Medical Application Based on Wireless Sensor Network

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Abstract— Sensor networks have great potential to impact many aspects of medical care. By outfitting patients with wireless, wearable vital sign sensors, collecting detailed real-time data on physiological status can be greatly simplified. Medical sensor networks must support multicast routing topologies, node mobility, a wide range of data rates and high degrees of reliability, and security. We proposed to look at the possibility of adding scope selection to the current implementations of data dissemination to add robustness and scalability, better utilization and limited bandwidth. This leads to energy saving at the same time it promote autonomy of the network which would facilitate deployment of wireless sensor network in more diverse scenarios.

Keywords— Robustness, Zigbee, ADCL (Analog to Digital Conversion Low), Sensor nodes

I. Introduction

Wireless sensors permit data acquisition at higher resolution and for longer durations than existing monitoring solutions. The communication protocols for data transfer can enhance efficiency in medical care. Medical care is an oft-cited application for sensor networks. Emergency medical care, triage, and intensive care can benefit from continuous vital sign monitoring, especially immediate notification of patient deterioration. The physiological data collected by the sensor networks can be stored for a long period of time, and can be used for medical exploration. The installed sensor networks can also monitor and detect elderly people's behavior. These small sensor nodes allow the subject a greater freedom of movement and allow doctors to identify pre-defined symptoms earlier. Each patient has small and lightweight sensor nodes attached to them. Each sensor node has its specific task. For example, one sensor node may be detecting the heart rate while another is detecting the blood pressure. The purpose is to look at the possibility of adding scope selection to the current implementations of data dissemination to add robustness and scalability, better utilization and limited bandwidth. This leads to energy saving at the same time it promote autonomy of the network which would facilitate deployment of WSN in more diverse scenarios.

II. Literature Survey

Recent advances in micro-electro-mechanical systems (MEMS) technology, wireless communications and digital electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate untethered in short distances. These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes. Sensor networks represent a significant improvement over traditional sensors, which are deployed in the following two ways,

- Sensors can be positioned far from the actual phenomenon, i.e., something known by sense perception. In this approach, large sensors that use some complex techniques to distinguish the targets from environmental noise are required.
- Several sensors that perform only sensing can be deployed. The positions of the sensors and communications topology are carefully engineered. They transmit time series of the sensed phenomenon to the central nodes where computations are performed and data are used.

III. Problem In Existing System

In a hospital or clinic resource utilization is limited. Monitoring patient on time to time basis is a time consuming process. Especially in an emergency case doctor needs to continuously monitor the status of multiple patient at the same time. Monitoring multiple input on same resource is difficult activity in real time.

IV. Proposed System

An emerging application for wireless sensor networks involves their use in medical care. In a hospital or clinic, outfitting every patient with tiny, wearable wireless vital sign sensors would allow doctors, nurses and other caregivers to continuous monitoring of patients. In an emergency or disaster scenario, the same technology would enable medics to work effectively towards large numbers of casualties. Main concept in these systems is a sensor node, small microcontroller integrated with number of sensors. In our system we are using Zigbee Serial1 module having range of 100ft Indoor & 300ft Outdoor. Project's goal includes the implementation of the service which provides information collection, storage and uploads without explicit input or maintenance, required from the user.

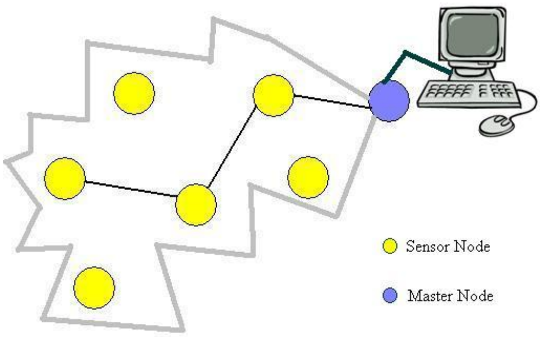


Fig. 1 Wireless Sensor Network

A. ADC Conversion Result

The conversion result can be found in the ADC. Result Registers (ADCL, ADCH).For single ended conversion, the result is

$$ADC = \frac{V_{IN} \cdot 1024}{V_{REF}}$$

Where VIN is the voltage on the selected input pin and VREF (value is 3300) the selected voltage reference. 0x000 represents ground, and 0x3FF represents the selected reference voltage minus one LSB. If differential channels are used, the result is

$$ADC = \frac{(V_{POS} - V_{NEG}) \cdot GAIN \cdot 512}{V_{REF}}$$

Where VPOS is the voltage on the positive input pin, VNEG the voltage on the negative input pin. GAIN is the selected gain factor, and VREF the selected voltage reference.

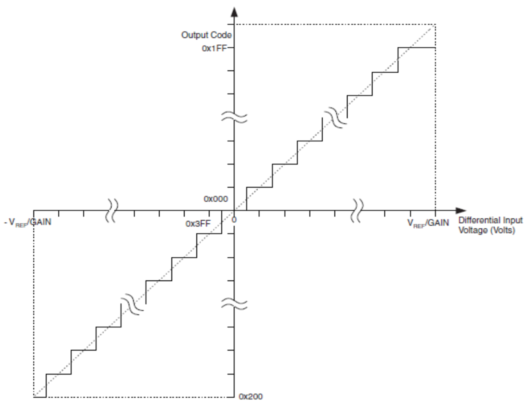


Fig. 2 Differential Measurement Range

B. Temperature Calculate

The general equation used to convert output voltage to temperature is:

Vout = Temperature (^{o}C) / (100mV/ ^{o}C)

Where Vout is 1V, then, Temperature = 100 ^{o}C. The output voltage varies linearly with temperature.

C. Heart Beat Rate Calculate

1) *Resting Average Heart Rate*
(m1+m2+m3)/3=ARHR
Where m1 = First morning Heart Rate Count
m2 = Second morning Heart Rate Count
m3 = Third morning Heart Rate Count
ARHR = Average resting heart rate

2) *Max Heart Rate*
220 – a1= HRmax
Where 200 = constant
a1 = Age of patient
HRmax = Max Heart Rate

3) *Reserve Heart Rate*
HRmax – ARHR = HRmaxR
Where HRmax = Max Heart Rate
ARHR = Average resting heart rate
HRmaxR = Reserve Heart Rate

4) *Lower Limit of THR*
(HRmaxR * 0.6) + ARHR = LTHR
Where HRmaxR = Reserve Heart Rate
ARHR = Average resting heart rate
LTHR = Lower limit of THR

5) *Upper Limit of THR*
(HRmaxR * 0.8) + ARHR = UTHR
Where HRmaxR = Reserve Heart Rate
ARHR = Average resting heart rate
UTHR = Upper limit of THR

6) *Target Heart Rate*
(LTHR + UTHR) / 2 = THR
Where LTHR = Lower limit of THR
UTHR = Upper limit of THR
THR = Target heart rate

D. Hardware Platform

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 °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. Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. This digital output can be connected to microcontroller directly to measure the Beats per

Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

E. Advantages of Proposed System

1) *Reliable Communication:* Reliable communication is important for medical applications. The communication requirements of different sensors vary with required sampling rates, from less than 1 to 1000 Hz. One approach to improve reliability is to move beyond telemetry by performing on-sensor signal processing. For example, instead of transferring raw data from sensor, we can perform feature extraction on the sensor, and transfer only information about an event.

2) *Interpretability:* Wireless medical sensors should allow users to easily assemble a robust depending on the user's state of health. Standards that specify interoperability of wireless medical sensors will promote vendor competition and eventually result in more affordable systems.

3) *Wearability:* To achieve non-invasive and unobtrusive continuous health monitoring, wireless medical sensors should be lightweight and small. The size and weight of sensors is predominantly determined by the size and weight of batteries. But then, a battery's capacity is directly proportional to its size. We can expect that further technology advances in miniaturization of integrated circuits and batteries will help designers to improve medical sensor wearability and the user's level of comfort.

4) *Low Cost:* Cost estimation is low; there is no large amount of devices as we used microcontroller, transceiver, and sensors. Since in existing system there is high cost of devices. And also need more power. We used batteries for power consumption and it saves the cost.

V. Future Scope

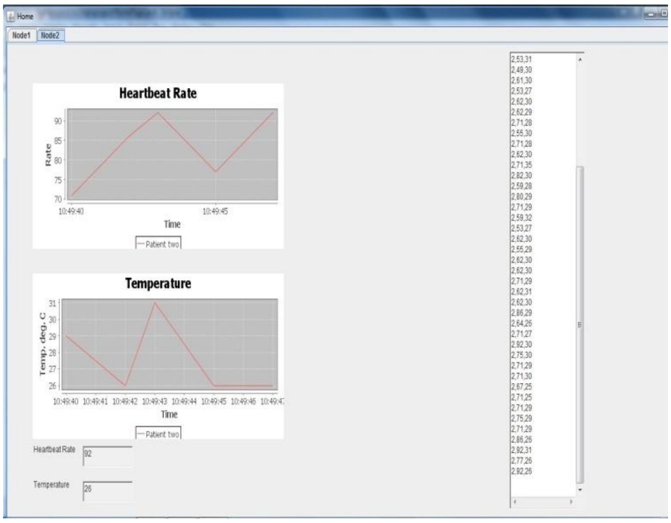
Driven by user demand and fuelled by recent advances in hardware and software, the first generation of wireless sensor networks for healthcare has shown their potential to alter the practice of medicine. Looking into the future, the ability to deploy large-scale systems that meet the applications' requirements even when deployed and operated in unsupervised environments is going to determine the extent that wireless sensor networks will be successfully integrated in healthcare practice and research.

VI. User Interface

The prototype provides a Java-based graphical user interface (GUI) that is intended to be easy for medical personnel to use and which provides enough detail on patient status. GUI is shown in Figure 3. The upper panel shows a graph of the heart beat rate and the lower panel displays graph of the temperature data received from the currently selected input.

Fig. 3 Graphical user interface

VII. Conclusion



Wireless Sensor Network has wide range of application. We have included sensors in healthcare application for temperature and Heart beats. In health care these two are major parameter of any treatment. Also these application sensors are regularly used in healthcare. Here we are implementing healthcare algorithm, it is easy to build, understand and simple to apply. The following are some features that make Wireless Sensor network are different from the other techniques,

- Less cost
- Reduced Complexity
- Less Space Requirement
- Easy to apply

VIII. Acknowledgment

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