

WIRELESS HEART RATE AND BODY TEMPERATURE MONITORING FOR U-HEALTHCARE SYSTEMS

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***Abstract**-Heart rate and body temperature are two vital signs for monitoring the patient's physical condition. Heart rate is also an indicator of cardiac arrhythmia (bradycardia and tachycardia) and condition of cardiovascular system. As well as Wireless technology has increasingly used in healthcare industry. Here we design and implement a real time heart rate and body temperature monitoring system which also can alert the respective patient, doctor or hospital wirelessly using smart phone during emergency. Comparing with the commercial heart rate measuring device we find the accuracy around 95-99%. Here the proposed heart rate and body temperature measurement system can be implemented as a small device such as smart watch. It is also effective for management of health status and information i.e. for u-Healthcare service.*

Keywords: Heart rate, Body temperature, Arrhythmia, Wireless, U-Healthcare System.

1. INTRODUCTION

Health care is an essential part of everyday life. Each of us requires a periodic monitoring of vital parameters and right treatments based on this data. These processes become even more crucial when people reach a certain age and are not able to follow their health condition properly without a special medical personnel or sophisticated equipment to perform the monitoring. The older person suffers from several of diseases and many emergency situations may occur at any time. In order to avoid this, he or she needs to be transported to the hospital, observed by medical staff and provided with immediate help if some of the parameters are abnormal. In many cases, even a short delay might lead to the dangerous consequences including death of the patient. Therefore there is a need to develop a compact device that can measure heart rate and temperature providing primary treatment to the person so that undue mishaps can be avoided within the golden hours after a patient is struck with a heart related problem. Heart rate and body temperature are two vital signs for monitoring the patient's physical condition. Heart rate is also an indicator of cardiac arrhythmia (bradycardia and tachycardia) and condition of cardiovascular system. Wireless Heart rate and Body Temperature Monitoring for U-Healthcare Systems is proposed in this paper. This system is mainly designed to monitor patients who are suffering from heart diseases or any people who need to measure the heart rate. The sensor simply senses the input signal from ear clip sensor and temperature sensor and displays on the TFT LCD and also send the data to the configured smart phone via Bluetooth (also with

some other wireless medium of transmission).

Many researches are done for evaluation in Healthcare System and also in wireless sensor network. Those are helpful in maintaining and monitoring the health of patient. Research is done in the domain Body Area Network (BAN) from 1967. There was a project named Code Blue Project by Astang Coupe in 1967. The wearable computer is made which was attached to the patient's wrist and the values are taken to predict disease [1]. In 2008 a project is made by V. Annamalai & S.K.S.Gupta named as Project Ayushman. It is a real time project which is sensor network based medical monitoring system which collect and analyze health information [1]. The project "European Mobihealth" by Katarzyna Wac in 2009 which works as WBAN. But it has some major issues; they are security and reliability of communication resource [2]. AID-N system developed. It consists of smart wearable computer attached to the patient's wrist. Parameters are continuously transmitted to doctors tablet device. Transmission protocol used is IEEE 802.15.4 standard. Due to this collaborative and time critical system is developed for emergency. AID-N system relieves the workload by automatically recording and analyzing the patient's vital data and alerts the doctor if any abnormal condition occurred [3]. Here we design and implement a wireless heart rate and body temperature monitoring using microcontroller and Bluetooth module. It can alert the respective personnel during emergency. Also it can be implemented as small as well as smart watch.

2. HEART ABNORMALITY

Any deviation from heart normal condition can be treated as heart abnormality. Heart rate is one of the indicators of heart abnormality. The normal resting adult human heart rate (HR) ranges from 60–100 bpm (beats per minute) [4]. Bradycardia is a slow heart rate, defined as a resting heart rate below 60 bpm. Tachycardia is a fast heart rate, defined as above 100 bpm at rest [5].

3. PROPOSED METHODOLOGY

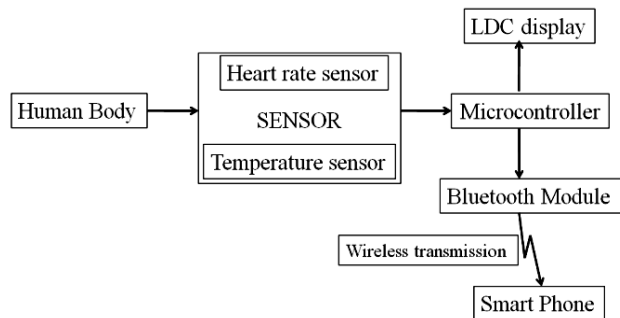


Fig. 1: Methodology

This project is divided into two parts:

1. Hardware
2. Software

Hardware part is used to collect and process the data from human body. And software part is used to show the heart rate and temperature in the smart phone.

(i) Sensor: The hardware part starts with sensor. There are two sensors: heart rate sensor and temperature sensor. These two sensors send analog data to the Microcontroller. We used Ear-clip Heart Rate Sensor to measure heart rate. It has 3 pin 5 Volt, GND and Output. Heart Rate sensor works on a very basic principle of photo-electronics. LM35 is a precision integrated-circuit temperature sensor whose output voltage is linearly proportional to the Celsius temperature. The LM35 does not need any external calibration or trimming to have accuracies. This is 3 legs IC that directly gives analog output. This unit requires +5V DC for its proper functioning.

(ii) Microcontroller: The microcontroller receives the data from the sensor and process the data. Then it sends the result to the LCD display and Bluetooth module. The microcontroller has wide range of interfaces including I2C, SPI, USB, UART, A/D, programmable comparators, PWM, LIN, PSP, and Ethernet. It is a 16-bit Flash microcontroller. It has 256KB of flash program memory along with 10bit 16 channel ADC. Internal oscillator is 16 MHz with on chip LDO voltage regulator.

(iii) LCD display: It is a TFT-LCD display that shows the temperature and heart rate. For displaying heart beat rate and temperature reading we have used TFT-LCD display.

(iv) Bluetooth Module: The Bluetooth module sends the data to smart phone after receiving the command and data from the microcontroller. Here the Bluetooth module HC-05 is used.

(v) Smart phone: It is the software part of the project. The data send by the Bluetooth module is received by an android application named 'Bluetooth spp pro'. It takes

the text as input and shows this in smart phone's display.

3.1 ANDRIOD APPLICATION

The android application is connected to the hardware via Bluetooth module. We have developed an android application where the data is received from hardware can be displayed on application i.e. temperature and heart rate pulse. We have developed another option is mailing this data to patient's relatives, doctors and hospitals. fig. 02 shows such a sample data.

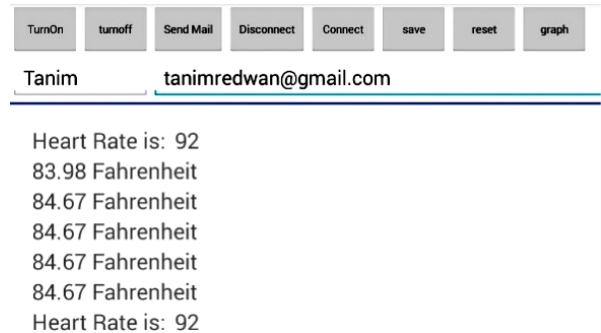


Fig. 2: Android Application

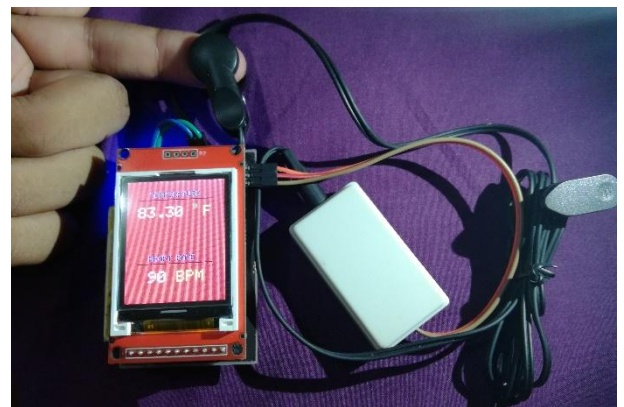


Fig. 3: Implemented Circuit with working condition

4. RESULT

4.1 Testing the System

The system is tested on 6 volunteers. Here we also compare the heart rate values that are taken by our design system with that of standard device. Table 1 shows the heart rate of the six volunteers that are taken by our designed system.

Table1: Heart rate of the volunteers from the designed system.

Name	Designed Device
Shzzad	59
Tanim	104
Nazmul	92
Suman	105
Mamun	94
Anamul	76

4.2 Performance Analysis

Table 2 shows the comparative analysis of our system with available standard device. The error and percentage of error of the system is also shown here. The highest percentage of error is 4.83% which is a satisfactory result.

Table 2: Comparison with standard device values.

Name	Standard Device	Designed Device	Error	% Error
Shzzad	62	59	3	4.83
Tanim	105	104	-1	0.96
Nazmul	91	92	-1	1.09
Suman	107	105	2	1.87
Mamun	94	94	0	0
Anamul	77	76	1	1.31

Here we found that the heart rate values from our system are satisfactorily similar to the standard device values. Fig. 4 shows the above data graphically.

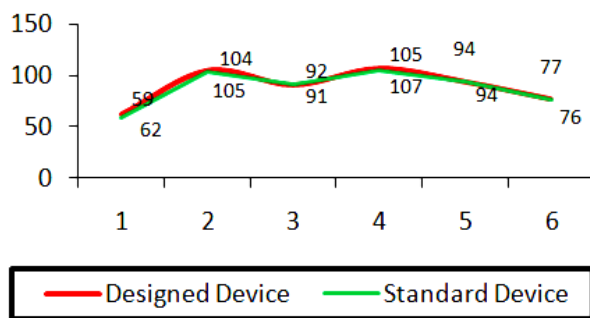


Fig. 4: Comparison between standard device values and values from design system.

5. CONCLUSION

Here we design and implement a real time heart rate and body temperature monitoring system. It can alert the respective patient, doctor or hospital wirelessly using smart phone during emergency. Comparing with the available commercial heart rate measuring device we find the accuracy around 95-99%. Here the proposed heart rate and body temperature measurement system can be implemented as a small device such as smart watch. It is also effective for management of health status and information i.e. for u-Healthcare service.

6. ACKNOWLEDGEMENT

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8. NOMENCLATURE

Symbol	Meaning	Unit
<i>Bpm</i>	Beats Per Minute	
<i>DC</i>	Direct Current	Amp.
BAN	Body Area Network	
<i>GND</i>	Ground	
<i>HR</i>	Heart Rate	bpm
<i>LCD</i>	Liquid Crystal Display	