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A Medical Wearable Device with Wireless Bluetooth-based Data Transmission

P.Kanagavalli[1], K.P. Jamunalaksmi[2]

PG Scholar, Department of ECE, Adithya Institute of Technology, Coimbatore, Tamil Nadu, India

Assistant Professor, Department of ECE, Adithya Institute of Technology, Coimbatore, Tamil Nadu, India

ABSTRACT: The main objective of this paper is to discuss and design a Bluetooth-based wireless transmission of acquired biomedical signals. Wireless technologies are gaining prominence in medical applications due to their flexibilities and ease of installation and configuration. The proposed system seeks to demonstrate the suitability of the Bluetooth Protocol as a means to transmit physiological signals from the point of acquisition to a distant location where the signals can be displayed, analyzed and stored, without any distortion or data loss. The implementation of this kind of system will assist in reducing the long patient-clinic encounter time typical of many Hospitals, as patient's data can be transmitted wirelessly and under reduced time . The design consists of two segments, the transmit end which has a Bluetooth-PRO (S2) module for transmission of the data, a PIC16F887 for processing and initial storage of the data in its EEEPROM. At the receive end is another Bluetooth-PRO (S2) module which does the reception of the data sent from the transmit end, as well as a PC equipped with Visual Studio software that is used to develop a Graphical User Interface with which received data can be analyzed.

KEYWORDS: Bluetooth,PIC 16F887,MEMS Sensor,Ultrasonic sensor,LCD,Proteus

I.INTRODUCTION

The Bluetooth technology based on IEEE802.15.4 is widespread use of biomedical applications providing wireless networks. A fully integrated low-power 2.4GHz Bluetooth transceiver implemented in CMOS technology is demonstrated. It has RF and analog front-ends, a frequency synthesizer, and digital modulator and demodulator compliant to IEEE 802.15.4. The direct-modulation using fractional-N synthesizer is adopted as transmitter architecture. The transmitter provides high output power of +9dBm and excellent EVM of 5.1%. The direct conversion architecture uses in receiver. Receiver sensitivity is -97dBm. Current consumption for continuous TX transmission at +9dBm output power is 28.2mA and for continuous RX reception is 16mA. Excellence coexistence performance is presented by studying WLAN interferer rejection. Patients who are fallen, abnormal of temperature & leaving the room, Bluetooth TX transmits the information from patient's module & receives in Bluetooth RX shows in the monitor section. Working persons taken care of those patients immediately known by alarm & details of the patients in the monitor.

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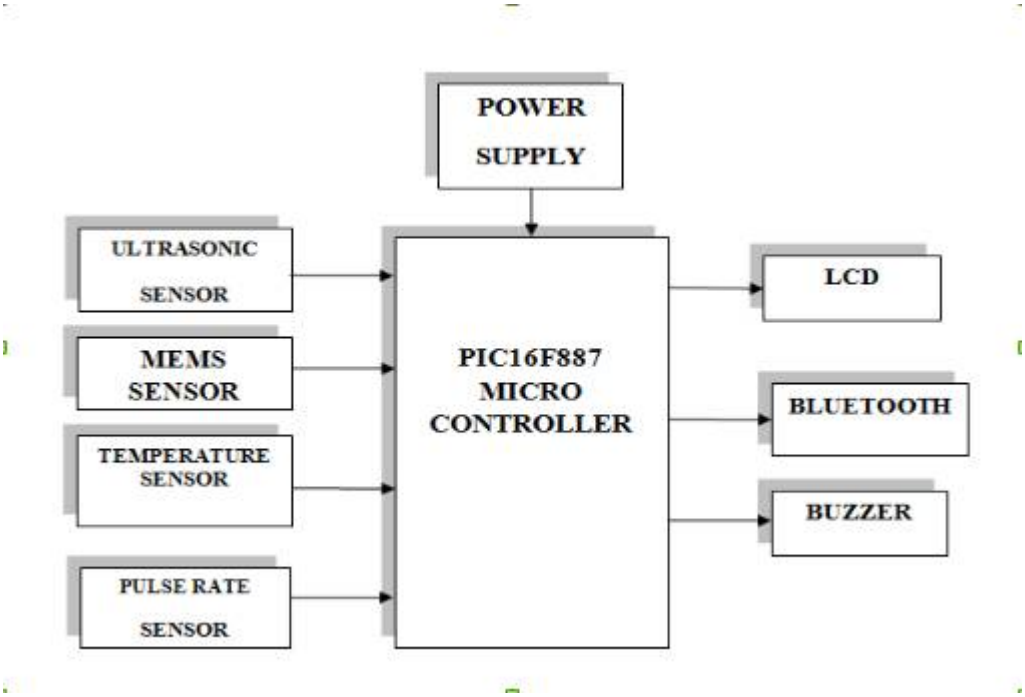

Fig 1:Block diagram

II. HARDWARE REQUIREMENTS

A.DC power supply

A DC power supply is supplies a voltage of fixed polarity (either positive or negative) to its load. Depending on its design, a DC power supply powered from a DC source or from an AC source .DC power supply use AC mains electricity as an energy source. Such power supplies will employs a transformer to convert the input voltage to a higher or lower AC voltage. A rectifier which is used to convert the transformer output voltage to a varying DC voltage, this in turn is passed through an electronic filter to convert it to an unregulated DC voltage.

The filter removes most of all the AC voltage variations; the remaining variations are known as ripple.

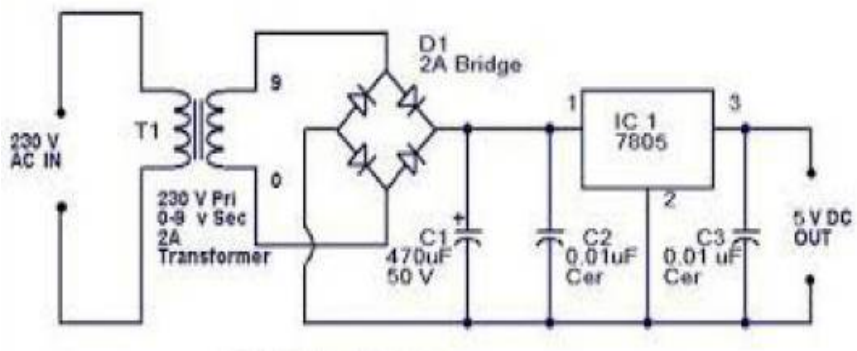

Fig 2:DC power supply

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The electric load's tolerance of ripple test the minimum amount of filtering that must be provided by a power supply. In some cases, high ripple is tolerated and therefore no filtering is required.

B.PIC16F887 MICROCONTROLLER

PIC 16F887 is powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC architecture into an 40- or 44-pin package. The PIC16F887 features 256 bytes of EEPROM data memory, selfprogramming , 2 Comparators, 14 channels of 10-bit Analog-to-Digital converter, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port can be configured either 3-wire Serial Peripheral Interface or the 2-wire Inter-Integrated Circuit bus and an Enhanced Universal Asynchronous Receiver Transmitter . These features are make it ideal for more advanced level A/D applications in automotive,industrial, appliances or consumer applications.

Fig 3:PIC16F887 IC

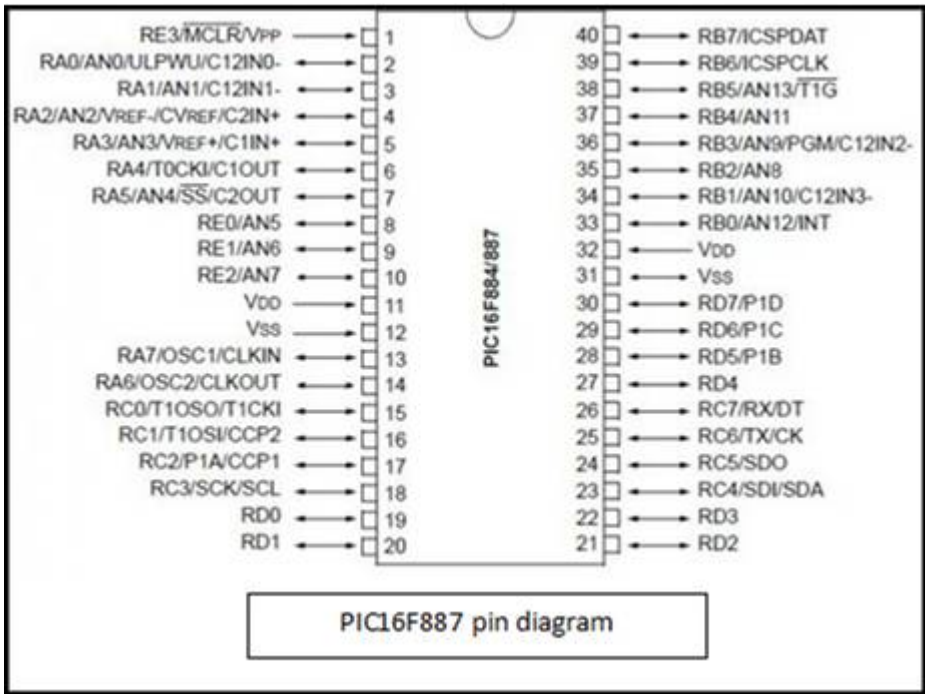

Fig 4:PIC16F887 Pin diagram

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C.MEMS

1.Patient section module

The mems is sense the activity of human weather they sitting, walking or sleeping etc.

Fig 5:MEMS Sensor

MEMS sensors are available with different technologies. The most are based on capacitors and gas chambers.MEMS sensor with capacitors is typically a structure that uses two capacitors formed by a moveable plate held between two fixed plates. The two capacitors are equal when under zero net force but a change in force will cause the moveable plate to shift closer to one of the fixed plates, increasing the capacitance, and away from the other fixed reducing that capacitance. This difference in the capacitance is detected and amplified to produce a voltage proportional to the acceleration. The dimensions of the structure is the order of microns.

D.TEMPERATURE SENSOR

1.Patient section module

Temperature is the most often-measured quantity in the environment. This might be expected since most physical, electronic, chemical, and biological systems are affected by temperature. Certain chemical reactions, biological processes, and even electronic circuits perform within limited temperature ranges. Temperature is one of the most common measured variables and it is not surprising that there are many ways of sensing it. Temperature sensing can be done either through direct contact with the heating source,without direct contact with the source using radiated energy instead. There are a wide variety of temperature sensors on the market today, including Thermocouples, Resistance Temperature Detectors , Thermistors, Infrared, and Semiconductor Sensors.

Ultrasonic sensors are devices that use electrical–mechanical energy transformation to measure distance from the sensor to the object. Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along with the direction of wave propagation through the medium. Apart from distance measurement, they are also used in ultrasonic material testing ,Object detection, position detection, ultrasonic mouse, etc.

These sensors are categorized in two types according to their working principle piezoelectric sensors and electrostatic sensors. Here we are discussing about the ultrasonic sensor using the piezoelectric principle. Piezoelectric ultrasonic sensors contains a piezoelectric material to generate the ultrasonic waves.

Fig 6:Ultrasonic sensor

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E.LCD

1.Monitoring section Module: PIN-(RB0-RB7)(RD5-RD7)

A liquid-crystal display is a flat panel display, electronic visual display, that is used to light modulating properties of liquid crystals. Do not emit the light directly liquid crystals.LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

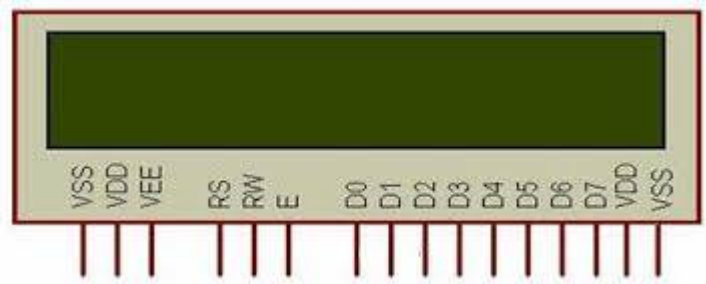

Fig 7: LCD Display

III.SOFTWARE REQUIREMENTS

The software which is used in this technique is shown below.

- Real time operating system
- MP Lab v8.63
- Proteus8.
- Embedded C

A.Real time operating system

Commercial Operating system to form a continuous of functionality, performance and price. These operating systems are ranges from those that offer a basic pre-emptive scheduler, a few key system services, are usually inexpensive, come with modifiable source code and are royalty free to those more sophisticated operating systems that typically include a lot of functionality beyond the basic scheduler and can be quite expensive. With such a variety of operating systems and features to choose from, it can be difficult to decide which is best for application of embedded. Many developers make their decision based on performance, functionality with their choice of compiler, debugger and other development tools. Many of use integrated development environments thatenable them to develop over a wider range of RTOSs.

B.PROTEUS 8

Proteus 8 is a Virtual System Modelling that combines circuit simulation, animated components and microprocessor models to co-simulate the complete microcontroller based designs. This is the perfect tool for to test their microcontroller designs before constructing a physical prototype in real time. This type of program allows users to interact with the design using on-screen indicators and/or LED and LCD displays and, if attached to the PC, switches and buttons.One of the main components of Proteus 8 is the Circuit Simulation-product that uses a SPICE3f5 analogue simulator kernel combined with an event-driven digital simulator that allow users to utilize any SPICE model by any manufacturer. Proteus 8 VSM comes with extensive debugging features, including breakpoints, single stepping and variable display for a neat design prior to hardware prototyping.

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IV.RESULTS

A.HARDWARE OUTPUT

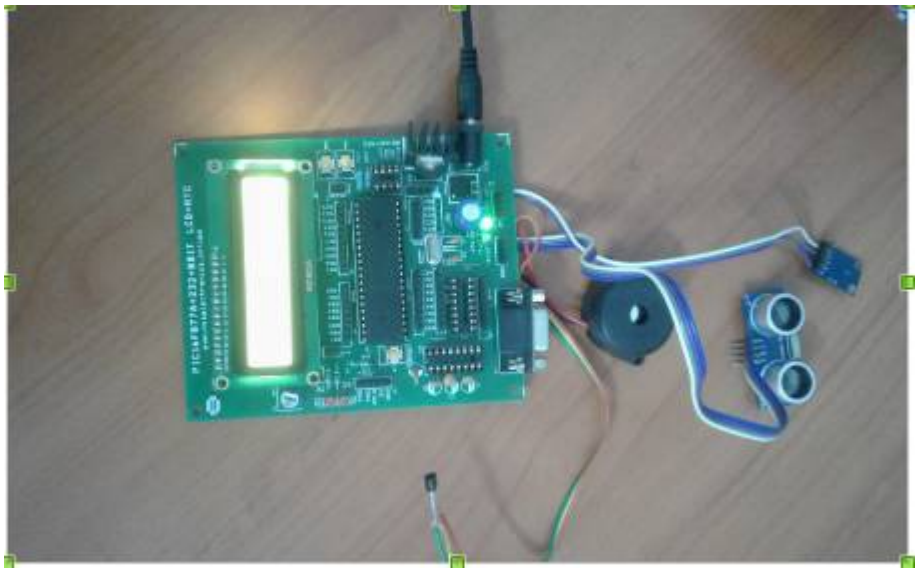

Fig 8: Hardware output

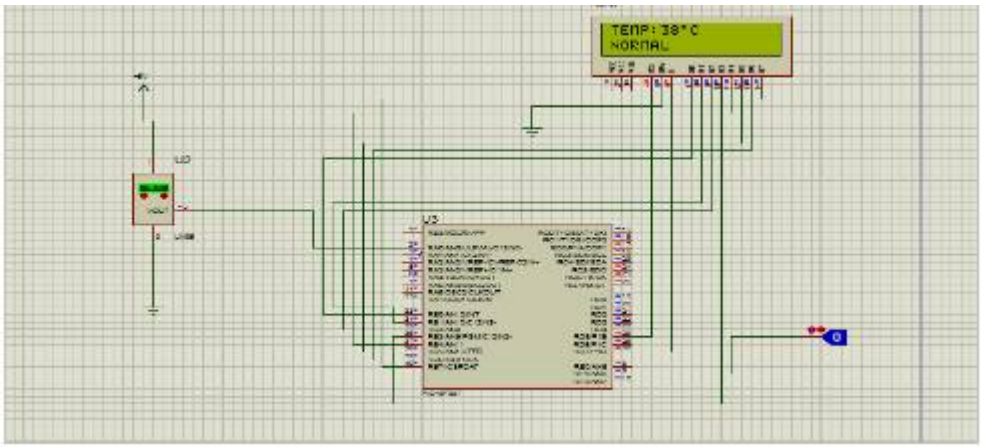

Fig 9: Simulation output

V. CONCLUSION

This system is made by using Temperature sensor, MEMS sensor and ultrasonic sensor. Temperature sensor sensing the patient body temperature (normal,abnormal,critical) which shows on the LCD display. MEMS sensor gives output according to the patient motion . Ultrasonic sensor measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the object. This paper is to discuss and design a Bluetooth-based wireless transmission of acquired biomedical signals. Wireless technologies are increasing prominence in medical applications due to their flexibilities and ease of installation, configuration and usage.

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VI. FUTURE SCOPE

Patients who are fallen, abnormal of temperature & leaving the room, Bluetooth TX transmits the information from patient's module & receives in Bluetooth RX shows in the monitor section. Working persons taken care of those patients immediately known by alarm & details of the patients in the monitor.

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