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WIRELESS SENSOR NETWORK BASED HEALTH MONITORING SYSTEMS USING GPS AND ZIGBEE

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Abstract:

The development of telemonitoring via wireless body area networks (WBANs) is an evolving direction in personalized medicine and home-based mobile health. A WBAN consists of small, intelligent medical sensors which collect physiological parameters such as EKG (electrocardiogram), EEG (electroencephalography) and blood pressure. The recorded physiological signals are sent to a coordinator via wireless technologies, and are then transmitted to a healthcare monitoring center. One of the most widely used wireless technologies in WBANs is ZigBee because it is targeted at applications that require a low data rate and long battery life. However, ZigBee-based WBANs face severe interference problems in the presence of WiFi networks. This problem is caused by the fact that most ZigBee channels overlap with WiFi channels, severely affecting the ability of healthcare monitoring systems to guarantee reliable delivery of physiological signals. To solve this problem, we have developed an algorithm that controls the load in WiFi networks to guarantee the delay requirement for physiological signals, especially for emergency messages, in environments with coexistence of ZigBeebased WBAN and WiFi. Since WiFi applications generate traffic with different delay requirements, we focus only on WiFi traffic that does not have stringent timing requirements. In this paper, therefore, we propose an adaptive load control algorithm for ZigBee-based WBAN/WiFi coexistence environments, with the aim of guaranteeing that the delay experienced by ZigBee sensors does not exceed a maximally tolerable period of time. Simulation results show that our proposed algorithm guarantees the delay performance of ZigBee-based WBANs by mitigating the effects of WiFi interference in various scenarios.

***Keywords**: GPS,Zigbee.*

INTRODUCTION

The development of health telemonitoring via wireless body area networks (WBANs) is an evolving direction in personalized medicine and home-based mobile health. In a health telemonitoring system, a WBAN consists of a number of lightweight miniature sensors. The sensors measure physiological parameters such as electrocardiography (EKG), electroencephalogram (EEG), body temperature and blood pressure. These measurements are transmitted to an external data aggregation device called a coordinator via wireless communication networks, and are then sent to a health telemonitoring center (e.g., a hospital) via the Internet. At the hospital, medical professionals monitor their patients' physiological parameters continuously so that there is no need for them to visit the hospital in person. The physiological signals in the system can be categorized into two types: regularly collected information and emergency messages. Regularly collected information is stored and transmitted after a given period of time, while emergency messages must be transmitted immediately since they alert the hospital to emergency situations such as excessively high or low blood pressure or body temperature, or heart beat stoppage. According to the TG6 Technical Requirement Document (TRD), emergency messages must be transmitted in less than 1 sec . Hence, guaranteed delay requirement is of utmost importance to the proper operation of health telemonitoring systems.

HARDWARE SYSTEM

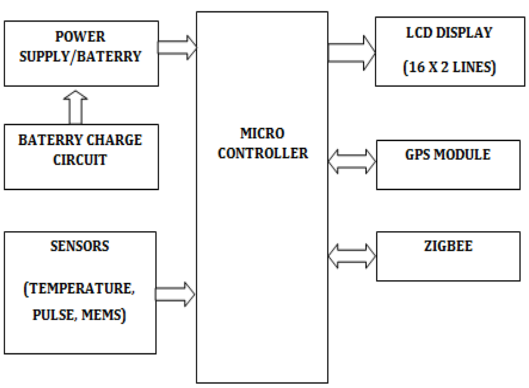

Fig:1:TX Block diagram

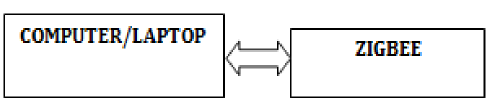

Fig:2:RX Block diagram

METHODOLOGY

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI:

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (LCD)

It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

PC Monitor:

The HDMI-VGA cable is attached updated raspberry-pi and the LJ R interface of the cable is attached updated. The face of the character getting captured can be visible on up-to-date. The Raspberry Pi has a HDMI port which you can plug without delay into a display or tv with an HDMI.

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature.

Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting over current protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig.3: Temperature sensor

ZIGBEE:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this case is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port. Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

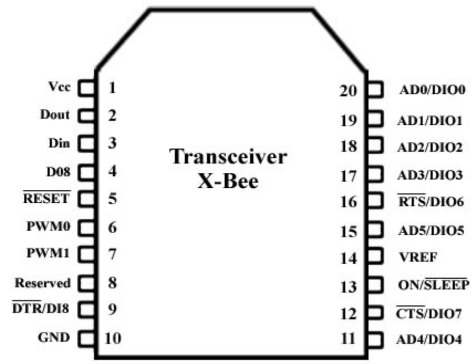

Fig.4: ZIGBEE pin diagram

Pulse sensor:

Attach to finger and get Analog out from the sensor based on heart beat pulse. You can read the analog output with microcontroller ADC and then plot it or calculate readings like heart beat per minute. It is simple to use and accurate results.

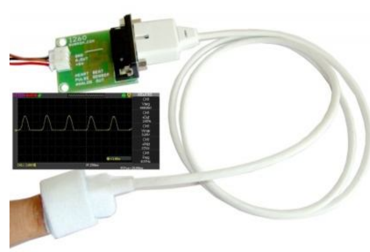

Fig.5: pulse sensor

MEMS:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications. Microelectronic integrated circuits can be thought of as the "brains" of a system and MEMS augments this decision-making capability with "eyes" and "arms", to allow micro systems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena.

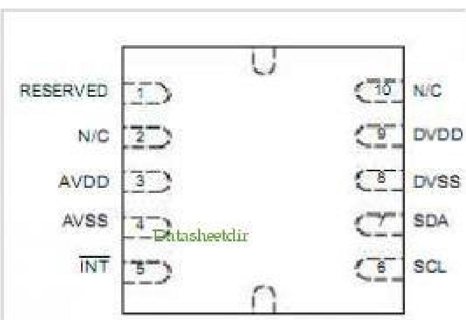

Fig.6: MEMS IC

The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose. Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost.

GPS:

Global Positioning System (GPS) technology is changing the way we work and play. You can use GPS technology when you are driving, flying, fishing, sailing, hiking, running, biking, working, or exploring. With a GPS receiver, you have an amazing amount of information at your fingertips. Here are just a few examples of how you can use GPS technology. GPS technology requires the following three segments.

- Space segment.
- Control segment.
- User segment

Space Segment

At least 24 GPS satellites orbit the earth twice a day in a specific pattern. They travel at approximately 7,000 miles per hour about 12,000 miles above the earth’s surface. These satellites are spaced so that a GPS receiver anywhere in the world can receive signals from at least four of them.

Control Segment

The control segment is responsible for constantly monitoring satellite health, signal integrity, and orbital configuration from the ground control segment includes the following sections: Master control station, Monitor stations, and Ground antennas.

User Segment

The GPS user segment consists of your GPS receiver. Your receiver collects and processes signals from the GPS satellites that are in view and then uses that information to determine and display your location, speed, time, and so forth. Your GPS receiver does not transmit any information back to the satellites.

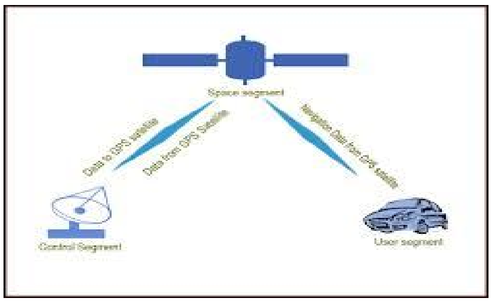

Fig.7: GPS Working

The following points provide a summary of the technology at work:

- The control segment constantly monitors the GPS constellation and uploads information to satellites to provide maximum user accuracy
- Your GPS receiver accounts for errors. For more information, refer to the Sources of Errors.
- Your GPS receiver determines your current location, velocity, and time.
- Your GPS receiver can calculate other information, such as bearing, track, trip distance, and distance to destination, sunrise and sunset time so forth.
- Your GPS receiver displays the applicable information on the screen.

CONCLUSION

In ZigBee-based WBANs with coexisting WiFi networks, most ZigBee channels overlap with IEEE 802.11 WiFi channels, resulting in increased delays for ZigBee packets due to interference. To solve this problem, we have proposed an adaptive load control algorithm that controls only the WiFi traffic generated from delay-tolerant applications dynamically with the aim of guaranteeing that the delays experienced by ZigBee sensors do not exceed the maximally tolerable delay period. We have also analyzed the PER in ZigBeebased WBAN/WiFi coexistence networks and the delay from a ZigBee sensor to the coordinator while considering the effects of interference from the ZigBee network and other WiFi networks. In addition, the traffic classification is presented to classify applications. We have demonstrated via simulation results that the proposed algorithm guarantees the delay requirement for ZigBee sensors.

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