Remote Patient Monitoring Using GSM

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Abstract— **The basic idea behind this project is, it implies that whether a person is at home, on a trip, or at his work place, he/she can stay connected with the doctor 24×7 and doctor can take immediate action if necessary. The Patient monitoring system for doctors provides solution for this. It continuously provides information to doctors about the patient's body temperature. As used in hospital the same system can be used for a person who is not under the continuous observation of doctor. The objective of this project is to design and implement a reliable, cheap, low powered, non-intrusive, and accurate system that can be worn on a regular basis and monitors the vital signs and displays the output to the doctor's cell phone. The normal body temperature of a healthy and resting human being is stated to be at 98.4°F for 37°C. Though the body temperature measured on an individual can vary, a healthy human body can maintain a fairly consistent body temperature that is around the mark of 37°C.An indication is** sent to the doctor's mobile phone when the body temperature is above 38°C.

1 INTRODUCTION

The main aim of the project is to monitor the patients remotely with the help of GSM technology. This project is designed with the help of Embedded Technology. This project is designed with the Microcontroller (PIC 16F877A), HD44780U LCD, LM 35 Temperature Sensor, Heart beat Sensor, SIM 300 GSM module and Buzzer. The temperature and heart beat sensor takes the reading from the human body and stores it in the microcontroller. The microcontroller will compare the two parameters with the ideal parameters, if some fluctuations are noticed, a SMS indicating "PATIENT ABNORMAL" with the body temperature value and also a call is immediately sent to the doctor's mobile phone.

1.1 BLOCK DIAGRAM:

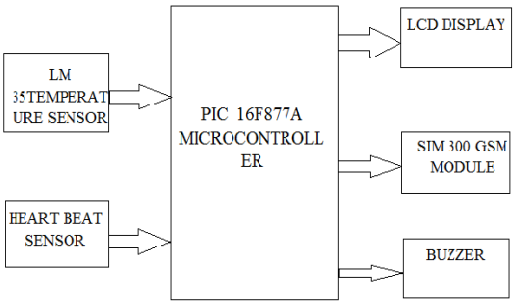

Fig 1.1 Overall Block Diagram

1.2 BLOCK DIAGRAM DESCRIPTION:

The block diagram consists of microcontroller, GSM modem, Temperature sensor, Heart beat sensor, LCD display and Buzzer. The microcontroller acts as a control function and memory organization. The gsm is for messaging service. The temperature and heart beat sensor is to sense the temperature and heart beat from the human body.

1.3 CIRCUIT DIAGRAM:

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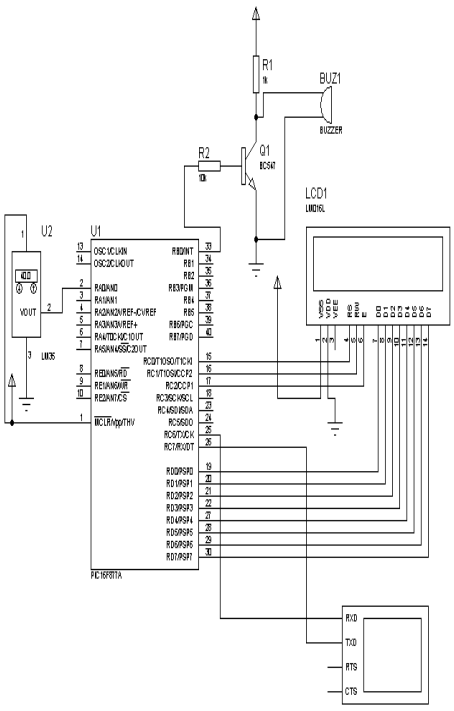

Fig 1.3 Overall Circuit Diagram

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1.4 CIRCUIT DIAGRAM DESCRIPTION:

1.5 POWER SUPPLY UNIT :

The AC voltage, typically 220v rms is connected to a transformer which steps that AC voltage down to the level of desired DC output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting voltage usually has some ripples or AC voltage variations.

1.6 MICROCONTROLLER UNIT :

A single chip microcontroller is obtained by integrating all the components of a microcontroller in one IC package. Hence apart from CPU such a single chip microcomputer will therefore contain its own clock generator and EEPROM and I/O ports on the same chip. It may also have other features like timer/counter, USART, PWM, A/D etc., Microcontroller is a tiny chip. It has inbuilt memory, timer, ports and other additional features. There are several companies manufacturing the microcontrollers like Intel, Motorola and Microchip.

1.7 TEMPERATURE SENSOR UNIT:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 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 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range.

1.8 LCD DISPLAY UNIT:

The liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver.

1.9 GSM MODEM:

GSM (Global System for Mobile communications) is the most popular standard for mobile phones in the world. Its promoter, the GSM Association, estimates that 80% of the global mobile market uses the standard. GSM is used by over 3billion people across more than 212 countries and territories. Its ubiquity makes international roaming very common between mobile phone operators, enabling subscribers to use their phones in many parts of the world. GSM differs from its predecessors in that both signalling and speech channels are digital, and thus is considered a second generation (2G) mobile phone system.

2 .EXISTING METHOD:

There are some shortcomings present in existing system. Currently there are number of health monitoring systems available for the ICU patients which can be used only when the patient is on bed. This system is wired everywhere. The patient is monitored in ICU and the data transferred to the PC is wired. Such systems become difficult where the distance between System and PC is more. The available systems are huge in size. Regular monitoring of patient is not possible once he/she is discharged from hospitals. These systems cannot be used at individual level. The other problem with these systems is that it is not capable of transmitting data continuously also range limitations of different wireless technologies used in the systems. So to overcome these limitations of systems we have proposed a system.

2.1PROPOSED METHOD:

The system which we proposed would not only help in monitoring the patient when he is in the bed but also when he is not in the bed i.e. when he is mobile. Such a system would constantly monitor important body parameters like Temperature and heartbeat and would compare it against a predetermined value set and if these values cross a particular limit it would automatically alert the doctor and relatives of the patient via a SMS. In such case the patient will get a very quick medical help and also would save time and energy of the relatives who would not be with them all the time.

2.2 CIRCUIT DIAGRAM:

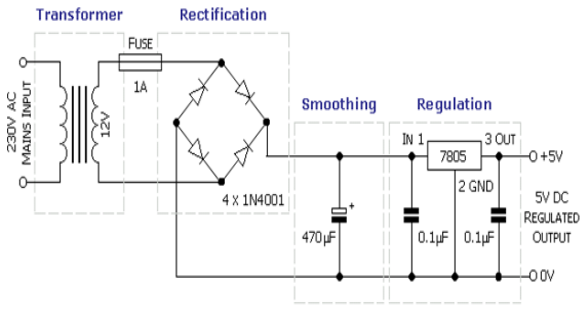

Fig 2.2 Circuit Diagram of Power Supply

2.3 WORKING PRINCIPLE:

The AC voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripples or ac voltage variations. A regulator circuit removes the ripples and remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

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2.4 BLOCK DIAGRAM:

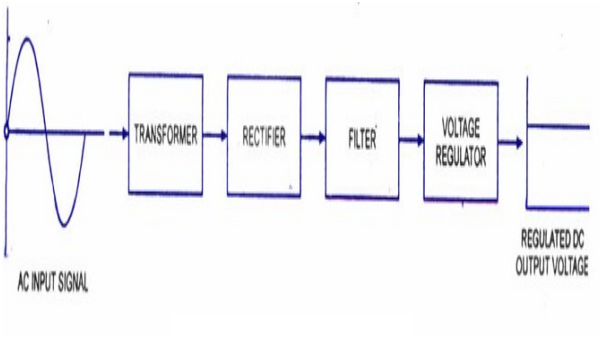

Fig 2.4 : Block diagram of power supply

2.5 TRANSFORMER:

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level.

2.6 BRIDGE RECTIFIER:

When four diodes are connected as shown in the figure 2.2,the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

2.7 VOLTAGE REGULATORS:

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC.IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

MICROCONTROLLER

2.8 DESCRIPTION:

PIC 16F877A:

PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on. The PIC 16F877 features all the components which modern microcontrollers normally have. The figure of a PIC16F877 chip is shown below.

Fig 2.8: PIC 16F877A

2.9 FEATURES:

- 1000000 times erase/write cycle data EEPROM memory.
- Self programmable under software control.
- In-circuit serial programming and in-circuit debugging capability.
- Single 5V,DC supply for circuit serial programming
- WDT with its own RC oscillator for reliable operation.
- Programmable code protection.
- Power saving sleep modes.
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3 MEMORY ORGANIZATION:

The memory of a PIC 16F877 chip is divided into 3 sections. They are

- Program memory
- Data memory and
- Data EEPROM

3.1 PROGRAM MEMORY:

Program memory contains the programs that are written by the user. The program counter (PC) executes these stored commands one by one. Usually PIC16F877 devices have a 13 bit wide program counter that is capable of addressing 8K×14 bit program memory space. This memory is primarily used for storing the programs that are written (burned) to be used by the PIC. These devices also have 8K*14 bits of flash memory that can be electrically erasable /reprogrammed. Each time we write a new program to the controller, we must delete the old one at that time.

Program counters (PC) is used to keep the track of the program execution by holding the address of the current instruction. The counter is automatically incremented to the next instruction during the current instruction execution.

The PIC16F87XA family has an 8-level deep x 13-bit wide hardware stack. The stack space is not a part of either program or data space and the stack pointers are not readable or writable. In the PIC microcontrollers, this is a special block of RAM memory used only for this purpose.

Each time the main program execution starts at address 0000 – Reset Vector. The address 0004 is “reserved” for the “interrupt service routine” (ISR).

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TEMPERATURE SENSOR

3.2 DESCRIPTION:

LM 35:

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 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 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range.. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA 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°C temperature range. The LM35 series is available packaged in hermetic TO-46 transistor packages

Fig 3.2 LM 35 Temperature Sensor

HEART BEAT SENSOR

3.4 DESCRIPTION:

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through Finger . As the heart forces blood through the blood vessels in the Finger, the amount of blood in the Finger changes with time. The sensor shines a light lobe (small High Bright LED) through the ear and measures the light that is transmitted to LDR. The signal is amplified, inverted and filtered, in the Circuit.

Fig 3.4Heart beat sensor

GSM MODULE

3.5 DEFINITION:

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would system operate at 900 MHz.

3.6 GSM NETWORK:

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The GSM network is divided into three major systems

- The Switching System (SS)
- The Base Station System (BSS)
- The Operation and Support System (OSS)

The basic GSM network elements are shown in the figure

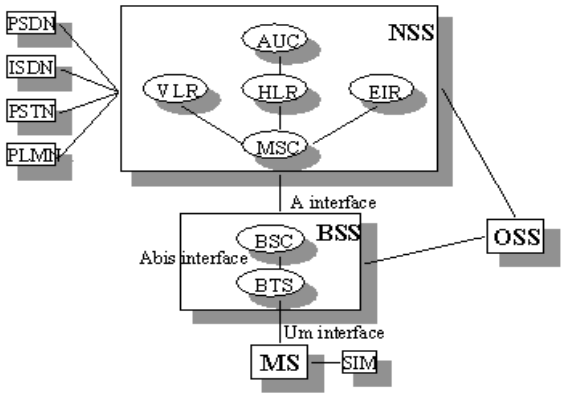

Fig 3.6 GSM Network elements

3.7 GSM MODEM :

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card/PCMCIA card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC card/PCMCIA card is designed for use with a laptop computer. It should be inserted into one of the PC Card/PCMIA card slots of a laptop computer. Like a GSM mobile phone, a GSM Modem requires a SIM card from a wireless carrier in order to operate.Computers use AT commands to control modems. Both GSM modems and dial up modem support a common set of standard AT commands. You can use a GSM modem just like a dial up modem. In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards

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LCD DISPLAY

3.8 DESCRIPTION:

The liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver.

A single HD44780U can display up to one 8-character line or two 8-character lines.

CONCLUSION

Remote monitoring system has made possible a new generation of noninvasive, unobtrusive personal medical monitors applicable during abnormal activities. There are many ongoing researches on remote patient monitoring system using GSM and the main purpose behind these researches is to make this system more compact, easily available at affordable price and to include as many parameters as possible required for heart rate monitoring. New technologies could also enhance the performance of the final project.The system can be further improved in several aspects. Once the system requirement have been clearly defined, the hardware can be optimized, especially regarding its size, weight and consumption.Together with clinical analyses, the protocols to optimize the system performance should be established. New technology such as Bluetooth, GPRS and UMTS could also enhance the performance of the final product Furthermore works in progress to develop and integrate a real time multichannel mobile telemedicine system capable of simultaneously transmitting medical data such as ECG, Non Invasive Blood Pressure (NIBP) and SpO2 applying Bluetooth and GPRS technologies could be done, to make the system more flexible.

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We wish to acknowledge with thanks the excellent encouragement given by the management of our college. We wish to express our hearty thanks to the Principal of our college and HOD. We are committed to place our heartfelt thanks to all teaching supporting staff members, lab technicians and friends, and all the noble hearts that gave us immense encouragement towards the bestowing the gifts of life on us and also for providing us the necessary help through his lovely creation in this endeavor of us.

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M.Punitha did her Bachelor of Engineering in Electronics and Communication Engineering at Vickram college of Engineering, Sivaganga and doing Master of Engineering in VLSI Design at Sri Shakthi Institute of Engineering and Technology, Coimbatore, India. Her research interests include Digital Electronics. Presented a paper in International Conference on "VLSI Implementation of Visual Feature Extraction.

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