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PATIENT HEALTH MONITORING SYSTEM USING CAN PROTOCOL

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Abstract - *In this paper we are dealing with the heart rate monitoring system using CAN protocol which is used to measure the heart rate of one or more patient at a time. The heart rate which is number of times your heart beats per minute (bpm) and send its measured data on CAN bus and it shown on a display. It's a real time monitoring system. In addition we added temperature sensor to measure the body temperature of patient. Control Area Network (CAN bus) is a serial communication protocol which allows microcontroller and devices to communicate with each other through serial communication. The requirement of host computers is eliminated completely by using CAN bus protocol. CAN protocol helps to send data on one system to see all patients measured heart rate as well as body temperature at a time on single monitor by using serial communication using UART.*

Key Words: **Heart rate monitoring, Control Area Control, Serial Communication**

1. INTRODUCTION

We all know how precious human life is and how doctor play crucial role in saving human life. Presently heart diseases are the leading cause of death in the world. When it comes to saving a human life human vital plays an important role. In this the two main vitals are body temperature and heart rate so if we can measure and monitor vitals of human we can give the doctors some crucial time to save life of human being. The purpose of this project is to it reduces the time & increase the flexibility. As it can measure the heart rate more than one person same time, so it will help doctors to see the heart rate of each person from one place. This system is portable.

This system consists of two nodes, one is transmitting node and another one is receiving node. The heart rate sensor and temperature sensor are connected to transmitting node.

The heart rate and temperature of patient is measured on node one and it is transmitted to another node via CAN communication and also it is displayed on a LCD display with real time. The second node will receive this measured data and transferred it serially to the PC via serial communication.

2. Related Work

Previous research states that, at a time only one patient's heart rate can be measured. In this system, it can measure heart rate and body temperature of one or more patients and that measured information transfer to display device using CAN protocol. In this project, it reduces the time & increase the flexibility. As it can measure the heart rate more than one person same time, so it will help doctors to see the heart rate of each person from one place. This system is portable.

3. Methodology

The CAN based heart rate monitoring system consists of microcontroller and sensors. There are two nodes one is transmitting node and receiving node. The main sensors, LCD display and CAN transceiver are connected to transmitting node and MAX232 and CAN transceiver are connected to receiving node. The microcontroller PIC18F458 is used which required 5V power supply. The input to PIC18f458 is heart rate sensor (RB-4, PORTB) and temperature sensor LM35 (RA1). When a finger is placed on HR sensor, the varying volume of blood flow is detected by the LED and light detector combination and is converted to digital output. PIC has a feature of interrupt on change; the heart rate is measured with respect to time. The HR sensor gives the digital output in the form count of heart beats per minutes. Heart beats are counted using the SUNROM technologies HEART BEAT SENSOR 1157 (heart bit sensor) and by implementing the interrupt on change logic of PORT-B. This change will be counted for 15 sec. Later on it will be multiplied by 4 in the program to get the heart beats for one minute. The measured heart rate (BPM) will be displayed on LCD. The other input to PIC is temperature sensor LM35 which is given to inbuilt ADC which will convert that analog signal into digital value, which is displayed on LCD. The received data from temperature sensor and heart rate sensor will be given to CAN-Transmitter (CANTX) pin of PIC to CAN Transceiver MCP2551 and also displayed on LCD. This data is transferred over CAN bus through CAN Transceiver at transmitter end. Thus via CAN bus data is received on receiver node again by using CAN-Transceiver MCP2551. The output of this CAN transceiver will be given to CAN Receiver pin (CANRX) of Microcontroller. After processing the data which is received at the CAN RX pin is transmitted serially to the PC side using RS232 protocol and displayed on LCD.

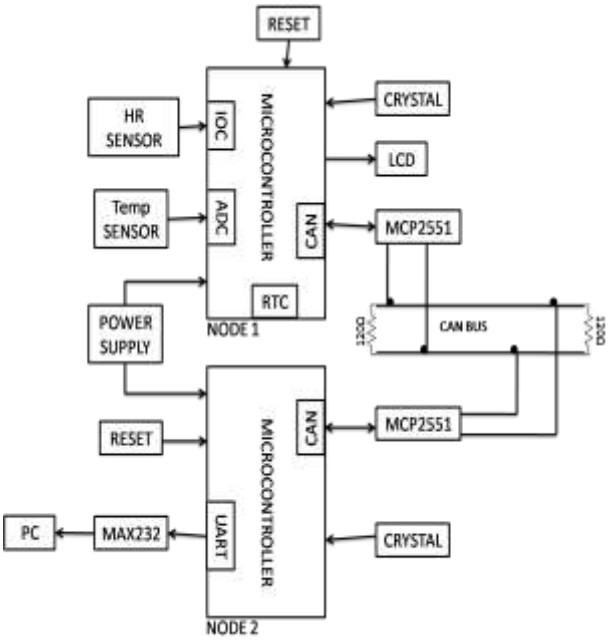

Fig-1: Block Diagram of Proposed System

4. HARDWARE INTERFACES

4.1 PIC18F458 Microcontroller:

The PIC18F458 microcontroller is 40pin IC, which has two enhanced flash program memory of 32 Kbytes and RAM of and 1526bytes and EEPROM of 256bytes. It is 8bit microcontroller with RISC CPU. Its sink/source current is 25mA.It has three external interrupts and four timers. It also supports CAN communication [6].

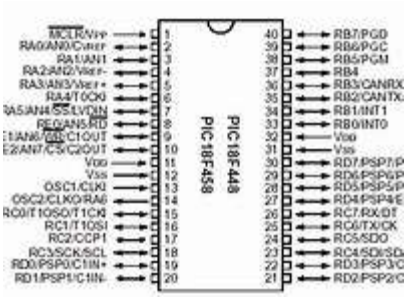

Fig-2: PIC18F458 IC

4.2 Heart Rate Sensor 1157:

Heart rate sensor module 1157 gives a digital output of heart beat when finger is placed on sensor. When heart rate detector is working, LED flashes unison with each heartbeat. This digital output is directly connected to microcontroller to measure Beats per Minute rate. The working principle of sensor is light modulation by blood flow through finger at each pulse. Operating voltage is 5V DC regulated and operating current is 100mA.

Fig-3: Heart Rate Sensor Sunrom 1157

The heart rate sensor consists of Red LED and Light detector. The LED needs to be super as maximum light must pass spread in finger and detected by detector. Now, when the heart pumps the pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reach to the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse [4].

4.3 MCP2551 Transceiver:

The MCP2551 is serving as interface between physical buses and CAN protocol microcontroller. It is high speed CAN and fault tolerant device. It provides differential transmit and receive capability for CAN protocol. It will operate at speed of 1Mbps.It will convert digital signal generated by microcontroller into signals suitable for transmission over cabling. Up to 112 nodes can be connected. [9].

Fig-4: MCP2551

4.4 MAX232:

The max232 is an integrated circuit which is used to convert TTL/CMOS logic level to RS232 logic levels in serial communication from microcontroller to PC. It operates on single5v power supply. It operates up to120Kbits/s. It is dual driver/receiver. It requires low supply current 8mA typical [10].

Fig-5: MAX232

4.5 LM35 Temperature Sensor:

The LM35 is temperature sensor device which output is linearly-proportional to centigrade temperature. It operates over a −55°C to 150°C temperature. It operates from 4V to 30V and current drain is less than 60μA.The linear scale factor is + 10-mV/°C. The device is used with single power supplies.. LM35 don't require any external calibration [7].

Fig-6: LM35

4.6 LCD 16*2 Display:

Liquid Crystal Display screen is an electronic display module. A 16*2 means it can display 16characters per line and there are two such lines.A character is displayed on 5*7pixel matrix.LCD has two registers, Command and Data. The command register stores the command instructions given to the LCD. A command Is an instrcution given to LCD to do a predefined task. like initilaizing, clearing the screen etc. The data register stores the data to be displayed on the LCD. The data is in ASCII value of the character to be displayed on the LCD [1] [5].

Fig-7: LCD 16*2 Display

5. COMMUNICATION PROTOCOL

5.1 CAN PROTOCOL:

The Control Area Network is communication protocol, developed by BOSCH to reduce the cost of vehicle wiring harness. It is used in automotive and industrial control application. CAN defines lower two layers of the OSI-7 layer reference model. A CAN made up of a group of 'Nodes' [8].

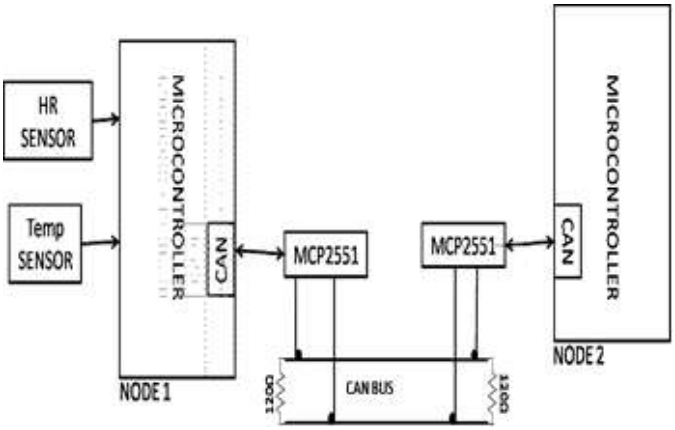

Fig-8: CAN Data Transmission and Reception

5.2 Serial Communication:

Universal Asynchronous Receiver Transceiver is serial communication protocol. UART transmits data asynchronously which means no clock signal is needed for transmission. Instead of clock signal UART transmitter adds start and stop bits to data packet which is to be transferred. In UART only two wires are needed to transmit data between two UARTs. Two UARTs directly communicate with each other. The Transmitting UART converts parallel data into serial form [11].

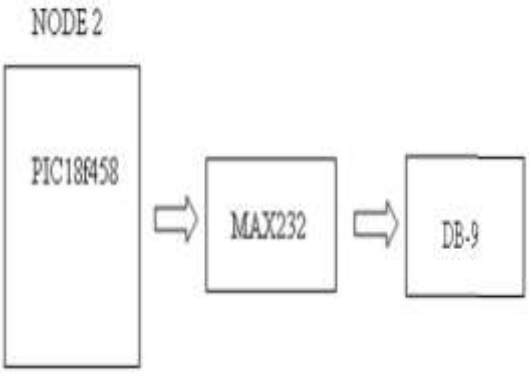

Fig-9: UART Data Transmission and Reception

6. SOFTWARE INTERFACES

6.1 MPLAB IDE V8.63:

MPLAB IDE is software; it runs on computer which used to develop applications for microcontrollers. It is called as Integrated Development Environment (IDE).For embedded microcontrollers it provides single integrated 'environment' to develop code. For application and development of embedded designs using PIC microcontrollers, MPLAB IDE is editor, project manager and design desktop [12].

6.2 Software Design Of NODE 1:

Fig-10: Process Flow of NODE 1

6.3 Software Design Of NODE 2:

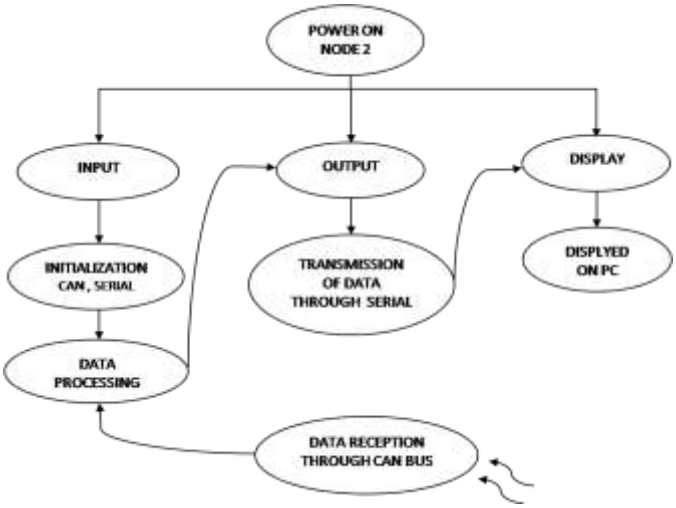

Fig-11: Process Flow of NODE 2

7. RESULTS

First, we put the finger on heart rate sensor, then sensor will measure the change in volume of blood, when the heart pumps the pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reach to the detector. The pic microcontroller will convert this change into the heart beat per minute (BPM). This converted data is displayed on to the LCD screen and then it will be transferred serially to PC.

To measure the body temperature, put finger on LM35, then it will detect the body temperature and it will convert analogue signal into digital signal. The LM35 gives output in centigrade, later we convert that into Fahrenheit. This measured data is displayed on LCD and then it will be transferred serially to PC.

Fig-12: Result of Proposed System

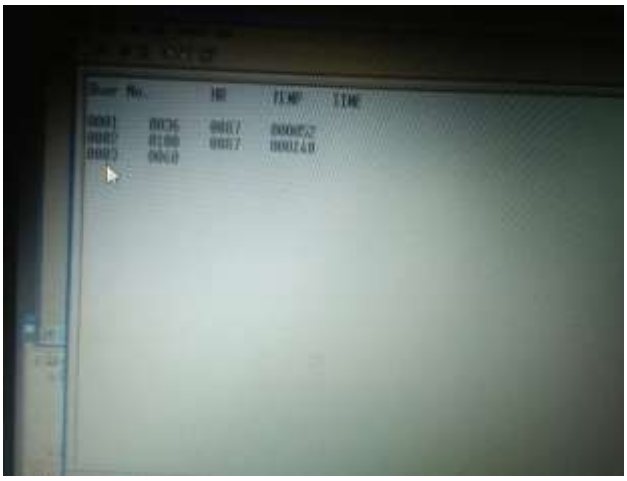

Fig-13: Result of Proposed System on PC

FUTURE SCOPE

- By setting threshold value (proper heart rate according to person's age) for heart rate, we can display message on LCD whether measured heart rate is proper for person's health or not.
- By using wireless communication as Bluetooth, Zigbee, GSM module we can send the person's data to doctor or to the caretaker on their communication modules.
- In future, we can measure blood pressure, sugar level, etc. by interfacing with required sensors.
- We can interface more nodes with more sensors.

8. CONCLUSION

The main objective of this project is to monitor the heart rate and body temperature of one or more patient. Display the real time data on LCD. At the same time transmit it to another node by using CAN protocol.In this System, first measured heart beat for 15seconds and displayed the measured value in beats per Minute (bpm) then measured temperature from LM35 whose output is in Degree Celsius. This is converted into Fahrenheit (F). Both heart rate and temperature is being measured in real Time. Using CAN protocol heart rate, temperature & real time was transmitted from node one to node two. From node two the data was transmitted to PC through Serial Cable.

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BIOGRAPHIES

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