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Health monitoring system for CHF patients based on GSM

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Abstract

Nowadays, chronic heart failure (CHF) affects an ever-growing segment of population, and it is among the major causes of hospitalization for elderly citizens. The actual out-of hospital treatment model, based on periodic visits, has a low capability to detect signs of destabilization and leads to a high re-hospitalization rate.Home based monitoring can reduce lengths of hospital stays and increase patient satisfaction. To reduce power and time consumption. A minimum set of vital parameters such as blood pressure, heart rate, posture, temperatute value of the CHF patients has been identified in this system.

Keywords: *GSM module, ARM controller LM35, Heart rate sensor, Pressure sensor.*

I. Introduction.

In recent days the rate of heart patients becomes more and more. And the hospital cost also increased day by day.[1] Because of this poor people's does not get the immediate treatments due to high medical cost. So the heart patient's health leads to critical stage.

In this proposed work, we have used an ARM controller consists of various sensors such as temperature sensor, pressure sensor, heart rate sensor to monitor the patient's vital signs and these values are send to the doctor's mobile using GSM module and also these values are displayed on the LCD display. The display shows the transmission status of the patient's report.

This system is used at home and also very useful for heart patients to monitor their vital parameters very cost effectively.[2] For transmission purpose GSM technology is used. Suppose when the controller receives abnormal values of the heart patient's from the sensor unit and these values are automatically send to the doctor's mobile through GSM. For body temperature Texas instrument is used and for pressure sensor Nova sensor product is used. GSM SIM300 is used for message transmission purpose.

II. Hardware.

A. GSM SIM300.

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number.[3] Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. The Fig.1 shows the GSM SIM300 Module.

Fig.1 GSM SIM300 Module

- Features

(1)Highly Reliable for 24x7 operation with Matched Antenna
(2) Status of Modem Indicated by LED
Simple to Use & Low Cost
(3)Quad Band Modem supports all GSM operator SIM cards.

This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

B. ARM CONTROLLER LPC2148.

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt
pins make these microcontrollers suitable for industrial control and medical systems.

C. LM35.

In this system the temperature level of the patient is calculated by LM35 manufactured by Texas instruments as shown in the Fig.2. The normal temperature for heart patients: 36-37'c.The figure shows the simulation output of temperature value.[4] Temperature is commonly considered to be a vital sign most notably in a hospital setting.

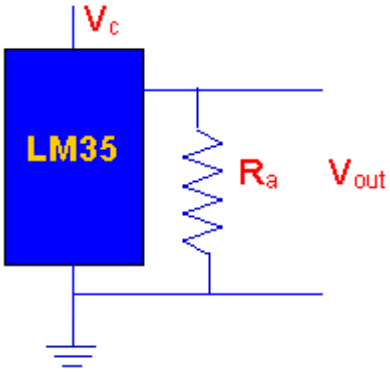

Fig.2 Temperature sensing circuit

- Features

(1)Calibrated directly in ° Celsius (Centigrade)
(2)Linear + 10.0 mV/°C scale factor
(3)0.5°C accuracy guarantee able (at +25°C)
(4)Rated for full −55° to +150°C range
(5)Suitable for remote applications

D. Heart rate sensor.

The Fig.3 (a) shows the heart rate monitoring circuit. This sensor monitors the flow of blood through Finger. As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes with time.

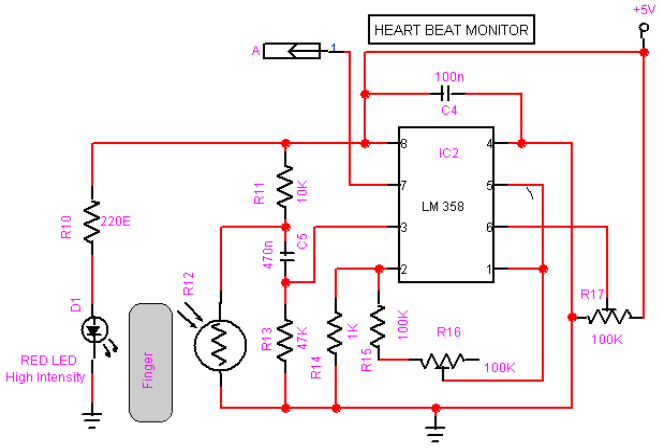

Fig.3 (a) Heart rate monitoring circuit

The sensor shines a light lobe (small High Bright LED) through the ear and measures the light that is transmitted to LDR. The normal Heartbeat level is 60/100bpm.If the measured value is more than 100 means then the result is automatically send to the doctor's mobile using GSM module and also the measured value is less than 60 means then the value is automatically send to the doctor's mobile.

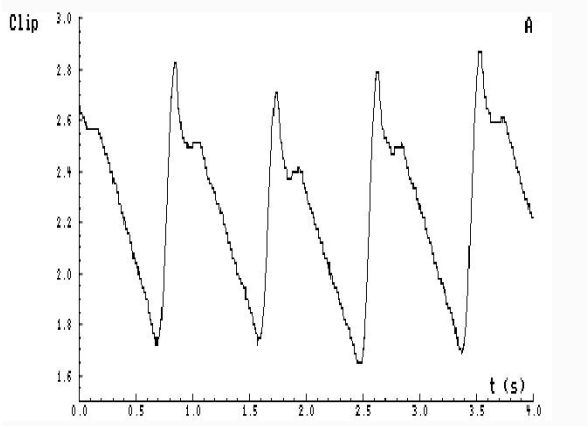

Fig.3 (b) A sample measurement taken with the heartbeat sensor

E. Blood Pressure sensor.

The Pressure sensor used here is NPC-1220.It is a NOVA sensor product. [5] The main need of the sensor is to monitor the pressure level of the CHF patient. The normal BP level of the patient is 120/80.

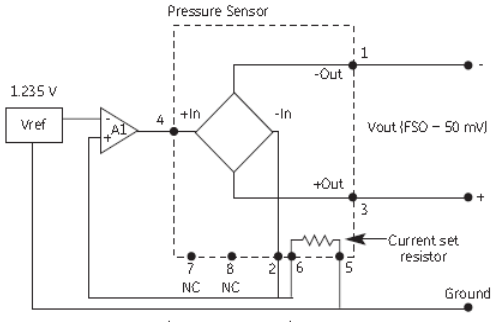

Fig.4 NPC-1220 series schematic diagram

If the measured value is more than 120 means then the result is automatically send to the doctor's mobile using GSM module and also the measured value is less than 80 means then the value is automatically send to the doctor's mobile. The LCD display shows the transmission status of the patient report.

III. Implementation.

The Fig.5 shows the block diagram of proposed work. Various sensors continuously monitor the patient's vital parameters such as temperature, BP, heart rate.

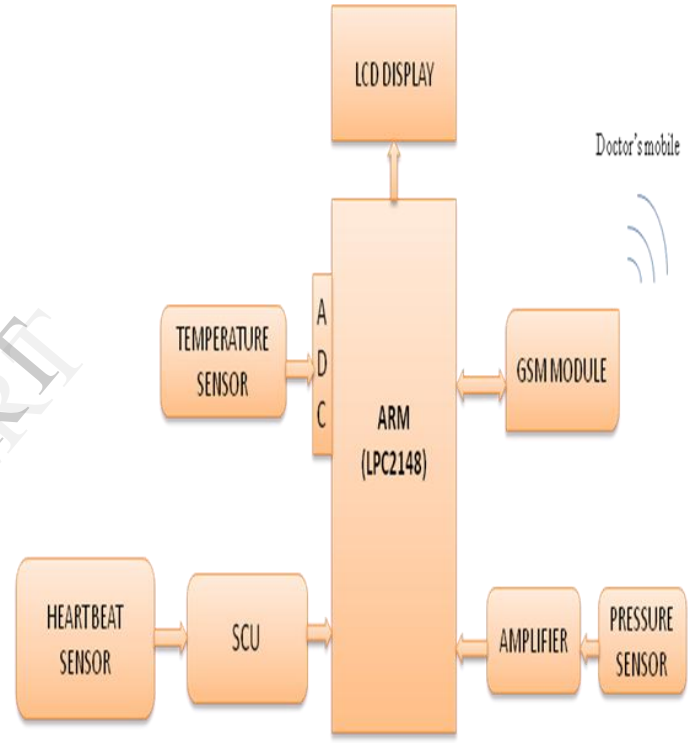

Fig.5 Block diagram of proposed system

A. ADC.

Here the ADC is 10-bit ADC. In order to covert the sensors output into digital values.

B. SCU.

The signal conditioning unit accepts input signals from the analog sensors and gives a conditioned output of 0-5V DC corresponding to the entire range of each parameter.[6] This unit also accepts the digital sensor inputs and gives outputs in 10 bit binary with a positive logic level of +5V. The calibration voltages* (0, 2.5 and 5V) and the health bits are also generated in this unit.

C. LCD display.

The LCD display displays the values of patient's vital parameters such as temperature, heart rate, blood pressure. It is also show the transmission status to the user.

IV. Flow chart.

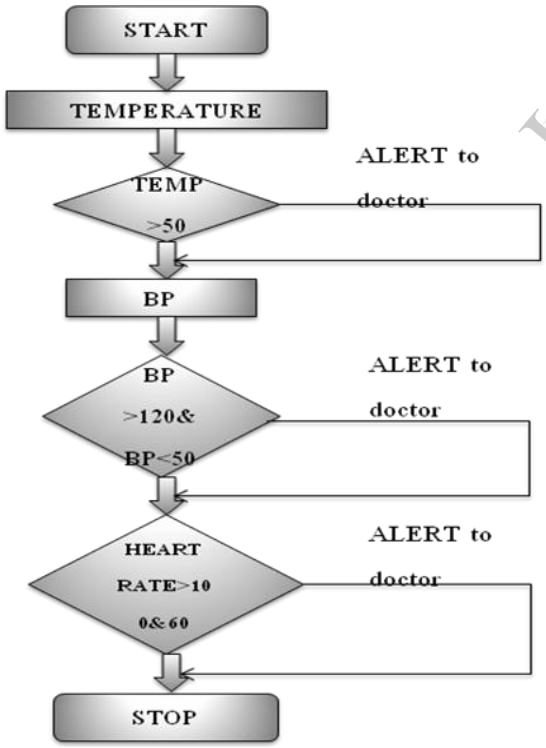

Fig.6 Flow chart for proposed syetem

V. Experimental results.

The Fig.7 (a) shows the simulation result of temperature level. When the controller receives abnormal temperature value it is automatically send to the doctor's mobile and also the result displayed on the LCD display.

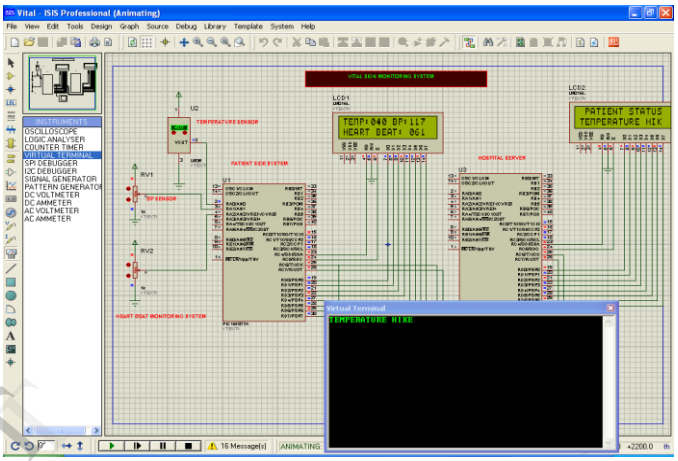

Fig.7 (a) Simulation result for monitoring of temperature value of the patient.

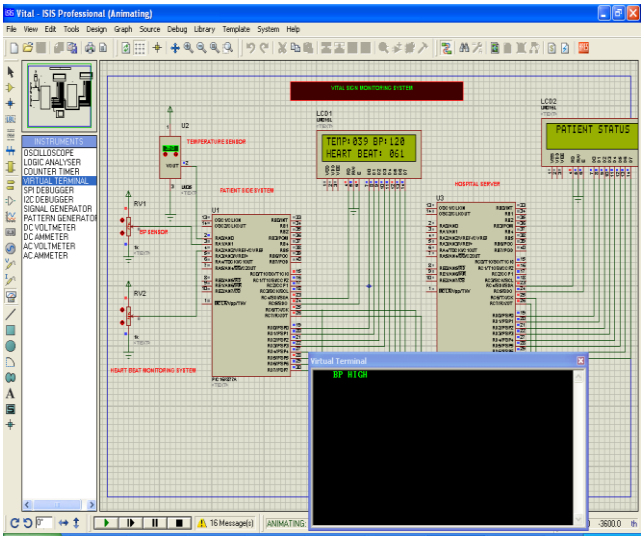

Fig.7 (b) Simulation result for monitoring of BP (high) value of the patient.

The Fig.7 (b) shows the simulation output of BP high level of the patient. When the controller receives BP value from the senor it is automatically send to the doctor's mobile similarly for BP low status as shown in the Fig.7 (c).

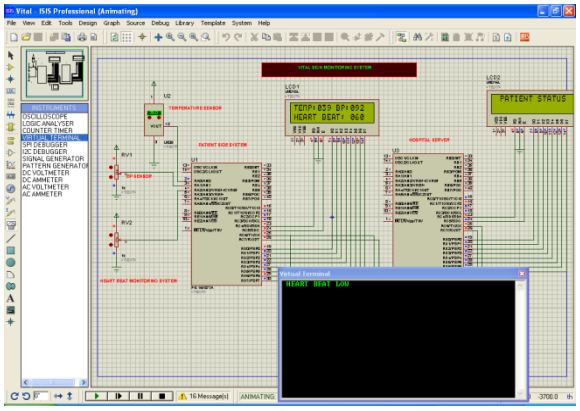

Fig.7 (c) Simulation result for monitoring of BP (low) value of the patient.

Fig.7 (d) shows the simulation result for heart beat high status of the patient. when the controller receives abnormal heart beat value from the heart rate sensor it is automatically send to the doctor's mobile similarly same as for heart beat low status as shown in the Fig.7.(e)

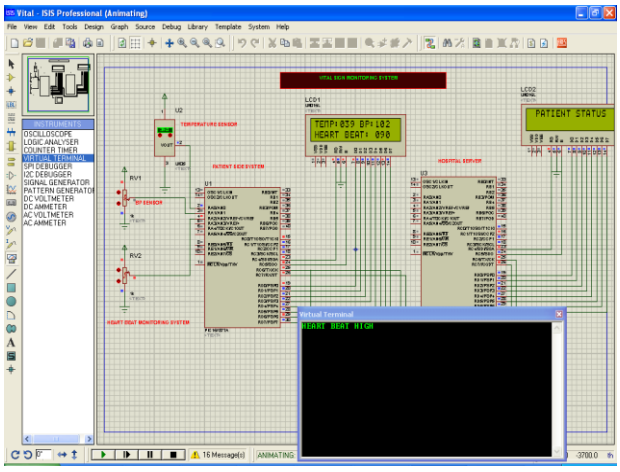

Fig.7 (d) Simulation result for monitoring of heart beat (high) value of the patient.

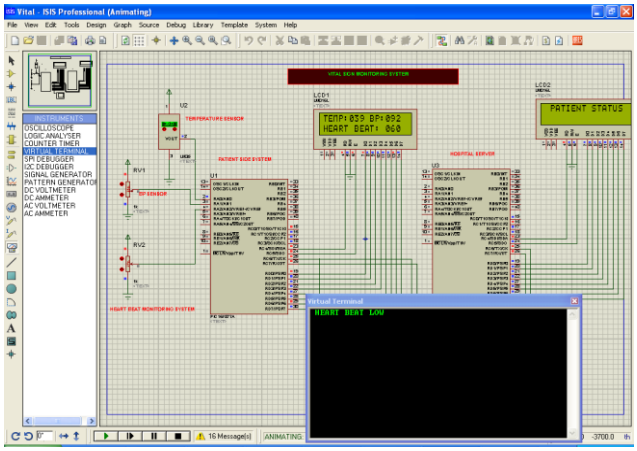

Fig.7 (d) Simulation result for monitoring of heart beat (low) value of the patient.

VI. Conclusion.

The proposed system is mainly used for those who need to monitor their vital signs at home as fast as possible. This system is easy to use at home and cost effective. We can expand this system by adding accelerometer to measure the posture of the patient and electrodes for ECG measurement. The main motive of our project is when a controller detects any abnormalities of the patient it is automatically send to the doctor's mobile using GSM technology and take timely actions in case of necessity.

VII. References.

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