www.ijraset.com
IC Value: 13.98
Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Remote Monitoring Of Vital Signs in Chronic Heart Failure Patients Using Zigbee

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Abstract: In an increasingly busy world people have no time to even to attend their health. In such a situation people often ignore routine checkups that are necessary especially for patients with heart failure. We proposes a model meant for heart patient's problems. We are going to develop a complete and integrated Information and Communication Technology system that enables the doctors to diagnose and monitor the Chronic Heart Failure (CHF) patients from distance. This system measures the heart beat rate, temperature and blood pressure of the patient through Heart beat sensor, temperature sensor and blood pressure sensor. The outputs from these sensors are transmitted to the remote system via ZIGBEE. This enables the CHF patients to daily collect their vital signs at home and automatically send them to the Hospital Information System and it also allows the physicians to monitor the patients from distance and to take timely actions in case of necessity.
Keywords: Blood pressure sensor, Heart beat sensor, Temperature sensor, ZigBee Transceiver, Hospital information system.

I. INTRODUCTION

Heart failure (HF) is a chronic disease characterized by the inability of the heart to pump an adequate amount of blood to achieve the demand of the different organ systems and/or doing so at increased filling pressures. The project module uses a portable sensor which is placed in the patient's body (finger).This method is useful to patients when they are in some other places other than the hospital. The main objective of the system is to collect the patient's vital signs at home and sent it to the hospital management system. So the sudden changes in vital signs are immediately reported to the doctors and the immediate actions are taken.

A. Zigbee Transceiver

ZigBee is the most popular wireless mesh networking standard for connecting sensors, instrumentation and control systems. ZigBee, a specification for communication in a wireless personal area network (WPAN), has been called the "Internet of things." ZigBee is an open, global, packet-based protocol designed to provide an easy-to-use architecture for secure, reliable, low power wireless networks. Zigbee and IEEE 802.15.4 are low data rate wireless networking standards that can eliminate the costly and damage prone wiring in industrial control applications. Flow or process control equipment can be placed anywhere and still communicate with the rest of the system. It can also be moved, since the network doesn't care about the physical location of a sensor, pump or valve. ZigBee's use of the IEEE 802.15.4 PHY and MAC allows networks to handle any number of devices. ZigBee's protocol code stack is estimated to be about 1/4th of Bluetooth's or 802.11's. Simplicity is essential to cost, interoperability, and maintenance.

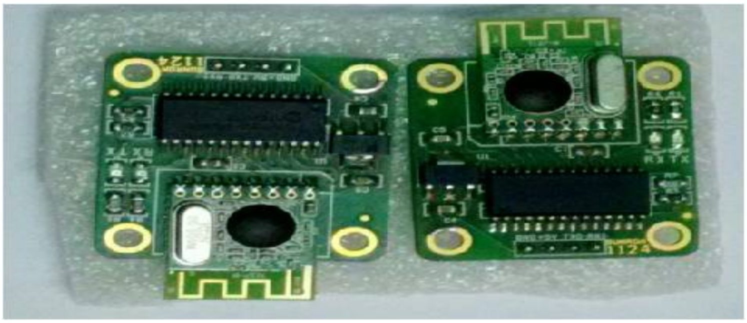

Fig. 1. ZIGBEE Transceiver

B. Blood Pressure Sensor

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by the heart. When your heart beats, it contracts and pushes blood through the arteries to the rest of your body. This force creates pressure on the arteries. Blood pressure is recorded as two numbers— the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats). The unit which measures this is called Sphygmomanometer Monitoring blood pressure at home is important for many people, especially if you are suffering with chronic heart failure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down. Blood Pressure & Pulse reading are shown on display with serial out for external projects of embedded circuit processing and display. Compact design fits over your wrist like a watch.

C. Heartbeat Sensor

Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. This project describes a technique of measuring the heart rate through a fingertip using a AVR microcontroller. While the heart is beating, it is actually pumping blood throughout the body, and that makes the blood volume inside the finger artery to change too. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified further for the microcontroller to count the rate of fluctuation, which is actually the heart rate. The sensor unit consists of an infrared light-emitting-diode (IR LED) and a photo diode, placed side by side, and the fingertip is placed over the sensor assembly, as shown below. So, every time the heart beats the amount of reflected infrared light changes, which can be detected by the photo diode

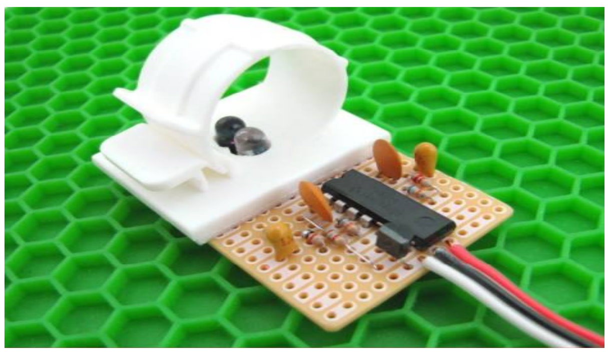

Fig. 2. Heartbeat Sensor

D. Temperature Sensor

LM35 is used to sense the temperature. It produces an analog ouput. ATMEGA 8 has an inbuilt ADC which converts the analog output to a digital output. It is used to sense temperature between the range -55 to +150.

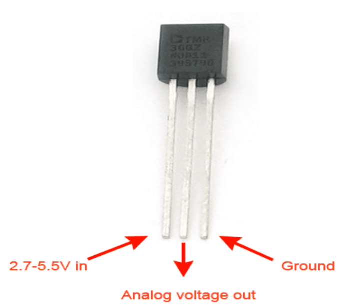

Fig. 3. Temperature Sensor

II. PROPOSED SYSTEM

This work introduces a novel based heart rate temperature and blood pressure monitoring system.AVR ATMEGA 8 microcontroller is used in this project. The project module uses a portable sensor which is placed in the patient's body(finger).This method is useful to patients when they are in some other places other than the hospital. It gives immediate indication of low and high blood pressure rates, heart rate beyond a certain limits and temperature beyond a certain limit to the patients and to the hospital management system values are displayed in the LCD.BUZZER is used to indicate the patients about the abnormal values. The values are transmitted to the remote system via ZIGBEE and then it is transmitted to the hospital so that doctors can take timely action when necessary.

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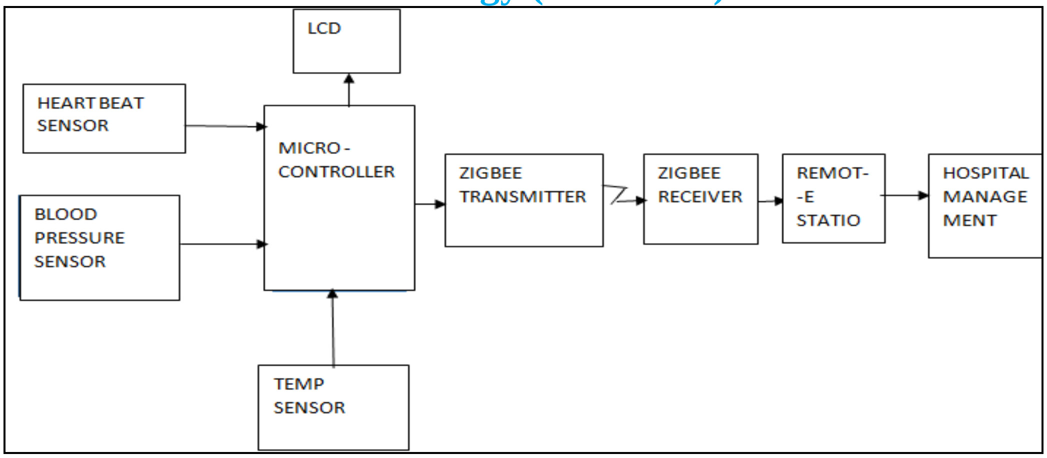


Fig.4. block diagram of proposed system.

III. HARDWARE & SOFTWARE

Transmitter Section Receiver Section

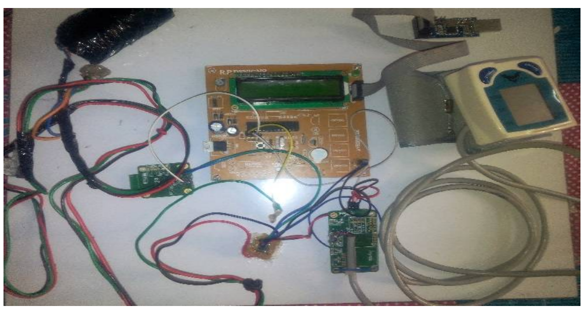
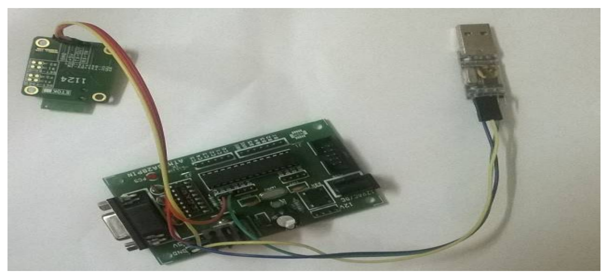
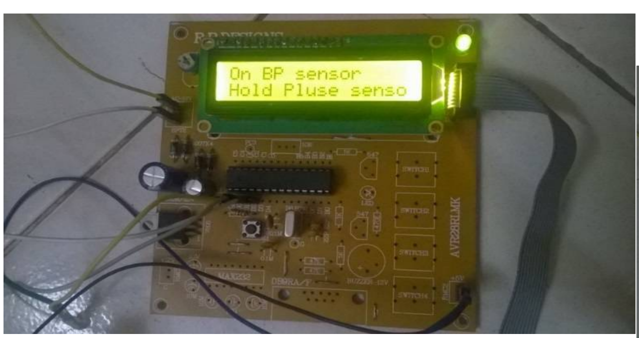



Fig. 5. (a) Transmitter Section (b). Receiver Section

A. Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code. Visual Studio includes a code editor supporting IntelliSense as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GIU applications, web designer, class designer, and database designer.

IV. EXPERIMENTAL RESULTS



sensor

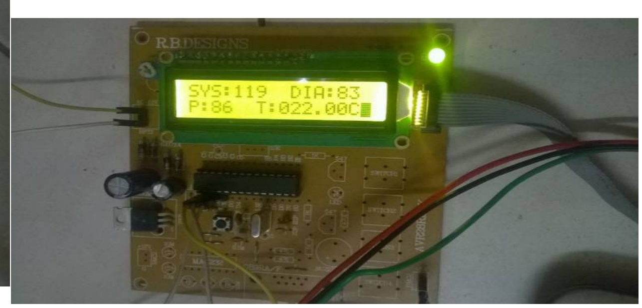
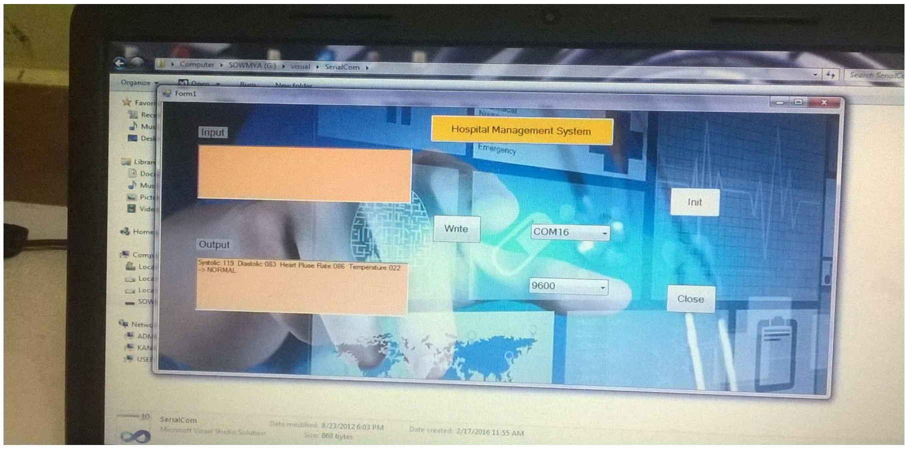


Fig. 6. (a) Display to turn on the BP and Pulse rate

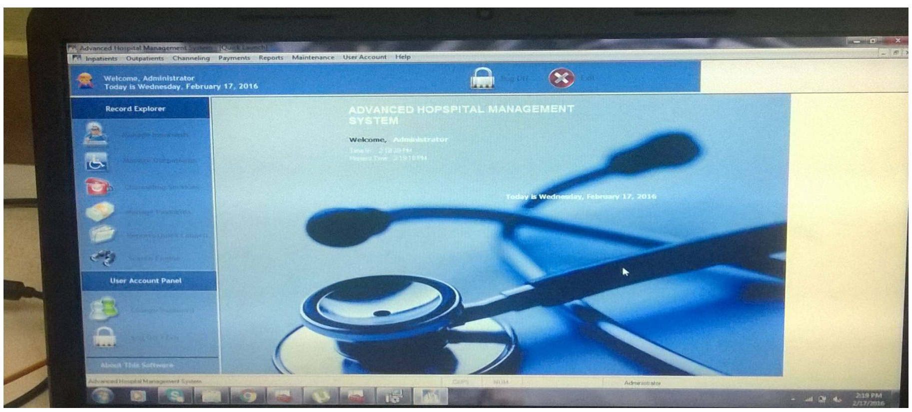
Volume 4 Issue V, May 2016
ISSN: 2321-9653

Fig. 6. (b) The output of sensed values are displayed in LED

If the sensed value is abnormal then it is transmitted to the remote system.The remote system is a hospital management wepage created with help of visual studio software.The abnormal values are displayed in the output field.



The results are finally transmitted to the hospital using advanced hospital management systems.



V. CONCLUSION

Our proposed model of remote monitoring of vital signs in chronic heart failure patients helps the elderly people who have chronic heart failure. The blood pressure ratings, temperature and heart rates can be measured using the required sensors by making it as a portable device and provide it to the patients. It is very much useful to the patients those who are away from hospitals. This system is affordable. Thus by using this system we can reduce frequent visit to the hospital. Moreover appropriate and timely actions are taken for patients with the help of this model

A. Scope of Future Work

The main contribution of this project is to propose a model for remote monitoring of vital signs in chronic Heart failure patients .Further work is to propose a a feedback mechanism from the hospital to the patient via a wireless medium and also to include more parameters such as spo2 etc.

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