RF Based Wireless Patient Monitoring System

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Abstract— Modern wireless system is mainly based on new technologies to transmit the data such as patient physiological parameters for a required distance. Monitoring patients wirelessly has become a new technology in medical field. Since the mobile phones which are wireless means for communicating over long distances and low in cost are afforded by all and are used for transmitting data. The purpose of this project is wireless transfer of data via the Bluetooth technology. The vital sign parameters of the body such as temperature, heart rate and respiration rate are measured and transmitted to the doctors. This helps them to monitor the patient continuously. An alarm system is provided so that the patient is attended by the nearest person in case of emergencies.

Key words: Wireless System, Bluetooth Technology, Vital Sign Parameters, Continuous Monitoring, Alarm, Remote Patients, Cost Efficient

I. INTRODUCTION

Nowadays most of the patient monitoring system is operated in offline mode. But in today's world the use of resources is veneration [1]. So the use of wireless technology is enhanced to meet the need of patient continuously. This wireless patient monitoring may save the time of doctors and the continuous monitoring of patients can also achieved even when he is attending other patients.

Patient monitoring is mainly for monitoring vital sign parameters like blood pressure, heart rate, respiration rate etc., for continuous monitoring.

The body temperature of patients can be varied according to patient body conditions and according to the environment where they present. Normal body temperature is about 37°C or 98.6 F[2]. This can be varied simultaneously or according to their body conditions also according to the climatic changes and based on seasons the temperature will get varied.

Here LM35 IC is used for sensing the temperature. It is an integrated circuit sensor used to measure temperature with an electrical proportional to the temperature (in °C).

Heart beat is also another vital sign parameter. Heartbeat varies from new born babies to old age people. Neurotransmitters are also one of the reasons for increase or reduction in heartbeat [3]. Heart rate mainly refers to contraction and relaxation of heart muscles per unit time [4].

Respiratory rate of a normal healthy person is 12 – 20 breaths per minute and respiration rate are the number of breathes taken by a person per minute [5]. Below 12 or over 25 BPM is considered as abnormal condition. This abnormal condition may be caused due to fever, illness and with other medical conditions. When respiratory rate is measured is also important to more than a person has difficulty for breathing [6].

This paper describes the design of low cost RF based wireless patient monitoring system. With the help of sensors various vital sign parameters are continuously measured. These parameters are directed towards the microcontroller and then displayed on a LCD screen. This real time measured parameters are transmitted to doctors via the Bluetooth technology. If the measured parameters show any abnormality then the alarm goes on and the doctor can immediately attend the patient.

II. EXISTING SYSTEM

The existing system uses the idea of measuring the vital sign parameters of the patient such as the temperature, heart rate and respiration rate. These parameters are measured and transmitted via the zigbee or GSM technology which is helpful to monitor the patient.

III. PROPOSED SYSTEM

In this paper the vital sign parameters of the patient are measured and transmitted using the Bluetooth technology. This makes the system cost efficient. Here the data can be sent continuously so that the doctors can attend the patient immediately in case of any emergency. This advantage is not seen in the zigbee and GSM technology. The data cannot be sent to phones using zigbee technology and the continuous monitoring cannot be achieved by GSM technology. This also has an alarm system so that goes on in case of abnormalities.

IV. BLOCK DIAGRAM

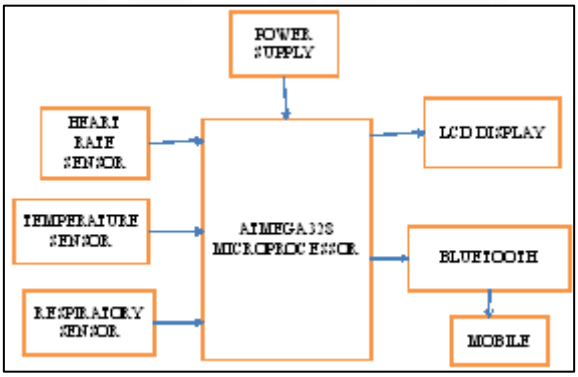

Fig.1: Block diagram of transmitting and receiving system

A. ATMEGA-328

The Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32k of flash memory 1k of EEPROM and 2k of internal 3RAM[7] .It has 14 digital input pins of which 6-pins can be used as PWM and 6-analog input pins. Atmega 328 has internal calibrated crystal oscillator. This is to provide a clock pulse for the atmega chip. A clock pulse is needed for synchronization so that communication can occur in synchrony between the atmega chip and a device that is connected to[8]. The operating voltage is about 1.5 – 5.5v and speed grade is about 0-20MHz at 1.8-5.5v[9].

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The atmega 328 chip has analog to digital convertor inside of it. This must be present or else chip cannot interpret the analog signals[10].

Architecture is more code efficient while achieving throughputs up to 10 times faster than conventional CISE microcontroller. It contains the features such as general purpose working registers, three flexible timer or counters with compare modes, internal and external interrupts, a serial programmable USART, an SPI serial pork, 6 channel 10-bit ADC, a programmable watchdog a timer with internal oscillator and five software selectable power saving modes. This device is manufacture using atmega high density non-volatile memory technology, and it is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications. The atmega328 AVR is supported with a full suite of program and system development tools including: c-compilers, macro assemblers, program debugger and simulators, in-circuit emulators and evaluation kits[11].

B. Liquid Crystal Display

LCD is finding wide spread use replacing LEDs because it has ability to display numbers, characters and graphics. The ease of programming 8-bit LCD mode for characters and graphics. The model used here is 8-bit LCD mode which is low price and it is based on HD44780 microcontroller and can display messages in two lines with 16 characters each[12]. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition it is possible to display symbols that user makes up on its own[13].

There are pins along one side of the small printer board used for connection to the microcontroller. There are total of 14-pins marked with numbers.

LCD screen consist of two lines with 16 characters each. Each consists of 5x7 dot matrix[14]. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. When used during operating, a resister for current limitation should be used[15].

C. Alarm

An alarm gives an audible or visual warning about a problem or conditions.

D. Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances in the range of 2400 – 2483.5MHz. Bluetooth uses a radio technology called frequency-hopping spread spectrum[16]. Here an internal notebook Bluetooth card which is about (14x36x4mm) is used.

E. Temperature Sensor

The temperature sensor used is LM35 IC. It is an integrator circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature[17]. The temperature can be measured more accurately with it than using a thermistor.

F. Heart Beat Sensor

Heart beat sensor is to give digital output of heartbeat. This digital output can be connected to microcontroller directly to measure the beats per minute (BPM). Its working voltage is about +5v DC[18]. It is compact in size. Here heart rate used is 555 heart rate sensors.

G. Respiratory Sensor

Here NSK85 respiratory sensor is used. This sensor measures breathing rate and relative depth of abdominal or thoracic breathing. If this sensor is available in an elastic band it can be worn over the clothing and usually placed over the abdomen [19].

V. CIRCUIT DIAGRAM

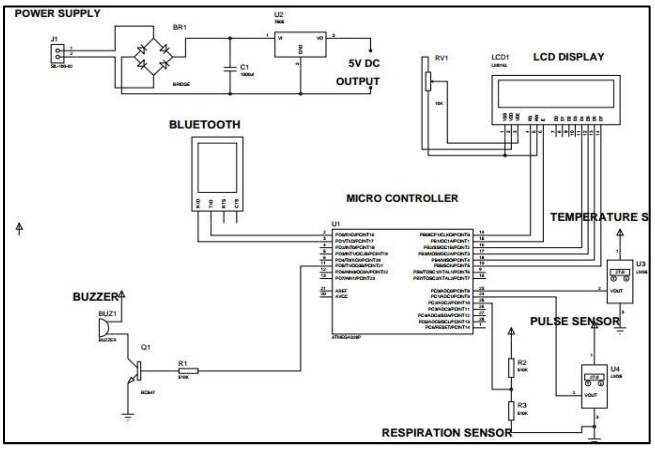

Fig. 2: Circuit diagram of the system

We know that most of the electronic devices can be operated in DC power such that we have to convert alternative current into direct current. This process is commonly called as rectification. For this a circuit is designed.

Initially a 230v power supply is given to the bridge rectifier which converts it into direct current. Here bridge rectifier used is (4x1N4007) and the converted direct current is given to the voltage regulator (v27805) which provides a constant voltage to the device so that output provided to entire circuit is about 5v because all the circuits and devices withstand the power between 1.5 – 5.5v.

This power supply is given to the pin7 of the Atmega 328 microcontroller which controls all the units and produces an appropriate output. The sensors such as temperature, heart rate and respiratory sensor produces analog outputs. The output of these sensors is given to the analog input pins such as (pin23, pin24, pin25) of the microcontroller. The microcontroller has an analog to digital convertor inside of it to interpret the analog signals. In order to function the ADC the power supply is given to (pin20, pin22) the converted digital signal is given to the Bluetooth, buzzer, and to the LCD display. Pin 2 is connected to RXD pin of Bluetooth to receive the data and pin3 is connected to TXD pin of Bluetooth to transmit the data.D5, D6, D7 pin of the LCD screen is connected to (pin16, pin17, pin18) of the microcontroller to display the digital data. The pin are connected to D5 D6 D7 because they receive data is high bit data. Digital pin14 and pin15 of the microcontroller are connected to the (pin4, pin6) of the LCD screen to interpret the data and transferring the data from controller to LCD respectively.

Power supply for LCD screenings given through (pin1 and pin2).Pin3 is used to control the contrast but contrast depends upon amount of power supplied to LCD screen. So in order to supply a limited amount of current to LCD screen it is connected to 10k ohm resistor.

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VI. RESULT

A. Hardware Output

A low cost wireless patient monitoring system has been designed which measures all the vital sign parameters of the patient such as temperature, heart rate and respiration rate. The measured parameters are transmitted via the Bluetooth system. When the abnormal readings are obtained then the alarm goes on.

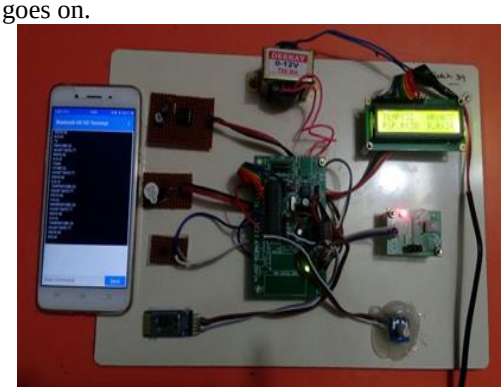

Fig. 3: Output of the system

B. Software Output

The Bluetooth technology is used to transmit data to doctor. The transmitted data is received over the mobile phone.

When the output produced above or below normal then alarm will goes on.

Sl. No	Parameters	Low	High
1.	Temperature(^{o}c)	36.5	39
2.	Heart rate (BPM)	70	75
3.	Respiration rate(BPM)	12	25

Table 1: Software Output

VII. APPLICATIONS

1) It can be used as a home based patient monitoring system.
2) The patients in remote areas can also be monitored with ease.
3) Low cost system that can be afforded by everyone.

VIII. CONCLUSION

Low cost RF based patient monitoring system was designed. The first and foremost function of the system is to monitor vital sign parameters such as temperature, heart rate, and respiration rate of the patient continuously. These measured parameters were displayed in the LCD screen at the same time these data will be transmitted to the doctor's mobile continuously the monitor the patient by obtaining real –time data. All the doctors are health care professionals cannot monitor the ICU or CCU patients 24x7hours. In case of emergency or any abnormal condition of the patient the doctors can continuously monitor them by receiving the data via the Bluetooth. This can also be applied to the home based Patient monitoring. The data can be continuously received on mobile phones via Bluetooth. This helps the physician in charge to monitor the patient.

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