

Patient Monitoring System Using GSM Technology

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Abstract: In this fast pace of life, it is difficult for people to be constantly available for their near ones who might need them while they are suffering from a disease or physical disorder. So also constant monitoring of the patient’s body parameters such as temperature, pulse rate, sugar level etc. becomes difficult. Hence to remove human error and to lessen the burden of monitoring patient’s health from doctor’s head, this paper presents the methodology for monitoring patients remotely using GSM network and Very Large Scale Integration (VLSI) technology. Patient monitoring systems measure physiological characteristics either continuously or at regular intervals of time.

Keywords: GSM network, Patient Monitoring System, VLSI.

INTRODUCTION

Recently, the health care sensors are playing a vital role in hospitals. The patient monitoring systems is one of the major improvements because of its advanced technology. So we are here, just connecting the temperature sensor and heartbeat sensor so that simultaneously we can monitor the patient’s condition and hence ruling out the use of the thermometer and other devices to check the condition of the patient. This project describes the design of a simple, microcontroller based heart rate & body temperature measuring device with LCD output. Heart rate of the subject is measured from the index finger using IRD (Infra Red Device sensors and the rate is then averaged and displayed on a text based LCD). Also Saline Level is measured continuously for different levels. The device alarms when the heart beat & the body temperature exceed the provided threshold value. This threshold value is defined by the programmer at the time of programming the microcontroller. The threshold value given for the project is as 20 to 120 pulses per minute for heart beat indication & 18°C to 38°C for temperature. This information i.e. the Heart Rate & the Body Temperature and saline level is then transmitted wirelessly to the doctor which in not in the vicinity of the patient through GSM technique. The sensors measure the information and transmit it through GSM Modem on the same frequency as on which cell phones work.

BLOCK DIAGRAM

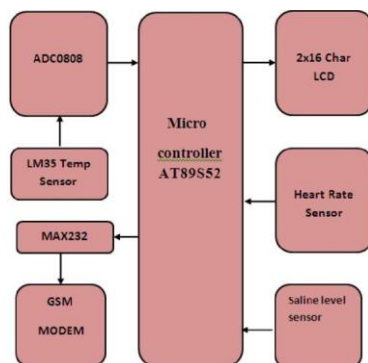


Figure 1: [Block Diagram]

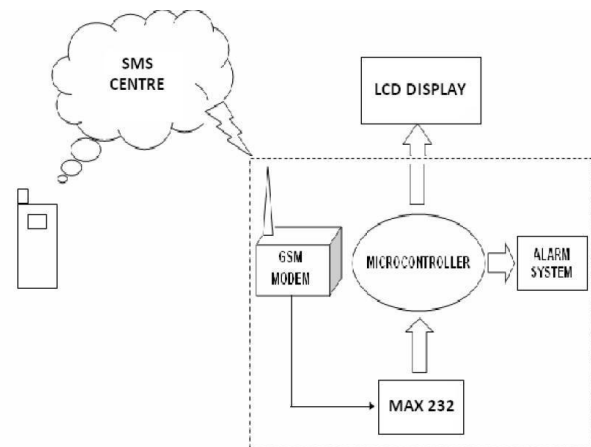


Figure 2: [Schematic Diagram]

ELEMENTS OF PMS

1. LM35 Temperature Sensor

The LM35 series are precision integrated-circuit LM35 temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 sensor thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55 to $+150^\circ\text{C}$ temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35’s low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only $60\ \mu\text{A}$ from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a -55 to $+150^\circ\text{C}$ temperature range, while the LM35C sensor is rated for a -40 to $+110^\circ\text{C}$ range (-10° with improved accuracy). The

LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D sensor is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

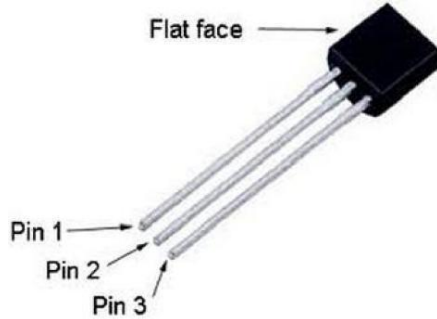


Figure 3. Temperature sensor

TABLE1. Specifications

Parameters	Value
Supply Voltage (minimum)	4V
Quiescent Current	56 uA
Temperature (minimum)	-40,-55,0 Deg Celsius
Temperature (maximum)	100,110,150 Deg Celsius

2. Heartbeat sensor

The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified through an amplifier which outputs analog voltage between 0 to +5V logic level signal. It works on the principle of light modulation by blood flow through finger at each pulse.



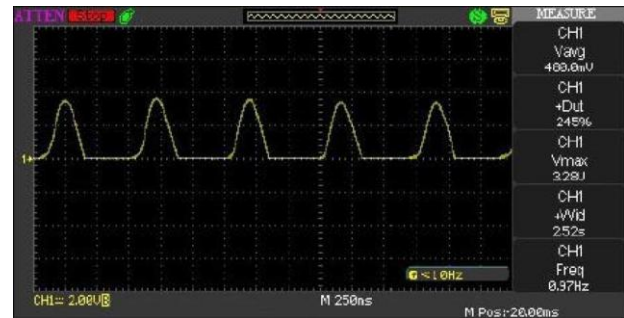
Figure 4: Heart Rate Sensor

TABLE2. Specifications

Parameter	Value
Operating Voltage	+5V DC Regulated
Operating Current	100 mA
Output Data Level	5V TTL Level

Heart Beat Detection	Analog Out
Light Source	660 nm super red LED
Detector	Photo Diode

Output:



2.1 Applications of Heartbeat sensor

- Digital Heart Rate monitor
- Patient Monitoring System
- Bio-Feedback control of robotics and applications

4. MAX232

The MAX 232 is a dual RS-232 receiver/transmitter that meets all EAI RS232c specifications while using only a +5v power supply. It has 2 onboard charge pump voltage converter which generate +10v and -10v power supplies from a single 5v power supply. It has four level translators, two of which are RS232 transmitters that convert TTL\CMOS input levels into +9V RS232 outputs. The other two level translators are RS232 receiver that converts RS232 inputs to 5V. TTL\CMOS output level. It is a serial communicating device it is used to the convert TTL Logic (Transistor Transistor Logic) to CMOS (Complementary Metal-Oxide Semiconductor) Logic.

The MAX232 device is a dual driver/receiver that includes a capacitive voltage generator to supply EIA-232 voltage levels from a single 5-V supply. Each receiver converts EIA-232 inputs to 5-V TTL\CMOS levels. These receivers have a typical threshold of 1.3 V and a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL\CMOS input levels into EIA-232 levels.

The MAX232 is characterized for operation from 0°C to 70°C. The MAX232I is characterized for operation from -40°C to 85°C.

3.1 Features of MAX 232

Operates With Single 5-V Power Supply

Two Drivers and Two Receivers

- ±30-V Input Levels
- Low Supply Current 8 mA typical
- Designed to be Interchangeable with
- Maxim MAX232
- Battery-Powered Systems

5. 555 Timer

555 is a very commonly used IC for generating accurate timing pulses. It is an 8pin timer IC and has mainly two modes of operation: monostable and a stable. In monostable mode time delay of the pulses can be precisely

controlled by an external resistor and a capacitor whereas in astable mode the frequency & duty cycle are controlled by two external resistors and a capacitor. 555 is very commonly used for generating time delays and pulses.

4.1 Features of 555

- Direct replacement for SE555/NE555
- Timing from microseconds through hours
- Operates in both astable and monostable modes
- Adjustable duty cycle
- Output can source or sink 200 mA
- Output and supply TTL compatible
- Temperature stability better than 0.005% per °C
- Normally on and normally off output
- Available in 8-pin MSOP package

4.2 555 Applications

- Precision timing
- Pulse generation
- Sequential timing
- Time delay generation

5. GSM module

GSM module is used to establish communication between a computer and a GSM system. GSM module consists of a GSM modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer. GSM MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM network. It requires aSIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

A GSM MODEM can perform the following operations:

- Receive, send or delete SMS messages in a SIM.
- Read, add, search phonebook entries of the SIM
- Make, Receive, or reject a voice call.

5.1 GSM module features

- Status of Modem Indicated by LED
- Simple to Use & Low Cost
- On board switching type power supply regulator
- RS232 output

CONCLUSION

This paper reviews the product Patient Monitoring System Using GSM which is innovated to enable remote monitoring of patients.

The key objective of developing patient monitoring systems is to reduce health care costs by reducing emergency room and physician office visits, hospitalizations, and diagnostic testing procedures. Many new wireless transmission protocols and technologies adapt easily to new applications. Some technologies and protocols most applicable to RPM include:

Bluetooth
Zigbee
Wifi
Wimax

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