ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Measurement of Vital Signs in Healthcare Environment using RTOS.

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ABSTRACT

This paper is an RTOS based patient monitoring through WSN without collision. RTOS is a Process which will be done between hardware and application. Here stack is the one which is used to avoid the independency of the layer from one with another inside the protocol comes under the standard IEEE802.15.4.Stack having two techniques (PAL and NILI) used in IEEE 802.15.4 to reduce the collision and timing. Mostly during the packet transmissions some collisions may occur. This collision has to be avoided to prevent the data loss during the transmission. This paper presents the monitoring system that has the capability to monitor physiological parameters from multiple patient bodies. In this proposed system a coordinator node has attached sensors on patient body to collect all the signals from the wireless sensor and send them to the base station the attached sensors on patients body from wireless body sensor network (WBSN) and they are able to sense the body temperature ,blood pressure and so this system detect the abnormal condition. The energy consumption prolong the network lifetime speed up and extend the communication coverage to increase the freedom for enhance patient quality of life.

Keywords: RTOS, Microcontroller, ARM LPC21428, Master control and data acquisition system

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ISSN: 0975-8585

INTRODUCTION

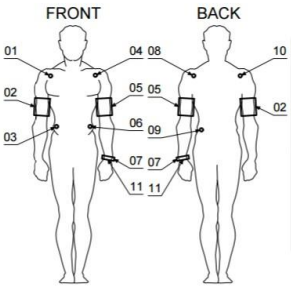
Now a days Most of the Patients are monitoring through doctors or Nurse. This method is quite easy but on the other hand it is Difficult also. So we required proper monitoring. This paper presents the modification of an existing safety model employed in domestic field and designing a microcontroller based sensors and if the Sensors have detected it automatically alerts the in charges. This safety system can be used in any automation Hospitals Houses etc. The advantage of this automated detection alarm system is that it offers faster response time accurate detection of an emergency in turns leading to faster diffusion of the situation compared to the manual methods. This is a very compelling reason that justifies designing such a safety system. This paper deals with the data transmission between two units in the exact time without any collision the data transmission time is increased with the protocol standard one of the sections runs with RTOS and LPC2148 as master node and another one as normal data acquisition node to which sensors are connected. Data acquisition node uses the ARM-7.Communications between two nodes (hardware and application) area accomplished through IEEE 802.15.4.

The RTOS is to manage the allocation of these resources to users in an orderly and in controlled manner. This wireless sensor node is composed of a microprocessor, transceivers, displays and analog to digital converters. The Sensor nodes are deployed for industrial process monitoring and control. The sensing parameter can be displayed as graph in Master node. The fundamental view of this technique is to reduce the possibilities of collision and to meet the critical requirement of timing for data transmission of patient monitoring applications.

EXISTING SYSTEM

Redundant Measurement of Vital Signs in a Wearable Monitor to Overcome Movement Artifacts in Home Health Care Environment. In existing system the design of a wearable device for measuring the vital signs oriented to monitoring applications and home health care. In order to improve the living conditions of patient the device allows that the patient can perform their daily activities while their health is monitoring. The designed device allows measuring ECG [electrocardiogram], blood oxygen saturation and non-invasive blood pressure and heart rate. This paper proposes a novel technique to reduce motion artifacts based on the signals measurement redundantly and also the importance at clinic level of measuring these variables .The device transmits the information wireless to a proprietary application for monitoring the results of used technique for reducing artifacts and a prototype of the device is presented. The advantages and future improvements of the wearable monitor are discussed. This process having possibilities of collisions and there is no layer architecture and no data acquisition node. It will not work on priority based operation.

Figure 1 shows the spatial distribution of sensors used in the wearable vital signs monitor. The ECG electrodes were placed on chest and back of the patient, allowing redundant acquisition. To register SpO2 was used a reflective sensor placed in a patient's wrist over radial artery; also, an Inertial Measurement Unit (IMU) was implemented to capture the patient movement for adaptive filtering. In the case of NIBP, two cuffs were used on each arm of patient.



PART	DESCRIPTION
01	Front right arm electrode
02	Right arm cuff
03	Right leg electrode
04	Front left arm electrode
05	Left arm cuff
06	Front left leg electrode
07	Oxygen saturation sensor
08	Back left arm electrode
09	Back left leg electrode
10	Back right arm electrode
11	IMU Sensor

Fig. 1. Scheme of sensors distribution around the body used in the vital signs monitor.

ISSN: 0975-8585

Figure 2 shows the principal components of the system in a block diagram, the device have a wireless communication interface that works with IEEE 802.15.4 standard [17]. This device transmits the acquired information through Wi-Fi protocol to two possible destinations.

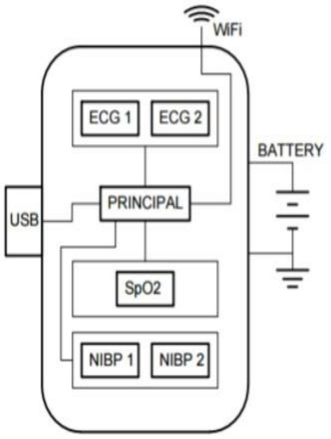


Fig. 2. Blocks diagram of system designed for wearable vital signs monitor.

Figure 3 shows a Prototype of wearable vital signs. The sensors for measuring physiological variables are located on the inside of the wearable clothing; the ECG electrodes are attached to the patient's body and secured in the clothing just like the other designed sensors.

Prototype of wearable vital signs monitor.

Fig 3: Prototype of wearable vital signs

PROPOSED SYSTEM

Measurement of vital signs in healthcare environment using RTOS:

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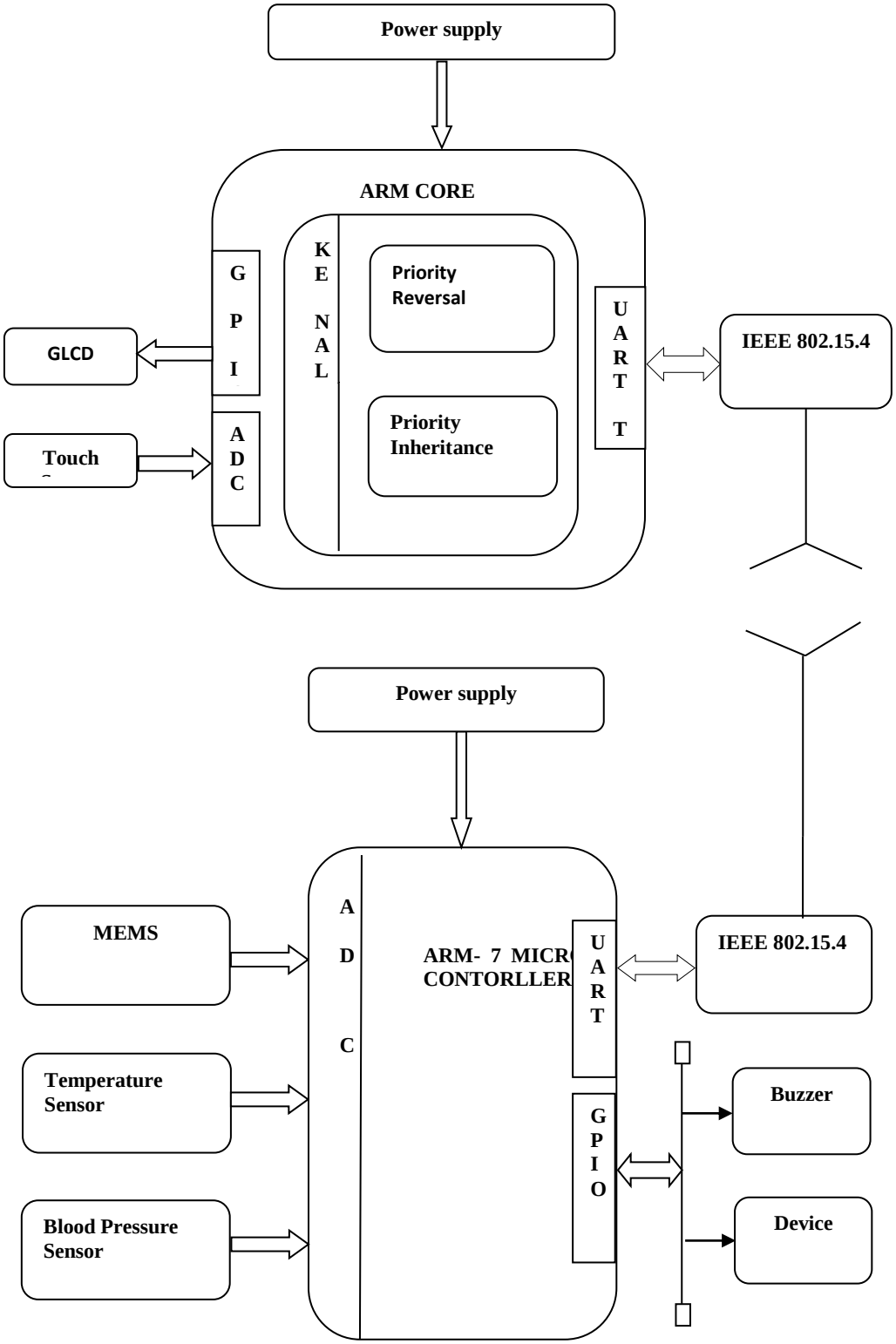
BLOCK DIAGRAM



Data acquisation node:

ARM LPC2148

LPC2141/2/4/6/8 microcontrollers are based on 32/16 bit ARM7TDMISCPU with real time emulation and the embedded trace support combines the microcontroller with the embedded high speed flash memory ranging from 32 kB to 512 kB a 128-bit wide memory interface and the unique accelerator architecture enable

32-bit code execution at the maximum clock rate. For critical code size applications alternative 16-bit thumb mode reduces code by more than 30 % with low performance penalty.

Features of LPC2148:

- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 60 MHz maximum and CPU clock available from programmable on-chip PLL with settling time of 100 µs.
- Typical frequency 12MHZ.
- CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pads.
- The LPC2146/8 provide 8 kB of on-chip RAM accessible to USB by DMA.
- ADC 3.3V and other functionality's like SRAM having 4KB, Flash memory having 512KB.
- On-chip integrated oscillator operates with an external crystal range from 1 MHz to 30 MHz and with an external oscillator up to 50 MHz Power saving modes include Idle and Power-down.

SENSOR

The sensors used in this paper are temperature sensor, BP sensor and MEMS sensor the temperature sensor to monitor the patients body temperature and BP sensor to monitor the patients blood pressure level and MEMS sensor is to monitor sudden changes in patients body[fix]. The three sensors are connected with the processor and acts as a data acquisition node. It is placed in every node to get the values. All the values are displayed in GLCD.

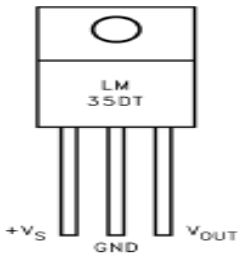
LM 35:

The LM35 sensor are precision integrated circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature .The LM35 sensor has an advantage over linear temperature sensors calibrated in ° Kelvin as user is not required to subtract a large constant voltage from its output to obtain the convenient Centigrade scaling. The LM35 sensor does not required 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. Low cost is assured by trimming, calibration at the wafer level. The LM35 sensor has low output impedance, linear output, and precise inherent calibration make interfacing to read out and control circuitry especially easy it can be used with a single power supplies or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating and less than 0.1°C in still air. The LM35 sensor is rated to operate over a −55° to +150°C temperature range, while the LM35 sensor is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 sensor is available package in hermetic TO-46 transistor packages while the LM35C, LM35CA, LM35D are also available in the plastic TO-92 transistor packages. The LM35D is available in an 8-lead surface mount small outline package and a plastic TO-220 package.

Features:

The features of LM35 Sensor the Calibrated directly in ° Celsius (Centigrade) and the Linear + 10.0 mV/°C scale factor0.5°C accuracy guarantee able (at +25°C) the Rated for full (−55° to +150°C) range Suitable for remote applications the Low cost due to wafer-level trimming Operates from 4 to 30 volts Less than 60 µA and the current drain Low self-heating 0.08°C in still air Non linearity ±1⁄4°C typical Low impedance output 0.1 ⍰⍰for 1 mA load

LM35 SENSOR



ISSN: 0975-8585

MEMS SENSOR

MEMS[micro electro mechanical system] sensor are one of the simplest but also most applicable micro electromechanical systems. They became indispensable in automobile industry computer, audio and video technology MEMS technology as a highly developing industrial Special attention is given to the capacitor accelerometers how do they work and their applications. MEMS accelerometer is an electromechanical device that measures the acceleration forces. These force may be static like the constant force of gravity pulling at our feet or they could be dynamic caused by moving the accelerometer. There are many types of accelerometers that developed and reported in the literature. The vast majority is based on the piezoelectric crystal but they are too big and clumsy. People tried to develop something smaller and that could increase applicability and started searching in the field of microelectronics. They develop MEMS (micro electromechanical systems) accelerometers. They have unique features and applications ranging from hard-disk protection on laptops to game controller more recently the same sensor core technology has become available in fully integrated and full featured devices and suitable for industrial applications. Micro machined accelerometers are highly enabling technology with a huge commercial potential they provide lower power and compact and robust sensing. Multiple sensors are often combined to provide multi-axis sensing and more accurate data.

Zigbee Module

The XBee/XBee-PRO RF Modules are designed to operate within the ZigBee protocol support the unique needs of minimal cost and low power wireless sensor networks. The modules required low power and provide reliable delivery data between remote devices. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

XBee RS-232 Adapter,XBee RS-232 PH (Power Harvester) Adapter ,XBee RS-485 Adapter , and XBee Analog I/O Adapter ,XBee Digital I/O Adapter and XBee Sensor Adapter , XBee USB Adapter , XStick ,Connect Port X Gateways and XBee Wall Router.

The XBee/XBee-PRO ZB firmware releases can be installed on xbee modules. This firmware is compatible with the ZigBee 2007 specification while ZNet 2.5 firmware is based on Embers proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB, ZNet 2.5 firmware is similar in nature but not over-the-air compatible. Devices running ZNet 2.5 firmware cannot talk to devices running the ZB firmware.

Key Features:

- **High Performance and Low Cost**
  - Indoor/Urban :up to 300 (100 m)
  - Outdoor line-of-sight: up to 1 mile (1.6 km)
  - Transmit Power: Output 100 mW (20 dBm) EIRP and Receiver Sensitivity: 102 dBmRF Data rate: 250,000 bps.

- **Advanced Networking & Security**
  - Retries & Acknowledgements
  - DSSS (Direct Sequence Spread Spectrum)
  - Each direct sequence channel has over 65,000 unique network address available
  - Point to point topology
  - Point to multipoint topology
  - Self healing and self-routing, fault-tolerant
  - mesh networking

- **Low Power**
  - TX Current 295 mA [@3.3 V] and RX Current 45 mA [@3.3 V]
  - Power down Current[< 1 µA @ 25Oc]

ISSN: 0975-8585

- **Easy-to-Use**
  - No configuration necessary for out of box
  - RF communications
  - AT & API Command Modes for configuring module parameters
  - Small form factor and Extensive command set
  - Free X-CTU Software (Testing and configuration software)

Mounting Considerations:

XBee modules were designed to mount into receptacle [socket] and therefore do not required any soldering when mounting it to a board. The XBee-PRO Development Kit contains RS- 232. USB interface boards use two 20-pin receptacles to receive modules. Figure 1.XBee-PRO Module Mounting to an RS-232 Interface Board.

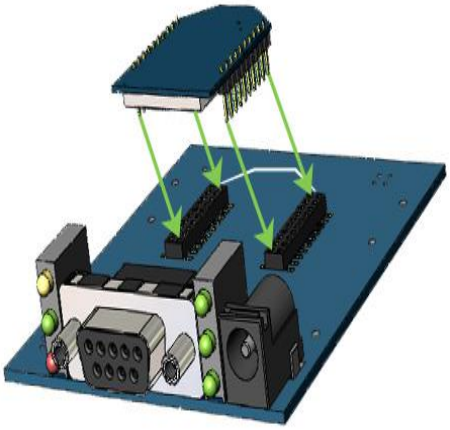
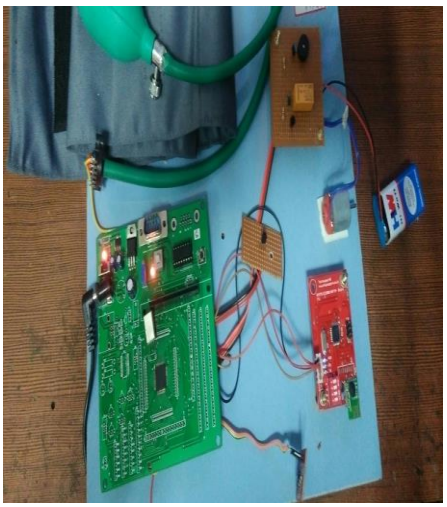


Figure 1: Zigbee Module Mounting to an RS232 Interface Board.

And the receptacles used on Digi development boards are manufactured by Century Inter connect. Several other manufacturers provide comparable mounting solutions however, Digi currently use the following receptacles

- Through hole single row receptacles Samtec P/N: MMS-110-01-L-SV (or equivalent)
- Surface-mount double-row receptacles Century Interconnect P/N: CPRMSL20-D-0-1
- Surface-mount single-row receptacles Samtec P/N: SMM-110-02-SM-S

EXPEREMENTAL RESULT



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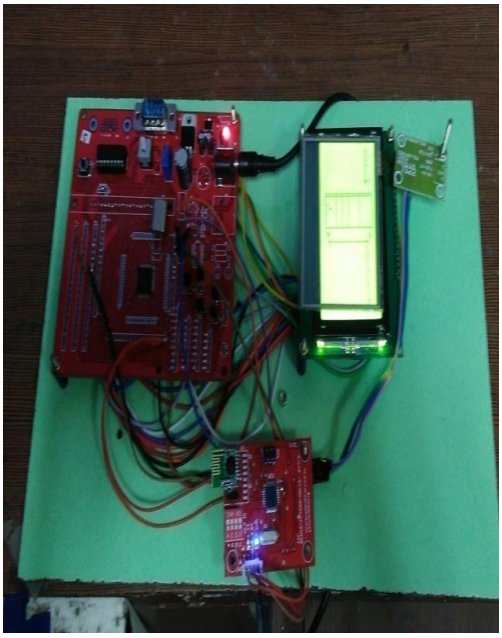
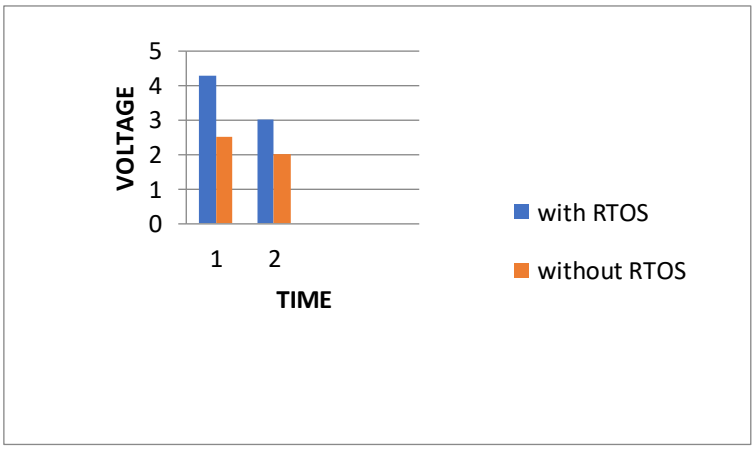


PERFORMANCE ANALYSIS:



CONCLUSION

The RTOS proposes health condition assessment system based on the vital sign data over certain number of days. Due to the deterioration of people's health could be reflected on the change pattern of vital sign e.g. increasing blood pressure could be dangerous for cardiovascular condition, the Hidden Markov Model is applied to describe the vital sign pattern of people in different health condition. Once the model for the historical data is built, it is able to estimate one's health condition by vital sign data over few days ago and also to make an alarm to people. Health condition is determined by the general health assessment tool, self-rated health, which is simple but effective question that has relationship with mortality and vital signs. The experiment has demonstrated the system's ability to identify the un-health situation by classifying the vital sign data.

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