Wireless patient monitoring and accidental crisis management system

Meena Chavan, Shrey Mishra, Tulika Sharma, Bincy Thomas

Meena Chavan DEPARTMENT OF ELECTRONICS ENGINEERING BVUCOE, PUNE

Shrey Mishra DEPARTMENT OF ELECTRONICS ENGINEERING BVUCOE, PUNE

Tulika Sharma DEPARTMENT OF ELECTRONICS ENGINEERING BVUCOE, PUNE

Bincy Thomas   DEPARTMENT OF ELECTRONICS ENGINEERING BVUCOE, PUNE

Prof. Mrs Meena Chavan, DEPARTMENT OF ELECTRONICS ENGINEERING, BVUCOEP, MAHARASTRA, INDIA

Abstract – *The current method of monitoring patients in hospitals keeps patients in a state of immobility and make them stick to their beds and which can be uncomfortable for patients to bear. The number of nurses in the workforce is also expected to decline by 2025, causing strain in an environment where excess pressure can lead to unacceptable and unfortunate accidents happening to their patients. The goal of this project was to produce a wireless patient monitoring system that could allow patients to be mobile in their environment. The developed system includes a heartbeat sensor for sensing the*

Pulses and a co2 sensor to measure CO2 concentration as well as a temperature and humidity sensor to keep watch of the patient's temperature and humidity of environment. This paper presents the development of Arduino based system for wireless pulse, CO2 concentration, humidity and temperature monitoring. In India, many patients are dying because of heart attacks and reason behind that they are not getting timely and proper help. To give them proper timely and proper help first we want a continuous monitoring of patient health. The fixed monitoring system can be used only when the patient is on bed and these systems are huge and only available in the hospitals in ICU. This system is developed for home use by patients that are not in a critical condition but need to be constant or periodically monitored by clinician or family.

***Key Words*: Heartbeat sensor, CO2 concentration, Temperature sensor, humidity sensor, home care, alertness alarms, low cost, feasible, mobile, simple circuitry.**

1. INTRODUCTION

It is very difficult to keep track on abnormalities in heartbeat count for patient itself manually. The average heartbeat per minute for 25-year old ranges between 140-170 beats per minute while for a 60-year old it is somewhat between 115-140 beats per minute and body temperature is 37 degree Celsius or 98.6 Fahrenheit. Patients are not well versed with manual treatment which doctors normally use for tracking the count of heartbeat, so there must be some device which would help patientand its family to keep track on their health by themselves. There are various instruments available in market to keep track on internal body changes. But there are many limitations regarding their maintenance due their heavy cost, size of instruments, ,complexity and mobility of patients. Wireless patient monitoring system is designed to solve some of these problems. To overcome these limitations a device is used to keep track on heartbeat count of patient which should be easy to use, portable, light weighted, small sized and easily mobile etc. so that it give freedom of mobility for patient. The devices which can be carried everywhere to keep track on patient's health. This device that is a heartbeat sensor would help them to keep track on heartbeat counts of a patient and check for any abnormalities and defects. If any variable changes *takes place, it is notified. This notification would help to take an appropriate and proper action at an instance of a time. This would save*

patients from the future health problems which may arise due to such complications. This is going to help patient's family and doctor to take appropriate action within the permissible time period.

1.1 Components used in wireless patient monitoring and accidental crisis management system

Arduino UNO:

The Arduino Uno is a microcontroller board which works on the ATmega328 model . It has 14 digital I/O pheripheral pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic A resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything is utilized to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or a external battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 programmed as a USB-to-serial converter..

Summary
Microcontroller ATmega328
Operating Voltage 5V
Input Voltage (recommended) 7-12V

Input Voltage (limits) 6-20V
Digital I/O Pins 14 (of which 6 provide PWM output)
Analog Input Pins 6
DC Current per I/O Pin 40 mA
DC Current for 3.3V Pin 50 mA
Flash Memory 32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM 2 KB (ATmega328)
EEPROM 1 KB (ATmega328)
Clock Speed 16 MHz

Liquid Crystal Display (LCD):

A 16x4 LCD display is very basic version and 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.

### Heart Beat / Pulse sensor using LM358

The heartbeat sensor is based and depends on the principle of photo plethysmography. It measures the change in amount of intensity and density of blood through any organ of the body generally fingers which causes a change in the light density and its intensity through that organ. In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood quantity or volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

Temperature sensor LM35

A temperature sensor is a kind of RTD or a thermocouple that gathers the temperature from a specific source and alters the collected information into understandable type for an apparatus or an observer. Temperature sensors are used in several applications namely HV system and AC system

environmental controls, medical devices, food processing units, defence operations, chemical handling, controlling systems, automotive under the open monitoring and etc.
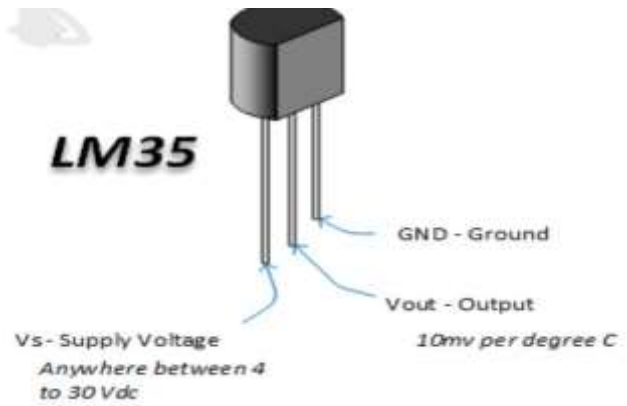

Accelerometer

It is a kind of positional sensors which is used to detect the positional sensitivity of the patient. The **accelerometer**, a dynamic sensor capable of a vast range of sensing helps in detecting the exact alignment of the patient and its positional outcomes. Accelorometers give position in refrence to all the axes i.e; X,Y,Z . these coordinates are used to detect the exact position of the patient with respect to the ground or bed. It can be used as-

- an method to detect the velocity and position;

- As a sensor of inclination, tilting , or orientation in 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s^2);

- As a measure of vibration or impact (shock) sensor to detect the fall of the patient.

Wi-Fi module

The Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller or processor access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. They come with a complete TCP/IP stack and a user-friendly application layer that ensures a simple and effective way to use the modules.. The latest models also supports other compilers and runtime implementation of programming language optimized to run in resource-constrained systems.

environments.
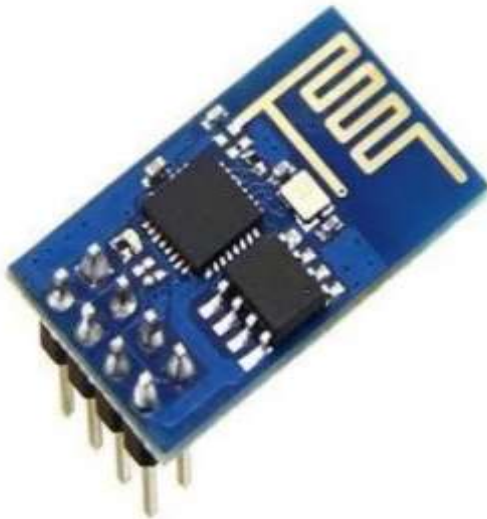
GSM module kit

GSM module is used to maintain communication between a computer and a GSM system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables much higher data transmission rate. GSM module is used to establish communication between a computer and a GSM system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM module consists of a GSM modem assembled together with power supply circuit and other external communication interfaces (like RS-232, UART) for computer. GSM MODEM is a class of wireless MODEM devices that are specially designed for communication of a computer with the GSM and GPRS network. It requires a SIM (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/GPRS MODEM can perform the following operations:

1.   Receive, &send or delete SMS messages in a SIM.
2.   Read, &add, search phonebook entries of the SIM.
*3.   Make,& Receive, or reject a voice call.*

1.2 Working

When user can power on the circuit , all the LEDs on PCBs starts glowing, indicating that   circuit is working properly. The use of arduino or processors in every field even we can use it in the design and fabrication of biomedical equipments. A little example is here. The processor is here used to develop a heart beat , co2 concentration, temperature , humidity and position monitoring system. By placing your finger in between a LED and photo resistance.Here there is a use of the industrial temperature sensor i.e. LM 35 which gives us room temperature in mC. That temperature is displayed on the LCD as shown in figure . Figure Implemented circuit in working condition Figure displays Temperature display on LCD Figure Heartbeat measurement there is a cavity for measurement of the heartbeat, which consist of a arrangement of LED and LDR. By placing your finger in between a LED and LDR, we can detect the pulses of heartor heart rate of hman body., the analog voltages are further processed with an operational amplifier LM 358, and this chip has two built in OPAMPs. Result is displayed on the LCD and is also conveyed on application through wi-fi modules.This collected data is transmitted using GSM module. This data is received at the receiver section using same module. 5.3 Use of USB port of laptop Here there is a use of the laptop to show the results, so that GSM module is connected with the USB.

Fig-1: Block Diagram of wireless monitoring and crisis management system.
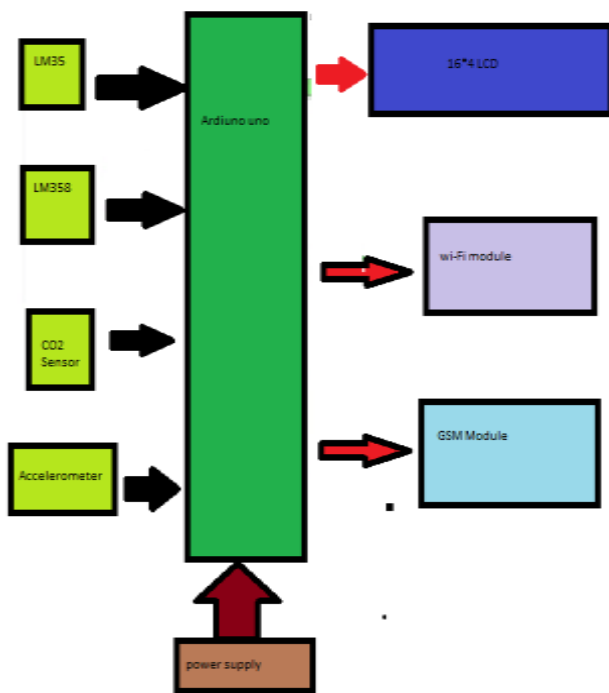
2. Advantages and Applications

Applications of the automatic wireless health monitoring system mainly include the following.

- The wireless health monitoring system is utilised to communicate the data from the transmitter section to receiver section wirelessly.
- The proposed system mainly focuses on the situation where the doctors and patients are at the distant location and it is very important to give the entire details about the heartbeat , humidity, co2 concentration and the temperature of the patient to the doctor. Also, it is used for conveying current humidity situations to the doctor.

Advantages includes the following.

- Bridging up the gap between the patients and the doctor.
- It is best to be used in rural areas for multipurposes,so that all the current situations can be easily conveyed to the appropriate authority with in permissible time period.
- Design and operation of this device is very simple.
- It gives a good performance when we utilise it with accurate and compact sensors.

3. FUTURE SCOPE

- In addition to this system, we can also provide more than one numbers so that more than one user can receive emergency message. According to availability of sensors or development in biomedical trend more parameters can be sensed and monitored which will drastically improve the efficiency of the wireless monitoring system in biomedical field.

- Besides this if made and considered particular changes in this project, it can also be applicable for acknowledging the students with the fastest mode of information about certain notices like edhitch.

4. CONCLUSION

We have analyzed the wireless patient health monitoring system of temperature and heartbeat of humans using arduino, GSM, and SMS. Any abnormalities in health conditions are informed via SMS to the indicated mobile number through GSM. The hardware is implemented and the output is studied.

5.REFERENCES

[1] Goutam Abinash ,” Wireless Heartbeat Monitoring System Using sensors IEEE 802.15.4 Standard”, 2011 Second International Conference on Emerging Applications of Information Technology.

[2] Kenneth j., The 8051 Microcontroller ARCHITECTURE, PROGRAMMING and APPLICATIONS, WEST PUBLISHING COMPANY. Page 138-189

[3] Michael Pont, Embedded and modified C, Edition 2004, Addison Wesley, and Page: 59-87,219

[4] R..Jain, Digital Electronics, Tata McGraw-Hill

[5] Ramakant\ Gayakwad, Op-Amps and Linear Integrated Circuits, 3rd Edition,Prentice-Hall, Page:242, 456, 489.

[6] Dave Gruneiger, Programming Visual Basic.Net, First Edition 2001, O'Reilly Publication, ISBN: 0-596-00089-6, 467 Pages

[7] Evangel0s Petroutsos, Mark Ridgeway, Mastering Microsoft Visual Basic 2008, First Edition, Wiley Publishing, ISBN: 978-0-4701-5.