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GSM Based Heart Rate and Temperature Monitoring System

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Abstract **- In this module we used advanced technology for patient monitoring those who are suffered from heart diseases & physical disorder. Therefore heart rate sensor and temperature sensor are used for patient monitoring. Sensors gives accurate output therefore it rules out the use of traditional medical instruments such as thermometer and other devices. For continuously sending message from patient's location to medical advisory GSM modem used. This module provides relief to medical advisory for patient monitoring and also to patients for freedom of movement.**

Keywords **– GSM Modem, Heart rate, LCD, PIC controller, Temperature.**

I. INTRODUCTION

Now days, heart diseases are exceeds up to dangerous level which leads to death of human being. Monitoring of patient constantly is difficult or doctors are also unable to monitor particular patient for total working hours. In many critical conditions such as patient is located far away from hospital or also in case of old patient who suffering with heart disease and physical disorders, continuous monitoring of patient is not possible. This module deals with solving above problems. Module consist of heart rate sensor and temperature sensor which measures the heart rate and body temperature and sends SMS through GSM module to the medical advisory for the preliminary precautions so that patient can be prevented from serious situation before reaching to the hospital. For temporary storage of the data,PIC16F877A controller device used. For display the measured values of heart beat and body temperature, LCD is used.

II. PROPOSED SYSTEM

Block diagram of proposed system is shown in Fig.1. In this module, 12V and 5V power supply given to GSM modem and other devices respectively.

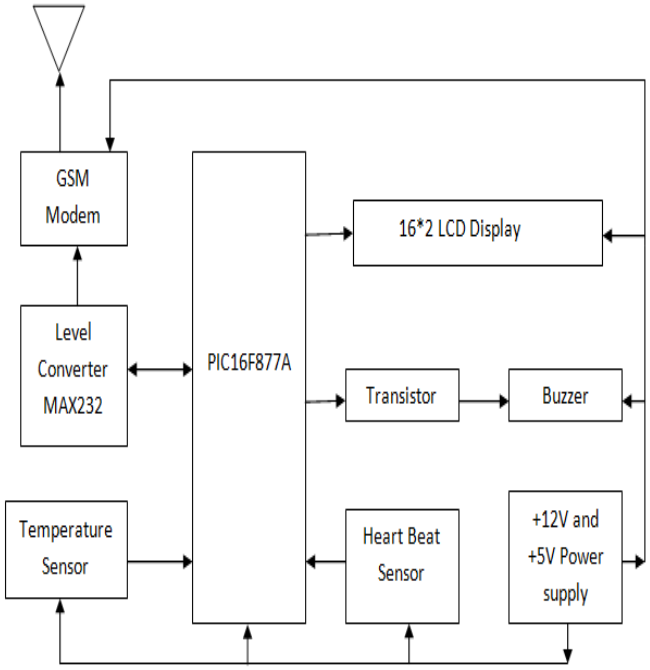

Figure. 1 Block Diagram of System

When system will start, all devices are initialized. Then heart rate sensor and temperature sensor measures heart rate and body temperature respectively and both outputs are given to the PIC controller. PIC controller have inbuilt ADC, so it converts analog data into digital form. Via GSM modem with the help of AT-Commands this information sends to medical advisory. In between PIC controller and GSM level converter is used to convert TTL to CMOS level and vice-versa. For level converting purpose, we used MAX232 IC. In this module, we are given threshold level for heart rate and body temperature. When heart rate and body temperature exceeded or below the threshold level buzzer will turns ON.

III. COMPONENT INTEGRATED

A. *PIC Controller*

In 1989, Microchip Technology Corporation introduced an 8-bit microcontroller called the PIC. PIC stands for Peripherals Interface Controller [1]. PIC16F877A is high performance RISC processor. PIC controller processes the outputs of sensor circuits. The small compact size combined with easy program updates and modifications. PIC16F877A is use in machinery and control system [1].

Specifications:-

- Clock input required to PIC controller is DC-20MHz.
- ADC is 10 bit, up to 8-channel ADC.
- Flash program memory is up to 8K*14 words.
- Data memory is up to 368*8 bytes.
- EEPROM data memory is up to 256*8 bytes.
- Timers are Timer0- 8 bit timer/counter, Timer1- 16 bit timer/counter, Timer2- 8 bit timer/counter.

B. *Heart Rate Sensor*

Heart rate sensor gives digital output of heart rate when a finger is placed on it. The beat LED on sensor is flashes with each heart beat, when the heart beat detector is working. The output of sensor is then connected to PIC controller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Specifications:-

- Operating voltage is +5V DC regulated.
- Operating current is 100 mA.
- Output data levels are 5V TTL level.
- LED is use to Heart beat detection and Output High Pulse.
- Light source are 660nm Super Red LED [10].

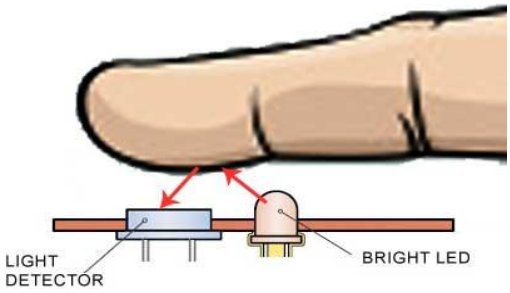

Figure.2 Hearts Rate Sensor [5]

C. *Temperature Sensor*

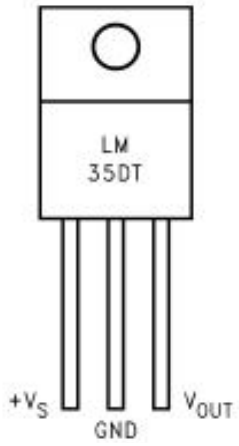

Figure.3 Temperature Sensor [5]

LM35 used as a temperature sensor which gives output voltage linearly proportional to Celsius temperature. External calibrations are not required for LM35. It operates from 4 to 30V and provides low impedance output.

Specifications:-

- Calibrated Directly in °Celsius (Centigrade).
- Linear + 10 mV/°C Scale Factor**.**
- 0.5°C Ensured Accuracy (at +25°C).
- Rated for Full −55°C to +150°C Range.

D. *GSM Modem*

GSM stands for global system for mobile, which is used to establish the communication between GSM modem and mobile device. For communication purpose GSM modem required 12V power supply, communication interface such as RS232, and SIM (Subscriber Identity Module) Card same as mobile phones to activate communication with the network. In GSM modem communication takes place with the help of following AT-Commands.

TABLE I
AT-Commands for GSM [2]

AT-Commands	**Description**
AT	Enter
AT+CMGF	Select SMS Message Format
AT+CMGS	Send SMS Message

E. LCD Display

LCD is a liquid crystal display. In market 14-pin and 16-pin LCD displays are available. In this project we use 16 pin16*2 LCD display. 16*2 means 16 characters per line and there are 2 such lines & LCD each character is displayed in 5*7 matrix.

IV. SOFTWARE DESIGN

A. Software

The mikroC PRO for PIC is powerful software which provides development tools for PIC controllers. Without compromising performance or control it provides the programmer with the easiest possible solution to developing applications.

B. System Design Flow

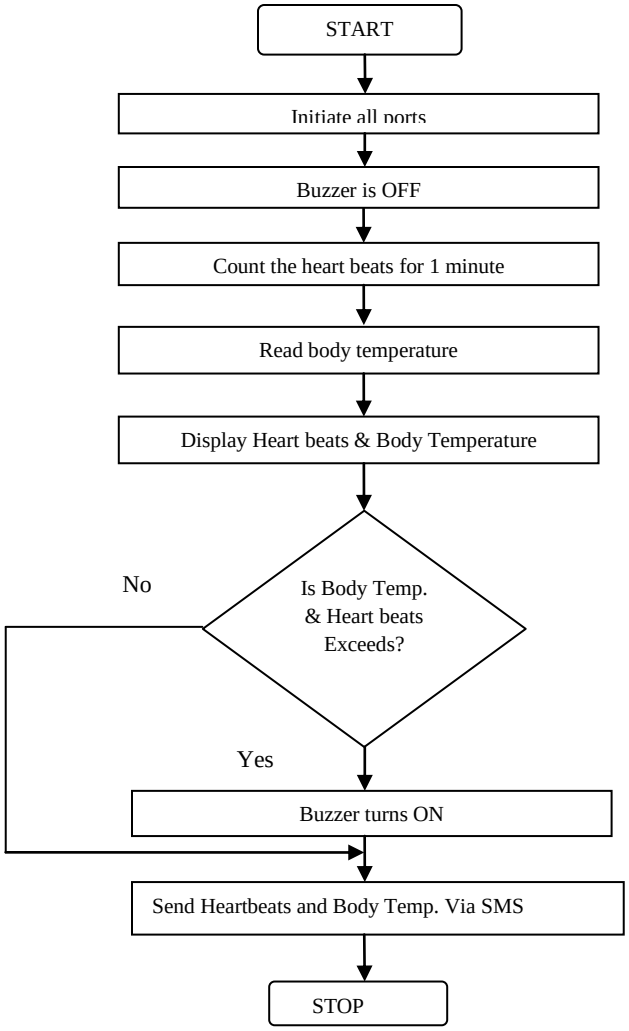

Figure.5 Flowchart of Proposed System

C. Design

When switch is turned ON, the hardware circuit is initialized. After pressing reset switch, calculation of heart rate and temperature takes place. In that heart rate count for 30sec. and then it convert into beats per minute using following formula:

$$CountRead=TMR0*2 \quad (1)$$

Simultaneously measure the body temperature and PIC convert it in °C (Celsius).Finally measured readings of temperature and heart rate sent to concerned medical advisor by GSM modem using AT+CMGS command. Also this information displayed on LCD display.

V. EXPERIMENTAL ANALYSIS

A. Tested Results

Screen displayed after switch on kit

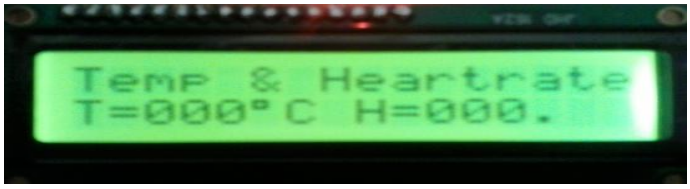

Figure.6 Output on LCD at Initial Condition

Display heart rate and Temperature

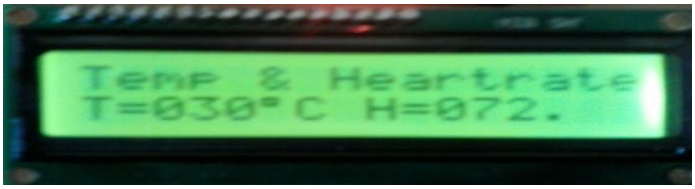

Figure.7 Output on LCD at Tested Condition

TABLE II
Results of different persons at different time

Sr. No.	Initial Condition		Tested Results		Time
	T	***HB***	***T***	***HB***	
Person 1	28	0	30	73	After 1 min
	28	0	32	69	After 5 min
Person 2	28	0	31	70	After 1 min
	28	0	30	68	After 5 min

B. Hardware Setup

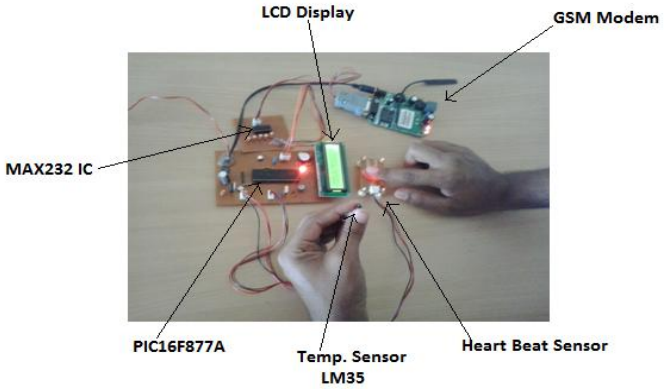

Figure 8 Working Setup of Developed System

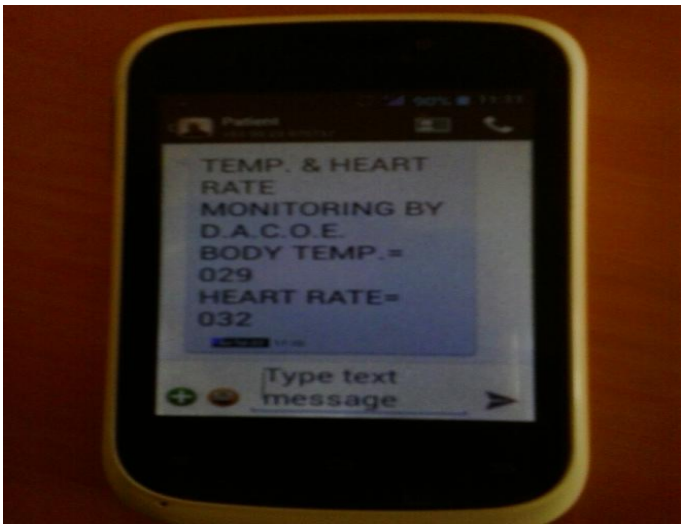

Figure.9 Output of Developed System

VII. CONCLUSION

The key objective of developing this module is to alert medical advisory about present health condition of patient via SMS. The buzzer will turn ON when body temperature and heart rate exceeds or below the threshold level. It fulfills the objective to measure the heart rate and body temperature. This module is advantageous where continuous monitoring of patient is required under critical condition. This module is applicable in Hospitals, homes and also in ambulances.

But for this module, GSM modem requires postpaid SIM card. Message cannot be send to medical advisory without network coverage.

VIII. ACKNOWLEDGMENT

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