like adding an IOT based sensor monitoring system. The user can monitor the data over internet. Also we can increase the number of slaves to increase the WSN range.

IX. REFERENCES