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Heart Beat Rate Monitoring Using Microcontroller

Kiran Meshram Siddharth Nagrale Sonika Pazare Prof. A. A. Chincholkar Dr. A. D. Shelotkar

***Abstract* - The design and development of heart beat rate sensor systems for health monitoring has garnered lots of attention in the scientific community and the industry during the last years. Mainly motivated by increasing healthcare costs and propelled by recent technological advances in miniature sensing devices, smart textiles, microelectronics, and wireless communications, the continuous advance of heart beat rate sensor-based systems will potentially transform the future of healthcare by enabling proactive personal health management and ubiquitous monitoring of a patient's health condition. These systems can comprise various types of small physiological sensors, transmission modules and processing capabilities, and can thus facilitate low-cost heart beat rate unobtrusive solutions for continuous all-day and any-place health, mental and activity status monitoring. This paper attempts to comprehensively review the current research and development on heart beat rate sensor systems for health monitoring. A variety of system implementations are compared in an approach to identify the technological shortcomings of the current state-of-the-art in heart beat rate sensor solutions. An emphasis is given to multi parameter physiological sensing system designs, providing reliable vital signs measurements and incorporating real-time decision support for early detection of symptoms or context awareness. In order to evaluate the maturity level of the top current achievements in heart beat rate health-monitoring systems, a set of significant features, that best describe the functionality and the characteristics of the systems, has been selected to derive a thorough study. The aim of this survey is not to criticize, but to serve as a reference for researchers and developers in this scientific area and to provide direction for future research improvements.**

I. INTRODUCTION

Health-monitoring systems (HMS) have drawn a lot of attention from the research community and the industry during the last decade as it is pointed out by the numerous and yearly increasing corresponding research and development efforts. As healthcare costs are increasing and the world population is ageing, there has been a need to monitor a patient's health status while he is out of the hospital in his personal environment. To address this demand, a variety of system prototypes and commercial products have been produced in the course of recent years, which aim at providing real-time feedback information about one's health condition, either to the user himself or to a medical center or straight to a supervising professional physician, while being able to alert the individual in case of possible imminent health threatening conditions. In addition to that, HMS constitute a new means to address the issues of managing and monitoring chronic diseases, elderly people, postoperative rehabilitation patients, and persons with special abilities. Heart beat rate systems for health monitoring may comprise various types of miniature sensors, heart beat rate or even implantable. These sensors are capable of measuring significant physiological parameters like heart rate, blood pressure, body and skin temperature, oxygen saturation, respiration rate, electrocardiogram, etc. The obtained measurements are communicated either via a wireless or a wired link to a central node, for example, a Personal Digital Assistant (PDA) or a microcontroller board, which may then in turn display the according information on a user interface or transmit the aggregated vital signs to a medical center. The previous illustrates the fact that a heart beat rate medical system may encompass a wide variety of components: sensors, heart beat rate materials, smart textiles, actuators, power supplies, wireless communication modules and links, control and processing units, interface for the user, software, and advanced algorithms for data extracting and decision making. A general HMS architecture is depicted, in accordance to the described system's functionality and components. However, this should not be perceived as the standard system design, as many systems may adopt significantly varying architectural approaches (for example signals may be transmitted in analog form and without preprocessing to the central node.

II. WORKING PRINCIPLE

The system Majority consists of three components like heart rate sensor circuit, RF module modem and Microcontroller .Let us see the brief explanation of circuitry.

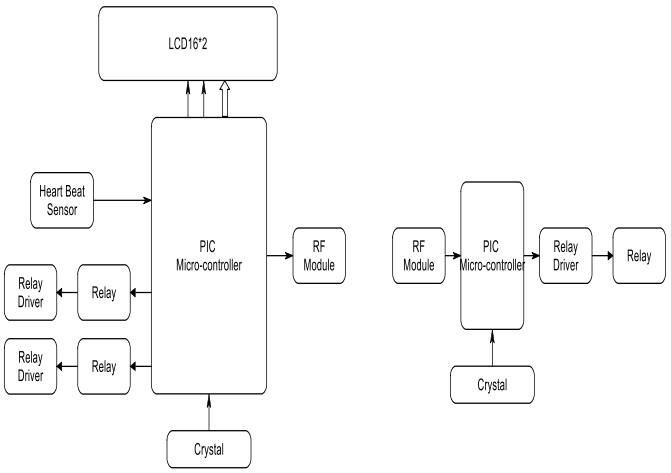
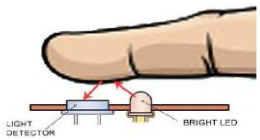


Fig. 1: Block diagram

Heart Beat Sensor

The Heart Beat signal is obtained by LED and LDR combination. Pulse form hands interrupts the light reaching the LDR and this signal is read by microcontroller, The RF signal is transmitted by transmitter in a digital format. This circuit uses Manchester encoding to avoid a long trail of one or zero. The protocol is well defined for different device types ensuring compatibility with your whole entertainment system 5 bit address and 6 bit command length. Constant bit time of 1.778ms bits are of equal length of 1.778ms in this protocol, A logical zero is represented by a pulse in the first half of the bit. Figure shows as the Heart beat Sensor working.



IR Sensor

The sensor consist of an IR light emitting diode transmitter and an IR photo detector acting as the receiver. The IR light passes through the tissues. Variations in the volume of blood within the finger modulate the amount of light incident on the IR detector.IR transmitter and receiver placed on the same place and the finger functioned as a reflector of the incident light. The IR receiver monitors the reflected signal.

PIC Microcontroller

The PIC 16F877 is an 8-bit microcontroller, which has an on-chip eight channel 10-bit Analog-to-Digital converter. First we detect fall down using accelerometer and conditioned Heart Rate signal is fed to input port RB0 (INT) of the microcontroller. Also, upon command, the microcontroller reads the temperature sample stored in the RAM of the LM35 through the ADC port RA0. It is then converted and stored in the PIC16F877 memory as two 8-bit unsigned integers (0-255). After completion of signals acquisition, the microcontroller construct signal to be transmitted through RF module and GSM using by last dial call. A complete system can therefor be built using one MCU chip and a few I/O devices such as a display and other interfacing circuits. Most of the pins are for input and output, and arranged as 5 ports: PORTA(5pins),PORTB(8pins),PORTC(8pins),PORTD(8pins) and PORTE(3pins),total of 32 I/O pins.

LCD Display

The Model JHD 162A Series LCD is the typical standard HD44780 type of LCD with 16characters x 2 row LCD module. Since this project the Heart Rate, temperature, adders and contact to display; therefore, a LCD module is necessary.

RF Module

This is a RF data modem working at 2.4 GHz frequency in half duplex mode with automatic switching of receive/transmit mode with LED indication. Receives and Transmits serial data of adjustable baud rate of 9600/115200 bps at 5V or 3V level for direct interfacing to microcontrollers.

RF Modem can be used for application that needs two way wireless data transmission. It features high data rate and longer transmission distance. The communication protocol is self controlled and completely transparent to user interface. The module can be embedded to your current design so that wireless communication can be set up easily.

III. APPLICATIONS

- Educational Institutions and Organizations: Currently we rely on putting up papers on notice boards to inform people of events. This method can be discarded by using wireless notice boards to display information in real time.
- Crime Prevention: Display boards put up on roads will display tips on public security, accident prevention, information on criminals on the run. The board will help flash messages such as vehicle thefts as and when they occur.
- Managing Traffic: In metropolitan cities we frequently come across traffic jams. One way to avoid this would be inform people beforehand to take alternate routes. A
- Wireless notice board serves well for this purpose.
- Advertisement: In shopping malls we get to hear the offers on various products from time to time. Instead we continuously display the information regarding the products and related offers on electronic display boards.
- Railway Station: Instead of announcing the delay in arrival of trains we can display the information.

IV. ADVANTAGES

- User friendly: Messages are only to be typed on a mobile or a computer, which in turn are displayed wirelessly on the display unit. Eliminates use of printers: Since we don't use papers to display information, printers are also of no use in this system.
- Faster means of transferring information: There is no delay in transmission of information. Messages are displayed in a matter of seconds after typing.
- Long Range: As long as we have the required network coverage we can send messages from any part of the world.

V. CONCLUSION AND FUTURE WORK

A commercial model should be able to display more than one message at a time. Currently in our project we are using onboard RAM memory to save a single message. To overcome this shortcoming we can interface an EEPROM to save messages. This not only allows more than one message to be displayed at a time but also allows us to retrieve messages from the EEPROM even after a power failure. Alphanumeric LCDs have a limitation on size as well as no of characters. These can be replaced with large LED display boards which are not only eye catching but display characters in a moving fashion one after the other. In our project we are sending messages via GSM network and displaying on a LCD by

utilizing AT commands. The same principle can be applied to control electrical appliances at a distant location. Robots can be controlled in a similar fashion by Sending the commands to the robots. These commands are read by using AT commands and appropriate action is taken. This can be used for spy robots at distant locations, utilized by the military to monitor movement of enemy troops. Currently farmers have to manually put on or off pumps, drippers etc by using electric switches. Using the principle of AT commands we can put on or off these appliances remotely.

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