Remote Health Care Monitoring Unit for Elderly Patient Using GSM Technology

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Abstract- With the increase in the number of senior citizens and chronic diseases, the number of elderly patients who need constant assistance has increased. One key point of all critical care for elderly patient is the continuous monitoring of their vital signs. So, we can use the purpose of Remote health care monitoring unit for elderly patient using GSM technology is used to identify the emergency of the patient. In this monitoring unit, we can monitor the range of heart beat, blood pressure, body temperature, oxygen level and glucose trips indicator. Here, heart beat is measured by electrodes, blood pressure is measured by pressure sensor, body temperature is measured by thermistor. The flash technology of PIC microcontroller is used to store the data for transmission. The data can be transmitted by GSM and received by GPS. It provides flexible and powerful patient surveillance through wearable devices at anytime and anywhere. The increasing feasibility and convenience of monitoring unit have several significant challenges for healthcare providers, policy makers, hospitals and patients.

Index Terms- GPS, GSM, PIC microcontroller, sensors

I. INTRODUCTION

Electrocardiography (ECG) is the recording of the electrical activity of the heart. Traditionally this is in the form of a transthoracic (across the thorax or chest) interpretation of the electrical activity of the heart over a period of time, as detected by electrodes attached to the surface of the skin and recorded or displayed by a device external to the body. The recording produced by this noninvasive procedure is termed an electrocardiogram (also ECG or EKG). It is possible to record ECGs invasively using an implantable loop recorder. Pulse oximeter is a noninvasive monitoring technique used to estimate the measurement of arterial oxygen saturation (SpO2) of hemoglobin. Oxygen saturation is an indicator of the percentage of hemoglobin saturated with oxygen at the time of the measurement. The reading, obtained through pulse oximeter, uses a light sensor containing two sources of light (red and infrared) that are absorbed by hemoglobin and transmitted through tissues to a photodetector. The amount of light transmitted through the tissue is then converted to a digital value representing the percentage of hemoglobin saturated with oxygen.

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver. The micro controller is the system on chip which is a small computer, which runs using embedded C program. The controller gets the inputs from the ECG and pulse oximeter and compare with the set value if ECG and oximeter value is exceed the set value then micro controller send the message to the particular mobile number. Micro controller continuously monitoring the GPS value and send message to that location also. Hitachi HD44780 LCD controller is one of the most common dot matrix liquid crystal display (LCD) display controllers available. Hitachi developed the microcontroller specifically to drive alphanumeric LCD display with a simple interface that could be connected to a general purpose microcontroller. LCD displays the current status of the ECG value, oximeter value, pressure value, temperature value and also GPS value. GSM is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation digital cellular networks used by mobile phones. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The pressure is measured by diaphragm which is one type of transducer. When pressure is applied, the diaphragm is moving in the forward side. The diaphragm moving is depends on the pressure. So it generates the voltage pulse depends on the movement of diaphragm. A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

II. EXISTING SYSTEM

In the present monitoring system, we can monitor the range of heart beat, oxygen value by GPS and GSM technology. In the emergency situation, doctors cannot able to measure the blood pressure, body temperature and glucose trips indicator. To overcome the disadvantage of existing system, remote health care monitoring unit for elderly patient using GSM technology is

used to provide the blood pressure, body temperature and glucose trips indicator.

III. PROPOSED SYSTEM

Remote health care monitoring unit for elderly patient using GSM technology is used to reduce the critical situation of the patient. The objective of this project is the dangerous condition of the patient will be informed to the relatives through sending a message. Heart beat is measured by electrodes, blood pressure is measured by pressure sensor, body temperature is measured by thermistor. The flash technology of PIC microcontroller is used to store the data for transmission. The data can be transmitted by GSM and received by GPS.
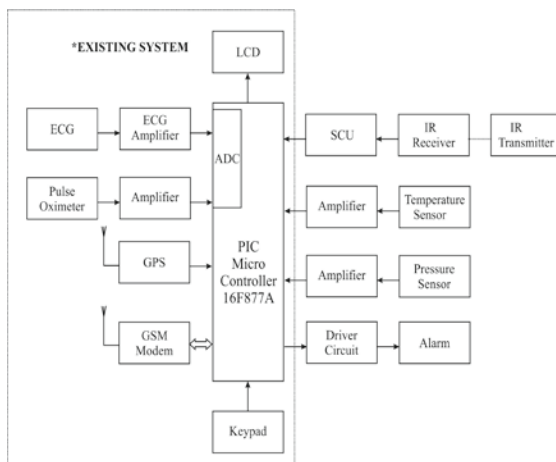

Fig . Block diagram

IV. HARDWARE DESCRIPTION

➢ PIC microcontroller
➢ ECG
➢ Pulse oximeter
➢ LCD
➢ Keypad
➢ IR sensor
➢ Temperature sensor
➢ Pressure sensor
➢ Alarm

PIC MICROCONTROLLER:

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip.

➢ The CPU core
➢ Memory(both ROM and RAM)
➢ Some parallel digital i/o

Microcontrollers will combine other devices such as:
➢ A timer module to allow the microcontroller to perform tasks for certain time periods.

➢ A serial i/o port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.
➢ An ADC to allow the microcontroller to accept analogue input data for processing.

Microcontrollers are:

➢ Smaller in size
➢ Consumes less power
➢ Inexpensive

Micro controller is a stand alone unit ,which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory. The heart of the microcontroller is the CPU core. In the past, this has traditionally been based on a 8-bit microprocessor unit. For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 microcontroller devices. In the recent years, microcontrollers have been developed around specifically designed CPU cores, for example the microchip PIC range of microcontrollers.

INTRODUCTION TO PIC :

The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

PIC (16F877):

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in PIC16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

PIC START PLUS PROGRAMMER:

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The PIC start plus development system includes PIC start plus development programmer and mplab. The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under mplab provides for full interactive control over the programmer.

ECG:

An electrocardiogram (ECG or EKG, abbreviated from the German *Electrocardiogram*) is a graphic produced by an electrocardiograph, which records the electrical activity of the heart over time. The electrocardiogram does not assess the contractility of the heart. However, it can give a rough indication of increased or decreased contractility.

PULSE OXIMETER:

Pulse oximeter is a noninvasive monitoring technique used to estimate the measurement of arterial oxygen saturation (SpO2) of hemoglobin. Oxygen saturation is an indicator of the percentage of hemoglobin saturated with oxygen at the time of the measurement. The reading, obtained through pulse oximeter, uses a light sensor containing two sources of light (red and infrared) that are absorbed by hemoglobin and transmitted through tissues to a photo detector. The amount of light transmitted through the tissue is then converted to a digital value representing the percentage of hemoglobin saturated with oxygen. . The use of the oximeter's two wavelengths of light is predicated on the following: red and near infrared light readily penetrate tissue, while blue, green, yellow and longer wavelength infrared light are absorbed by tissue and water. Light emitting diodes (LEDs), which reliably emit a specific wavelength of light are widely available at the red and near infrared wavelengths, to use as light sources. Each pulse oximeter probe contains LEDs, which emit two wavelengths of light, (red and near infrared) through a cutaneous vascular bed. The probe is commonly placed on the digits or earlobe. A photo detector on the other side measures the intensity of transmitted light at each wavelength from which oxygen saturation is derived, based on human volunteer data stored in the memory of the oximeter. Red and infrared light transmitted through a tissue bed are measured using the finger or ear as a cuvette containing haemoglobin. Modern pulse oximeters consist of a peripheral probe together with a microprocessor unit displaying a waveform, the oxygen saturation and the pulse rate. The probe is placed on the digit, earlobe or nose. Within the probe are two LEDs, one in the visible red spectrum (660nm) and the other in the infrared spectrum (940nm). The beams of light pass through the tissues to the photo detector. During passage through the tissues some light is absorbed by blood and soft tissues depending on the concentration of haemoglobin. The amount of light absorption at each frequency depends upon the degree of oxygenation of haemoglobin within the tissues.

LCD:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

KEYPAD:

A group of keys in a single printed circuit board is call key pad. These keypads are classified into two types.
1) Key pad
2) Matrix keypad

1. KEYPAD

In a keypad it has one or more than one key placed in a PCB. And all the keys are commonly grounded. This is the main difference between normal keypad and matrix keypad. Matrix keypad has maximum 8 number of keys, more than 8 keys cannot be connected because it's not a efficient one. If we need more than 8 keys means, then only we can operate it a matrix keypad.
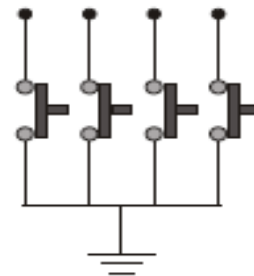

Fig: Keypad

2. MATRIX KEYPAD:

Above same keys are connected in a matrix principle it is called as a matrix key pad. This matrix key pad is working with the help of software. Otherwise it cannot work. This key pad is normally 3X3, 4X3, 4X4 like that
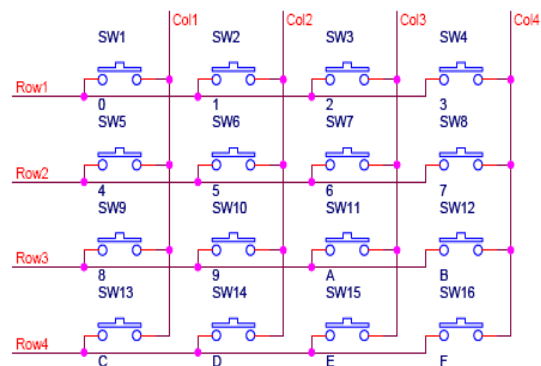

Fig: Matrix keypad

IR SENSOR:

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator. The comparator is constructed with LM 358 operational amplifier. In the comparator circuit the reference voltage is given to Non inverting

input terminal. The inverting input terminal is connected IR receiver. When interrupt the IR rays between the IR transmitter and receiver, the IR receiver is not conducting. So the comparator Non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of 0V. This voltage is given to microcontroller and LED will OFF. When IR transmitter passes the rays to receiver, the IR receiver is conducting due to that non inverting input voltage is higher than inverting input. Now the comparator output is +5Volt so the output is given to microcontroller so LED will glow. This circuit is mainly used to for Line tracking and length calculators etc.
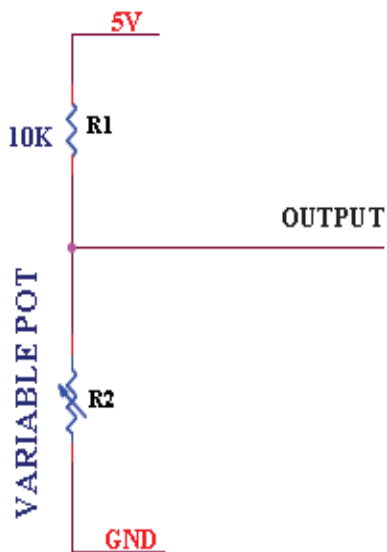
TEMPERATURE SENSOR:

In this circuit, the thermistor is used to measure the temperature. Thermistor is nothing but temperature sensitive resistor. There are two type of thermistor available such as positive temperature co-efficient and negative temperature co-efficient. Here we are using negative temperature co-efficient in which the resistance value is decreased when the temperature is increased .

Potential divider form:

$$V_{out} = V_{in} \frac{R_2}{(R_1 + R_2)}$$

POTENTIAL DIVIDER FORM

If the R1 and R2 value is equal means the output is half of the Vcc supply. In this circuit output is a variable one. So the output is depending upon the R2 resistance value. Resistance value will be varied depend upon the temperature level. Temperature varied means the resistance value also varied. If resistance value increased means output also increased. The resistance value and output is a directly proportional one. Then the final voltage is given to ADC for convert the analog signal to digital signal. Then the corresponding digital signal is taken to process in microcontroller. The ADC value will increase if the temperature increased. We can measure the temperature only with the help of any controller or processor.

ALARM:

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). The circuit is designed to control the buzzer. The buzzer ON and OFF is controlled by switching transistor (BC 547). The buzzer is connected in the transistor collector terminal. When high pulse (5 Volt) signal is given to base of the transistor, the transistor is conducting and closes the collector and emitter terminal. Hence the buzzer was already getting a volt power supply in the positive terminal. At that time the buzzer gets the negative supply. So the circuit will close and the Buzzer will ON. When low pulse is given to base of transistor, it will turn OFF. So buzzer will also OFF because it doesn't get negative power supply. This type of transistor arrangement is called driver circuit. We cannot connect any load to the Micro-controller output terminals. That is why we need a driver circuit
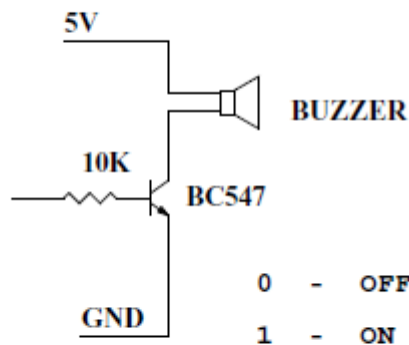
ALARM CIRCUIT

Fig: Alarm circuit

PRESSURE SENSOR:

The Smart Pressure Device SPD series of pressure sensors are silicon based and encapsulated in modified plastic Dual In Line packages, to accommodate six pins for through-board printed circuit mounting. The sensors come in two distinct types: Gauge and absolute. The gauge type merely measures the pressure with respect to the atmospheric pressure. The absolute type contains a reference vacuum chamber, which is formed on the die during manufacturing. The output voltages of both types are proportional to the pressure that is measured. Various pressure ranges are available. On request, other ranges and encapsulations can be supplied.

V. CONCLUSION

This project is used to reduce the critical position of the patient by identifies the range of heart beat, blood pressure, body temperature, oxygen level and glucose trips indicator. It can supervise a patient without being continuously connected to a health-centre. It can reduce the workload of medical staff; communication costs and motivates the patient's self-care. In which situation, the patient can be caused by disease that can be immediately inform to the relatives. And also, it can be used to send the current status of the patient to the relatives. It can be used by any number of patients. It can be used in hospitals, home and ambulances etc.

ACKNOWLEDGMENT

REFERENCES

[1] "Intra-Body Temperature Monitoring using a Biofeedback Solution"-João M. L. P. Caldeira, José A. F. Moutinho, Binod Vaidya, Pascal Lorenz, and Joel J. P. C. Rodrigues.

[2] "Daily Monitoring of Asthmatics by Means of Individual Devices for Exhaled Breath Temperature Measurement" Todor A. Popov, Tanya Z. Kralimarkova, Cvetelina T. Lazarova, Christo T. Tzachev, Vasil D. Dimitrov, and Jas Gill. IEEE Sensors journal, vol.10, no.1, jan 2010.

[3] "A Mobile Monitoring System of Blood Pressure" for Underserved in China by Information and Communication Technology Service Jiehui Jiang, Member, IEEE, Zhuangzhi Yan, Member, IEEE, Jun Shi, Prabhu Kandachar, and Adinda Freudenthal. IEEE transactions on information technology in biomedicine, vol.14, no.3,may 2010.

[4] "Design of Blood Pressure Measurement with a Health Management System for the Aged" Chi-Huang Hung, Ying-Wen Bai and Ren-Yi Tsai.

[5] "Remote Monitoring System of ECG and Body Temperature Signals" J.P.Tello, O.Manjarrés, M. Quijano, A. Blanco, F. Varona and M. Manrique. IEEE latin America transactions, vol.11,no.1, feb 2013.

[6] "Monitoring patients via a secure and mobile healthcare system"-Yonglin Ren, Richard Werner Nelem Pazzi and Azzedine Boukerche.

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