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Patient Monitoring System

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ABSTRACT
The paper presents the incorporation of electronics in medical field in order to ease the difficulty of patients for monitoring their physiological conditions in their regular routine life. In the past few decades, due to the advancement in the field of technology, it has proved to be much useful to implement numerous techniques in various other fields like 'medical and its application'. This paper deals with an implementation of a microcontroller based system called as 'Patient Monitoring System'. The 'Patient Monitoring System' can be used as a technology for monitoring patients outside of conventional clinical settings like home settings, which may lead to increase in the care of patients. It has been recognized as a valuable tool that can enable the care givers to effectively maintain compliance with established guidelines forpatients. It can be defined as a system used for monitoring the various physiological conditions. This can be done with the help of taking different body parameters like heart beats, blood pressure and temperature. These body parameters act as multiplesignal inputs which can be given in order to find out the corresponding outputs which might be so obtained. The result so obtained can thus be compiled into a single device. It can thus help to measure various body parameters of various patients and store the result as database.

Keywords: Photoplethysmography, Heart Rate, Body Temperature, Blood Pressure, Electrocardiograph (ECG).

I. INTRODUCTION

There are many portable devices available in market that can measure a single body parameter and keep the records like thermometer. But there is a scarcity of devices that can measure all the body parameters together and continuously monitor them.[1] This system is thus presented with an aim of saving the time of both the doctors as well as patients and hence a number of patients can be observed within a much lesser time. The proposed system has sensors incorporated together to monitor vital signs of human body such as Heart rate, Temperature and Blood pressure. The human vital body signals which are in analog form are sent to ADC and then to microcontroller. [2] The LCD connected with the microcontroller displays the output of different sensors and simultaneously the output is stored in memory connected with microcontroller.[2]

The heart rate is measured with the help of a principle called as photoplethysmography (PPG). The body temperature is measured by using a thermo sensor ,LM35which measures the temperature directly in Fahrenheit and does not need external calibrations. The blood pressure is measured with the help of a pressure sensor; the signals from which are conditioned with an instrumentation amplifier before data conversion by an ADC.[3] Thus, with the help of microcontroller, we can give multiple inputs in the form of body parameters and outputs depending upon the inputs can display the necessary results on LCD.[3]

II. SYSTEM DESCRIPTION

The proposed system is developed on the integration of hardware as well as software. Fig 1 given below shows thegeneralized block diagram of the system.

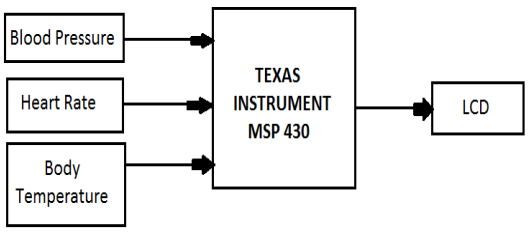


Fig 1: System Block Diagram

MSP430 Microcontroller

MSP430 Microcontrollers (MCUs) from Texas Instruments (TI) are 16-bit, RISC-based, mixed-signal processors designed specifically for ultra-low-power (ULP). It is based on Von Neuman architecture.MSP430 MCUs have the right mix of intelligent peripherals, ease of use, low cost, and lowest power consumption for thousands of applications. TI offers robust design support for the MSP430 MCU platform along with technical

documents, training, tools, and software to help designers develop products and release them to market faster.

Blood Pressure

The body parameter, Blood Pressure (B. P.) is then given to the pressure sensor. The signal from the pressure sensor is then conditioned with an op-amp circuit or by an instrumentation amplifier before data conversion by an analog-to-digital converter (ADC). The systolic pressure, diastolic pressure and pulse rate are then calculated in the digital domain using a method appropriate for the type of monitor and sensor utilized. The resulting systolic, diastolic and pulse-rate measurements are then displayed on a liquid-crystal display (LCD). The fig below shows the blood pressure sensor employed in the project.

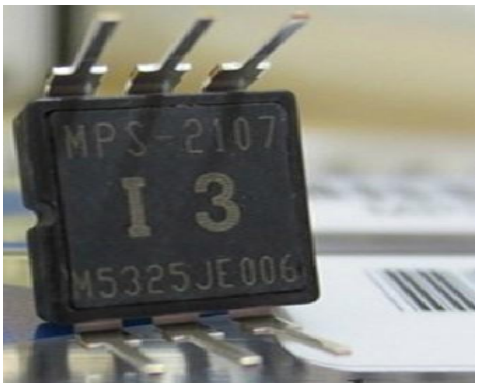


Fig 2: Blood pressure sensor

Heart Rate:

The body parameter, heart rate is evaluated with the help of a principle known as photoplethysmography (PPG). It makes use of transmittance PPG which helps in designing a pulse sensor. It further leads to the evaluation of appropriate heart beats rates corresponding to the obtained input heart beats.The heart beat sensor circuit uses a reflective IR sensorwith necessary instrumentation circuit to illustrate the principle of photoplethysmography as a noninvasive technique for measuring heart rate. The sensor used in this project is TCRT1000, which is a reflective optical sensor with both the infrared light emitter and phototransistor placed side by side and are enclosed inside a leaded package so that there is minimum effect of surrounding visible light. A subject's finger is illuminated by an IR light-emitting diode. More or less light is absorbed, depending on the tissue blood volume. Consequently, the reflected light intensity varies with the pulsing of the blood with heart beat. A plot for this variation against time is referred to be a photoplethysmographic or PPG signal. Fig 3 shown below shows the external biasing circuit for the TCRT1000 sensor. It requires about 3.3-5V power supply. Pulling the Enable pin high turns the IR emitter LED 'on' and activates the sensor. A fingertip placed over the sensor acts as a reflector of the incident light. The amount of light reflected back from the fingertip is monitored by the phototransistor.

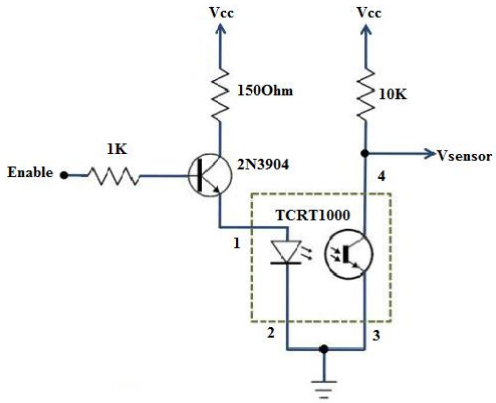


Fig 3: External biasing circuit for the TCRT1000 sensor.

The output (VSENSOR) from the sensor is a periodic physiological waveform attributed to small variations in the reflected IR light which is caused by the pulsatile tissue blood volume inside the finger. The waveform is, therefore, synchronous with the heart beat and the corresponding result is displayed on the LCD.

Body Temperature:

The body parameter, body temperature is measured by using a thermo sensor which measures the temperature directly in Fahrenheit and does not need external calibrations.Fig4 below shows the internal configuration and working of the thermo sensor LM35 used in the project.

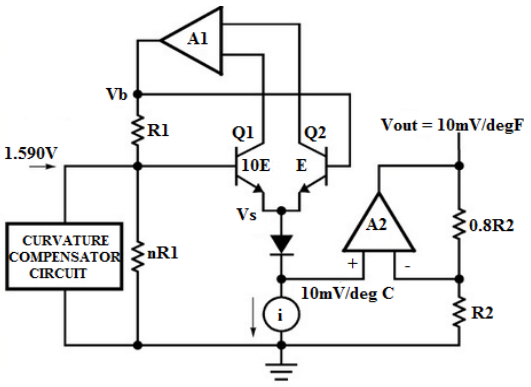


Fig 4: Internal configuration of LM35

There are two transistors in the center of the drawing. One has ten times the emitter area of the other. This means it has one tenth of the current density, since the same current is going through both transistors. This causes a voltage across the

resistor R1 that is proportional to the absolute temperature, and is almost linear across the range we care about. The "almost" part is taken care of by a special circuit that straightens out the slightly curved graph of voltage versus temperature. The amplifier at the top ensures that the voltage at the base of the left transistor (Q1) is proportional to absolute temperature by comparing the output of the two transistors. The amplifier at the right converts absolute temperature (measured in Kelvin) into either Fahrenheit or Celsius, depending on the part (LM34 or LM35). Output isthus directly displayed on the LCD.

III. SYSTEM IMPLEMENTATION

The following figure 5 shows the interfacing of microcontroller MSP 430 with the three specified body parameters viz., blood pressure, body temperature and heart beats. The results so obtained are displayed on the LCD which is interfaced with MSP 430.

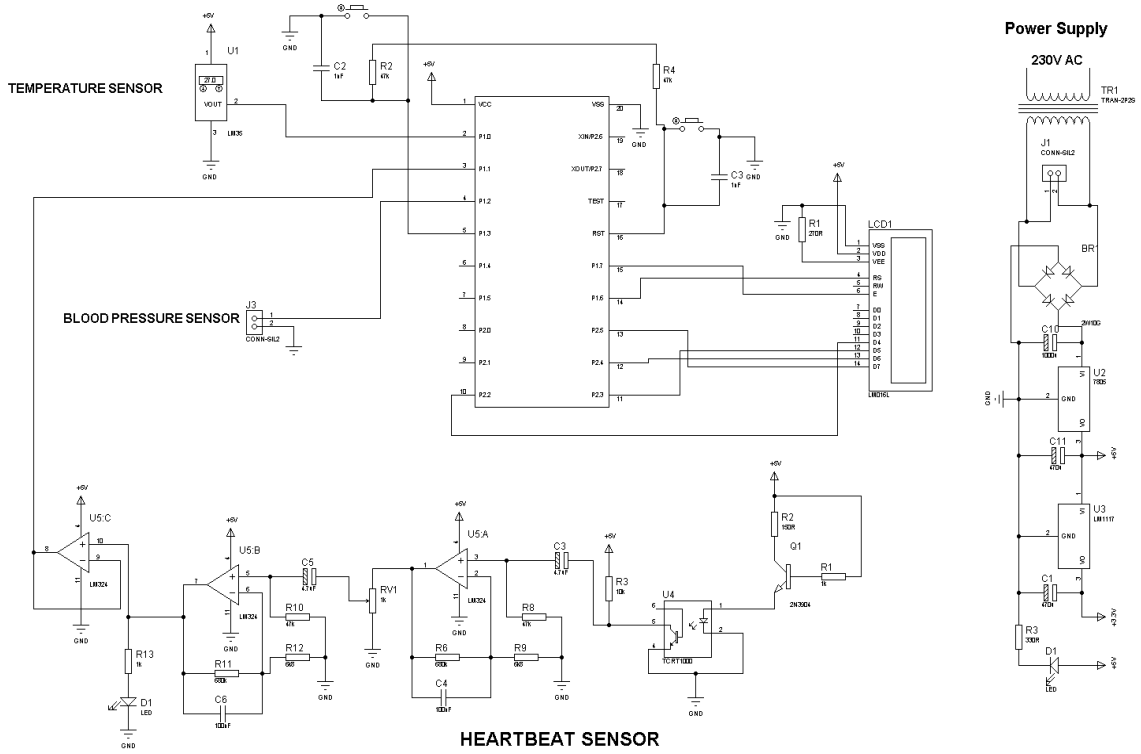
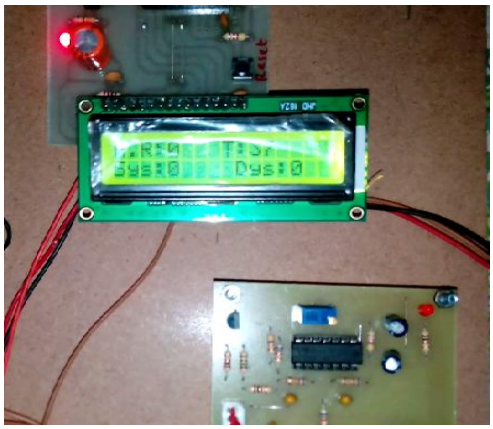


Fig 5: Interfacing diagram

After completing all the processes like PCB designing, etching and soldering, the proposed system was thus finally practically implemented as shown in the fig below



IV. ADVANTAGES AND DISADVANTAGES

4.1 Advantages:

- Real time support for improved health outcome and quality of life.
- Provides extension of care at home after discharge helping to prevent emergencies.
- Ability to continue monitoring patient's health, regardless of patients location, even when not at home.
- Provides out of hospital remote monitoring of patients to improve patients' care and reduced costs.
- More accountability from patients and care provider.

4.2 Disadvantages:

- Potential for professionals to become over reliant on technology and forget to interact directly with patient.
- Remote monitoring increases the amount of incoming data.
- More health care professionals may need to be hired to review and interpret this information and make decision regarding multiple patients' health care. Lack of system interoperability with electronics health record and other IT tool.

V. CONCLUSION& FUTURE SCOPE

5.1 Conclusion

This paper presents an overview of the proposed system which is 'Patient Monitoring System'. This paper discusses regarding the techniques which can be implemented for providing the pre-requisite information about any patient's physiological conditions by taking the body parameters into consideration. The results so displayed can thus prove to be extremely helpful for self-monitoring of the various physiological conditions of the patient apart from the clinical settings.

5.2 Future scope

- The entire medical data acquisition can be made wireless and wearable.
- A package as such, would then be able to contain the necessary circuits for inputs from ECG sensors, EEG sensors, pressure measurements and pulse rate transducers.
- The wearable module so obtained can then be made capable of transmitting data with the help of internet to the required destination. to the concerned medical authority in charge for further diagnosis.
- The received data can be stored in a separate memory and processed by a microcontroller.
- The human body scanning system can thus be made more sophisticated by incorporating wireless capability which will allow the doctors to acquire their patients' database.

ACKNOWLEDGEMENT

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