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A System for Patient Monitoring Based on GSM Technology

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ABSTRACT:
Patient monitoring system using GSM technology concentrates on basic medical check-up system including heart rate measure, breath rate and temperature. In this paper, we present the implementation of hardware and interface it with embedded C language programming. The microcontroller used is AT89S52. There is a sensor for temperature measurement, breath rate and heart rate. All three give input to ADC which converts the signal into digital signal and passes to the microcontroller which works at 5V. The result will be displayed on the LCD screen and simultaneously sent to the user and the doctor using GSM technology. An alarm/Buzzer system is also introduced which will alert on either high or low results.

KEYWORDS: GSM, AT89S52, ADC, LCD, LED, Photodiode.

1. INTRODUCTION:

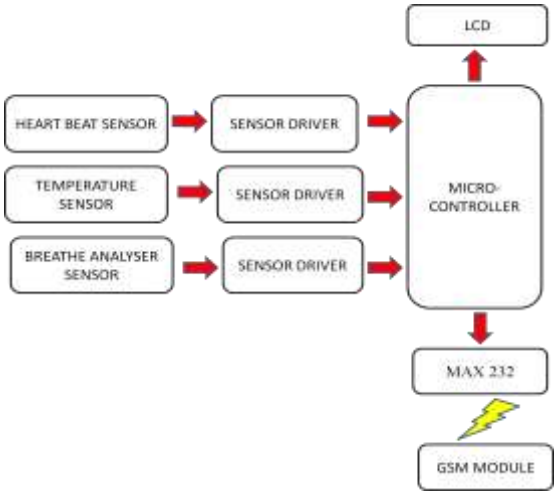
A. MOTIVATION:

In a highly populated country like India which is still a developing nation in many aspects, the field of medicine though may boast of complex surgeries and robotic assistance but the basic medical assistance is yet to reach every individual in any terrain of the country. It is also important for a layman to be aware of his basic body statistics on a regular basis. The basic motto of this project is to provide medical assistance in even most of the deserted parts of the country and that is why there was a huge emphasis for this project to be portable and user friendly. This whole monitoring system can be used by any individual who is initially trained and guided about the system as the end result will reach a medical practitioner.

B. PATIENT MONITORING SYSTEM:

The patient monitoring system consists of three basic body statistical measurements namely heart rate, temperature and breath rate which can be considered as primary aspects of knowing the wellbeing of a human body. The system is smartly designed with the main aim of keeping it portable with an easy circuit design. There is a temperature sensor for the measurement of body temperature in the unit Fahrenheit. There is a IR-Photodiode pair involving an interrupt (thermocol ball) for the breath rate count and a LED Photodiode pair used for counting the heart beat rate. Logically the interrupt signal for breath rate and the signal from the temperature sensor will be fed to an Analog to Digital Converter which will convert the signal in digital form and pass it to the microcontroller. The result will be displayed on the LED working at 5V and simultaneously send to a mobile operator using GSM Module. A MAX 232 is an integrated circuit. It is a dual transmitter receiver which is used to interface GSM module. The GSM module is based on Time Division Multiplexing (TDMA) which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone.

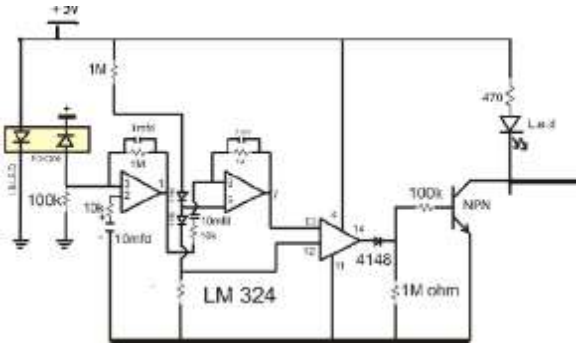
2. BASIC WORKING:



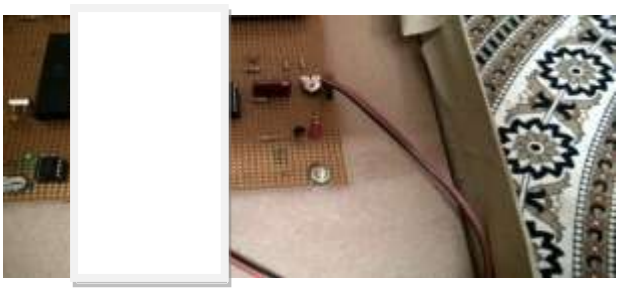
The basic working can be explained using the block diagram of the module. There are three types of sensors used namely, heartbeat sensor, temperature sensor and the breathing analyzer sensor. All the sensors hence pass on the data to their respective sensor drivers which pass on the output to the microcontroller. The output from the microcontroller on one side is displayed at the LCD screen on the other side through MAX 232 sent to a GSM module from where it can be sent as a text message to the registered mobile number.

3. PATIENT MONITORING:

A. HEARTBEAT MEASUREMENT:



The heartbeat measurement circuit is the most complex circuit and uses a method called pulse oximetry are used. A pulse oximeter measures the amount of oxygen in a patient's blood by sensing the amount of light absorbed by the blood in capillaries under the skin. In a typical device, a sensing probe is attached to the patient's finger. On one side of the probe is a pair of Light- Emitting Diodes (LEDs), and on the other side is a photodiode. One of the LEDs produces red light, and the other produces infrared light. Pulse oximetry depends on the optical characteristics of hemoglobin, the blood protein that carries oxygen. When hemoglobin is more highly oxygenated, it becomes more transmissive to red light and more absorptive to infrared light. When hemoglobin contains little oxygen, it becomes relatively more transmissive to infrared, and more absorptive to red light. This property means that by measuring the ratio of red light to infrared light passing through the patient's finger, the probe can produce a signal proportional to the amount of oxygen in the blood. In addition, the surge of blood on each heartbeat generates a signal representative of the patient's pulse rate. Since the output of the photodiode is low amplitude current, some signal conditioning must be applied before it can be used. Operational amplifier is an ideal choice for use in a resistor-feedback transimpedance amplifier configuration.



HEARTBEAT SENSING PROBE:

B.TEMPERATURE MEASUREMENT:

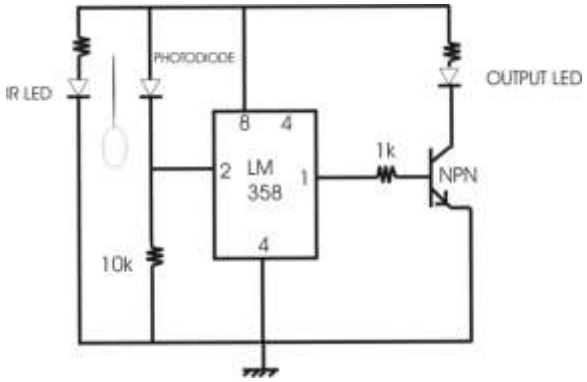
The temperature measurement can be done in various ways namely,

1. Using sensor LM335.
2. Using Thermistor
3.

THERMSITOR:

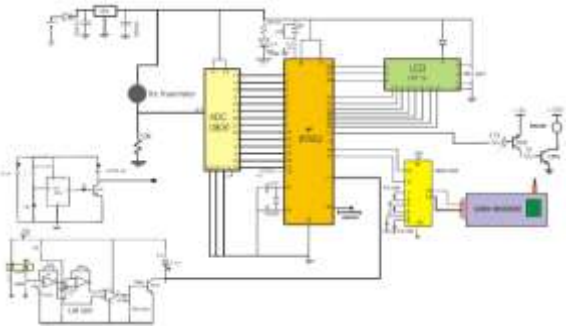
A thermistor is a temperature sensor constructed of semiconductor material that exhibits a large modification in resistance in proportion to a tiny low modification in temperature. They are very accurate and cost effective sensor measuring temperature. They are available in two types, Negative temperature coefficient (NTC) and Positive Temperature Coefficient (PTC), however NTC is used to measure temperature. The thermistors are least affected by the temperature of the surroundings.

C. BREATH RATE MEASUREMENT:



A tube is constructed with a IR-Photodiode pair on either side of the tube and a thermocol ball is installed in a pipe. Whenever an individual exhales or inhales the air an interrupt occurs. An IR sensor is basically a device which consists of a pair of an IR LED and a photodiode which are collectively called a photo-coupler or an opto-coupler. The IR LED emits IR radiation, reception and/or intensity of reception of which by the photodiode dictates the output of the sensor. Now when there is an opaque object like that of thermocol ball the light will not reach to the photodiode. The type of IR diode used is analog so the values sent will be in terms of voltage to the ADC which will send the digital data to the microcontroller.

BREATHING ANALYZER TUBE



CIRCUIT DIAGRAM OF THE PATIENT MONITORING SYSTEM USING GSM MODULE

4. MICROCONTROLLER AT89S52:

The AT89S52 is a low-power, high-performance 8-bit microcomputer with 4K bytes of Flash Programmable and Erasable Read Only Memory (PEROM). The AT89S52 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port, and on-chip oscillator and clock circuitry.

The microcontroller is working at 5V supply. It has a clock cycle of 30second. A buzzer is attached to it. In case any value goes above or below the threshold set the buzzer will go off.

5. GSM MODULE:

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator.

The GSM module is connected to the microcontroller via MAX232. The MAX232 is an integrated circuit that converts signals from a serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

CIRCUIT OF THE WORKING MODEL:

6.CONCLUSION:

Hence, as discussed above we can check the vital statistics of any human body using "Patient Monitoring system using GSM technology". We can carry out check-ups in faraway places, remote villages and deserted islands so that medical assistance can be provided to those in need. This system is also useful to be provided in trains, buses, restaurants and schools. It can give precise results and medical care to the one in need.

7. REFERENCES

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