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# Health Monitoring and Control System Using Wireless Sensor Network

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**Abstract:** We present a WI-FI based smart transmission technique to achieve remote health monitoring applications. To achieve real time implementation, a smart sensor unit and ATmega328 microcontroller is proposed. The main goal of this system is to monitor and control abnormalities of the patient. The sensor unit acquire some parameters like human body temperature, heart beat, blood pressure, glucose from patient. In this paper data acquisition and data transmission process is also considered. Data transmission subsidize to a substantial amount of power disbursed by the transmitter and increase in the network traffic. Continuous transmission of data is used to reduce amount of power disbursed by the transmitter.

**Key words:** Atmega328 microcontroller · Sensor unit · Data acquisition · Data transmission

## INTRODUCTION

Health care is an important part of everyday life for all human beings on the planet. Each of us requires a periodic monitoring of imperative parameters and right treatments based on this data. These processes become even more crucial when people attain a certain age and are not able to follow their health condition properly without a special medical recruits or sophisticated equipment to perform the monitoring.

The older person gets, the wider spectrum of possible diseases and unexpected emergency situations might occur. In order to avoid this, he or she needs to be elated to the hospital, observed by medical staff and provided with immediate help if some of the parameters are abnormal.

In isolated health monitoring the proactive diagnosis is mainly constrained due to the unavailability of the patient under ubiquitous monitoring. Many architectures for remote health monitoring procedures were developed in the recent years such as [1-3]. In [1], the isolated health monitoring system is based on the smart phone for enabling the real time monitoring and complete Internet Protocol (IP) connectivity has been used.

The problems that occur due to the inappropriate data association collected from patients have been discussed in [2]. The architecture anticipated in [2] consists of a central gateway which gathers the data from all the users and transfers it to the central server occasionally, where clinicians can organize the user's health status. One of the major issues in these isolated health *monitoring* systems is the continuous data transmission, which leads to the overexcited connectivity scenario [4], [5]. In [6], smart indoor positioning algorithm that fuses a Pedestrian Dead Reckoning (PDR) system and a Received Signal Strength (RSS) located Wi-Fi positioning system is discussed.

The application of Wireless Body Area Networks (WBAN) like intra-space suit radio propagation channel in various frequency bands including 2.4 GHz is discussed in [7]. In isolated health care monitoring application we cannot make use of the available bandwidth effectively, if we use the conventional mode of transmitting the data continuously. It reduces the node life time, even leads to data losses due to delay and buffer overloading, which is not acceptable particularly in the health care applications [8].

In this paper, we present a WI-FI based smart transmission technique [9] to achieve remote health monitoring applications. At first, Wi-Fi is engaged in place of only the 2.4GHz IEEE 802.11b communication standard. WLAN invention based on one of the 802.11 communication standards, including 802.11a, 802.11b, twin-band and so on. There is no wired connection between sender and receiver.

The paper describes the following details. Section II discusses the system hardware architecture and the internal functional units. In section III, we discussed the

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software requirement. Section IV includes simulation results of system architecture. Section V concludes the paper by discussing the future scale of the work.

**Hardware Architecture:** The proposed system architecture consist of three main units namely monitor unit, sensor unit and control unit. The sensor unit acquires the multi parametric medical data such as Electro Cardiogram (ECG) [10-12], body temperature, glucose levels, heart beat etc. from different sensors using various signal processing techniques. Better proactive analysis can be given only if the data collected from the patient is classified properly.

The collected parameters are given to controller unit.It compares collected data values to original values.If any deviation occur, it produce control signal to patient via actuator. For monitoring purpose LCD display is used.

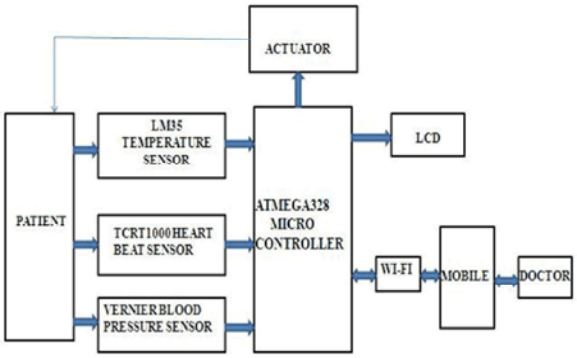


Fig. 1: Block diagram of health monitoring and control system

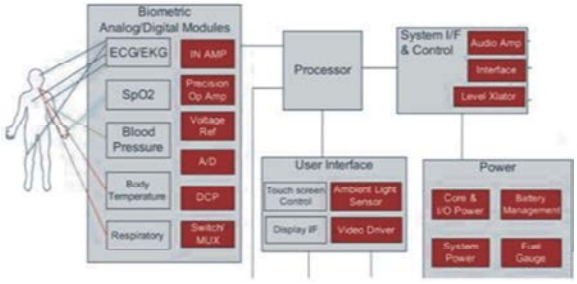


Fig. 2: Typical health monitoring system

**Temperature Sensor:** LM35 is one of the most precision IC temperature sensor. Temperature measurement is more accurately than a thermistor. The range of operating temperature is from - 55°C to 150°C. The sensor circuitry is fully sealed and there is no oxidation and other processes. The output voltage is proportional to ambient temperature varies by 10mV in response to every °C rise/fall in temperature.

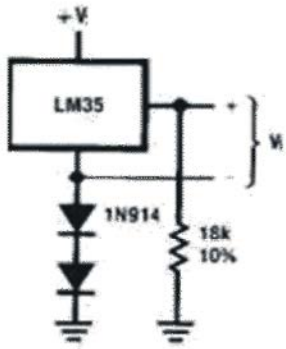


Fig. 3: LM35 temperature sensor

**Heart Beat Sensor:** In this project TCRT1000 sensor is used, which is a reflective optical sensor with both the infrared light emitter and phototransistor located side by side and are enclosed inside a leaded package so that there is minimum effect of surrounding visible light. A fingertip placed over the sensor will act as a reflector of the incident light. The quantity of light reflected back from the fingertip is monitored by the phototransistor.

Fig. 4: Heart beat sensor

**Blood Pressure Sensor:** The purpose of Vernier Blood Pressure Sensor is used to measure systemic arterial blood pressure in humans (non-invasively). it can measure arterial blood pressure and estimate both the systolic and diastolic blood pressure using the oscillometric method. The dynamic sensor in this unit is the SenSym SDX05D4 pressure transducer. It has a membrane which flexes as pressure changes. This sensor is prearranged to measure differential pressure. It includes special circuitry to minimize errors caused by changes in temperature. We offer an amplifier circuit that conditions the signal from the pressure transducer. In this circuit, the output voltage from the Blood Pressure Sensor will be linear with respect to pressure.

Fig. 5: Blood pressure sensor

**Atmega328 Microcontroller:** The ATmega328 is a single chip miniature size controller produced by Atmel and belongs to the mega AVR series. The controller voltage range 1.8-5.5 V. The controller achieves throughputs approaching 1 MIPS per MHz; A common option to the ATmega328 is the " Pico Power " ATmega328P. The ATmega32 provides the following features: 32Kbytes of In-System Programmable Flash memory with Read-while-Write facilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers.

**LCD Display:** A liquid-crystal display is an electronic display, even panel display, or video display. Liquid crystals don't turn out light directly. Liquid crystal displays are accessible to display random images (as in a general-use computer display) or fixed images which can be showed or hidden, such as preset words, digits and seven-segment displays as in a digital clock. LCD displays are used for many more applications including computer monitors, instrument panels, aircraft cockpit displays, televisions and signage. They are proverbial to end user devices such as DVD players, clocks, watches, calculators, gaming devices and telephones.

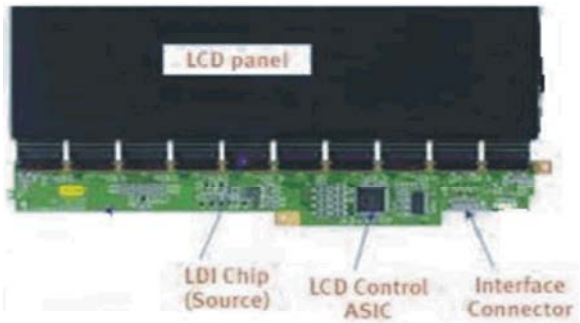


Fig. 6: LCD Display

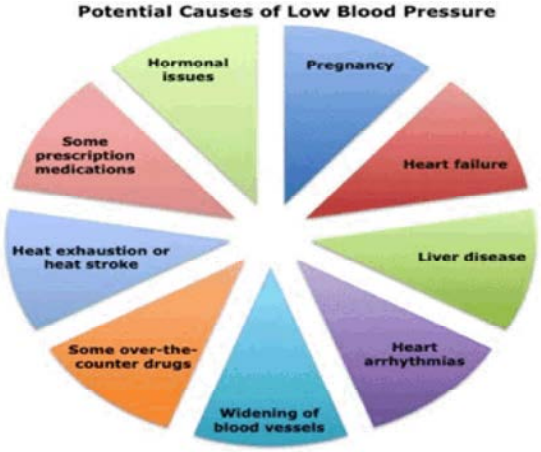


Fig. 7: Graphical representation

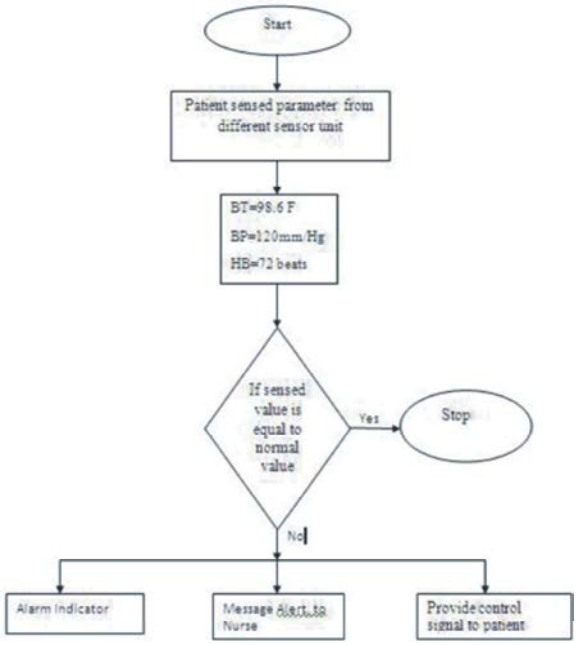


Fig. 8: Flow chart

**Software Requirement**

**Arduino:** Arduino is a type of computer software and hardware company that offers open-source environment for user project and user community that intends and fabricates microcontroller based inventions for construction digital devices and interactive objects that can sense and manage the physical world. For programming the microcontrollers, the Arduino proposal provides an software application or IDE based on the Processing project, which includes C, C++ and Java programming software. It also support for embedded C, C++ and Java programming software.

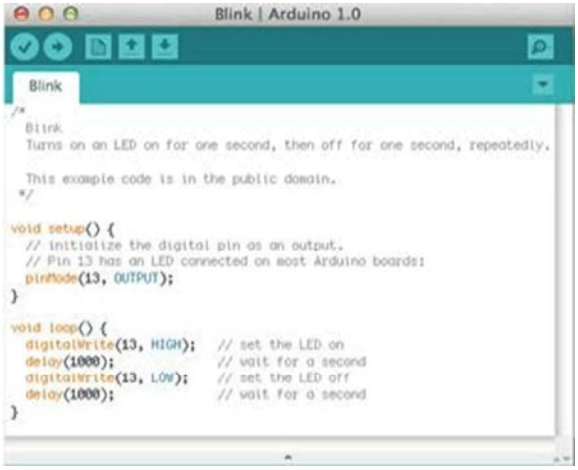


Fig. 9: Program Compilation

**Proteus Isis7 Simulator:** Proteus is design software urbanized by Lab center Electronics for electronic circuit simulation, schematic capture and PCB design. Its plainness and user friendly design made it popular among electronics hobbyists. Proteus is commonly useful for digital simulations such as microcontrollers and microprocessors. It can simulate LED, LDR and USB Communication etc…

**Simulation Results:** Proteus ISIS7 simulator is used for simulation purpose. For program computing purpose, Arduino IDE tool is used. The simulation results are given below:

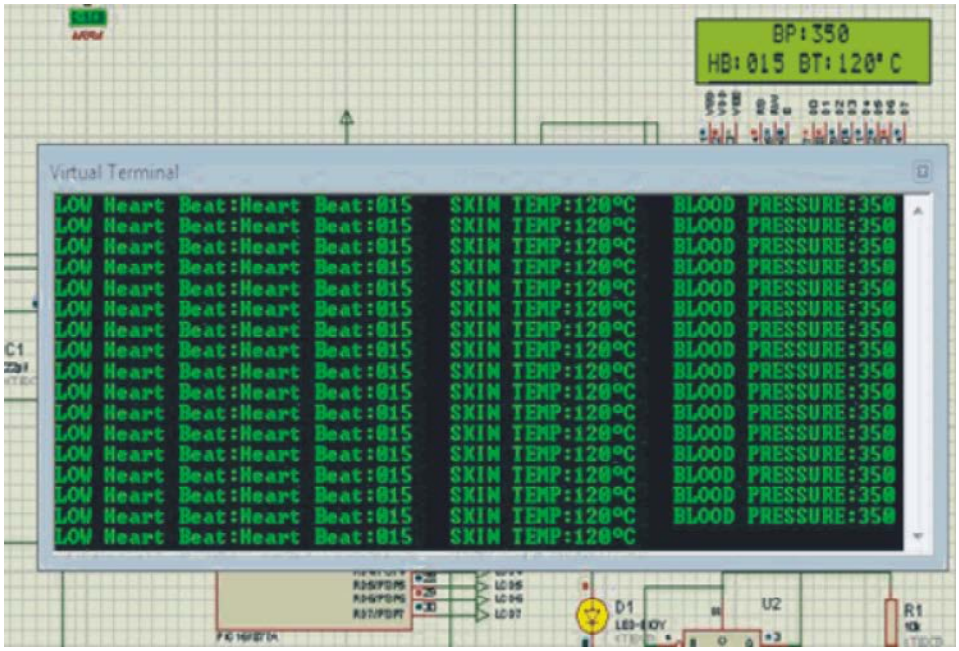


Fig. 10: Simulation output

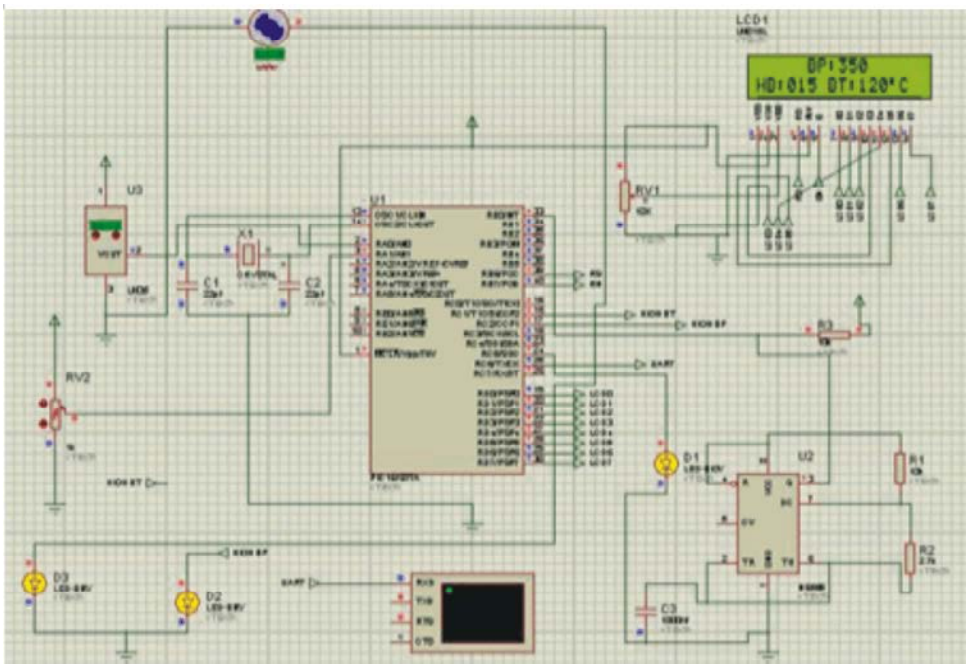


Fig. 11: Circuit diagram

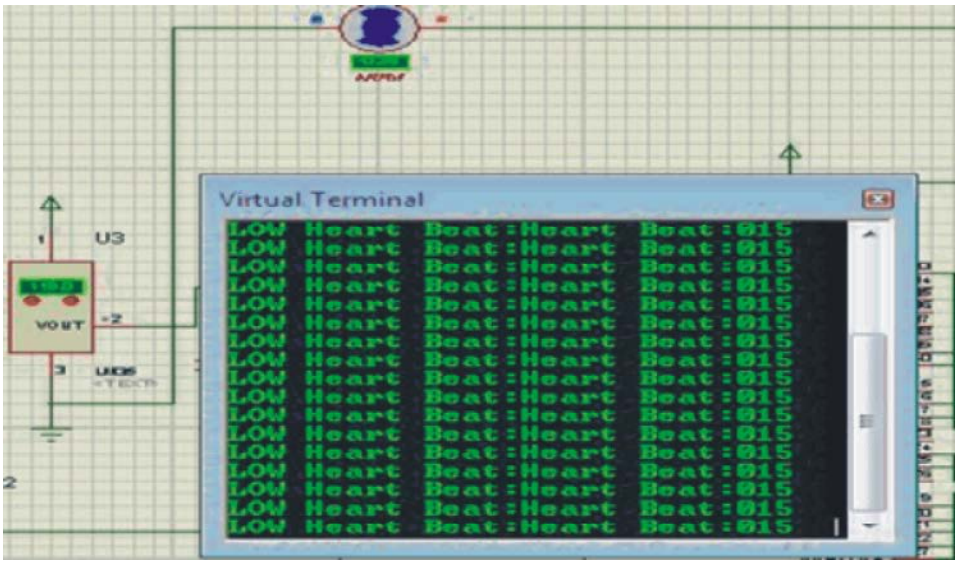


Fig. 12: Detection of low heart beat

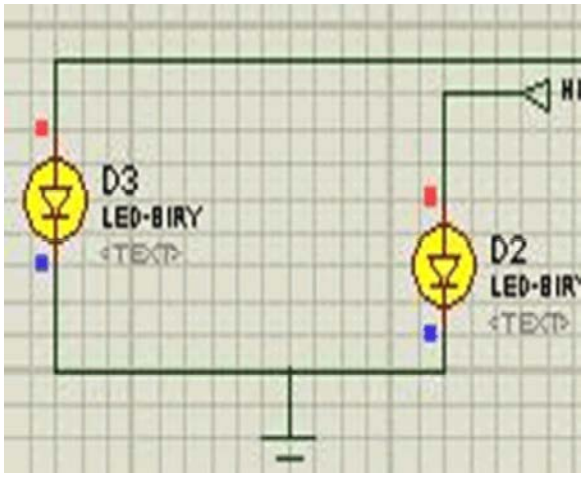


Fig. 13: Glow of LED


Fig. 14: Control action

## CONCLUSIONS

In this paper, we proposed a Wi-Fi based remote health monitoring and control system using atmega328 microcontroller, which is capable to continuously monitor the patient's heart beat, blood pressure and other critical parameters in the hospital. We also proposed a continuous monitoring and control mechanism to monitor the patient condition and store the patient statistics in server. For the performance valuation, simulation results are taken by using PROTEUS 7 simulation tool.

Our future work is to explore the hardware multiplexing between the two radios and achieve a significant area reduction in the development of multiple radios based communication devices like an "IoT chipset". Envisaged IoT chipset will have features like adaptive rule engine based smart transmission technique to achieve low power and seamless hand-off controller (SHC) integrated for seamless hand-off between multiple on-chip radios to enable ubiquitous connectivity.

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