GSM based Patient Monitoring System using Sensors

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Abstract

Ongoing patient health checking framework with remote sensor system using delicate registering is an innovative concept that has been already introduced in developed country in recent years. Body Area network is implemented by using compact sensors that gather and assess body parameter and development. The device gives few assistant capacities that satisfy the living request of patients. What's more it uses different sort of sensors to obtain ceaseless key signs of patients counting heart rate and body temperature. Transmission of these patients' records over web is done by GSM module to web server where database is stored. Moreover, it will produce a prediction on patient's wellbeing condition based on summation of all records of patient. Generated report will be shown on web application. With the assistance of web application both doctor and patient can have real time communication. The prototype has been effectively implemented where data has been obtained and shown. The purpose to build the prototype is to help people in developing countries as they still lack access to medical technology and proper diagnosis and treatment in proper time. In medical field, electronics industry gaining to develop medical equipment at very high advanced level techniques, they use electronics system every time for patient caring. Patient monitoring system can be defined as the system used for monitoring physiological signals that includes the parameters like electro-cardio graph, respiratory signals, invasive and non-invasive blood pressure, body temperature, gases related parameters, etc. This paper proposes to develop medical field and provide another patient caring facility to medical service for patient monitoring.

Keywords: GSM, UNO, Patient Monitoring, Temperature, Pulse

I. INTRODUCTION

Advancement in medical technologies have made rapid changes in e-health care system. An innovative and effective e-health monitor model with wireless technology can be a great help for the people of developing countries. The technology provide assistance physicians to better diagnose and treat patients not physically presence on spot as sometimes it's crucial to provide remedy or treat patients who are unluckily away from well treatment. In modern era advanced medical technology effectively contributing in our personal lives. This assists on improving and saving countless lives all around the world. Medical technology is a broad field where innovation plays a crucial role in sustaining health.

The existing medical environment in developing countries allows patients to appear physically for regular health checkup or patient needs to get admitted for continuous observation. The system is non-flexible and time consuming. Today remote sensor system allows patients to control their daily lifestyle constantly from anywhere at any places. Hence, to support real time patient health monitoring, in this work we propose constant health monitor of a person by transmitting one's body temperature and heart rate's data utilizing GSM module to a web server that is accessible to both doctor and patient. Potential utilization of remote e-health framework is useful for regular checkup, crisis alert to avoid further critical situation based on patient's constant record.

According to American Heart Association treatment within first 12 minutes can bring positive rate about 45% to 60%.Here it is mentionable that the proposed design is aimed for everyone including patients to keep their regular health condition's record and create a flexible environment between doctor and patient by checking persistent well-being of ones.

II. LITERATURE REVIEW

Since technology has reached in every corner of our day to day life, it is not an exception that it has entered in to the medical field too. The many work related to our proposed method have given us the confidence of being able to build a system for a better cause. Some of the works are discussed in the following: This paper, "Patient Health Monitoring Using Wireless Body Area Network" is proposed by Hsu Myat The and Hla Myo Tun, where they made a proposal of a health monitoring system which would take temperature and pulse rate of a patient and display it on an LCD screen. At the same time the data would be transmitted through Radio Frequency network to a PC or Laptop. From that PC or Laptop data is sent to a database to store. Their proposal includes the data transmission through sensor nodes which are built using transceivers. There will be one transceiver configured with one microcontroller at the patient end. Another one will be configured with another microcontroller and connected a PC/Laptop for a doctor to check.

The patient end part consists of a microcontroller which will receive data from a pulse sensor and Temperature sensor connected to it. The transceiver at this end will send data through the Radio Frequency network. In the LCD screen it will show the data received by the both sensors as well. On the other end the receiver (another transceiver) will receive the data sent by the sender node. Since the microcontroller is configured with the PC, with the help of a GUI it stores the data in the database. A Graphical User Interface is designed in such a way that it will store the data after the microcontroller receives data of pulse and temperature sent by the transmission node. One of the main components from this proposal is Nrf24L01module. This module is most likely to be used in applications in order to communicate data wirelessly in ultra-low power Microcontroller is used to change the mode of this module's operation; Transmitter and Receiver. 2.

The temperature has been taken using temperature sensor LM35, the pulse sensor is used to take the pulse rate. Lastly, the sensor nodes which are the sender nodes as well and the receiver nodes are configured with ATmega328. Alongside ATmega328 in the base station Arduino is used as the programmer of the ATmega328 microcontrollers. So this paper has published a way of transmitting data of a patient through Radio Frequency network at a remote PC. That PC has to stay within a range of the RF network. Further, a doctor can access the data from that PC and monitor patient health. This paper, "Patient Monitoring And Alerting System By Using Gsm", is published by Shrenik Suresh Sarade, Nitish Anandrao Jadhav,Mahesh D. Bhambure.

This paper is based on a Patient Monitoring and Alerting System using GSM module. The main purpose of this paper is to build a system that will give an alert message to the doctor whenever there is seen abnormality in the patient vital signs. As vital signs a patient's heart rate and temperature is taken. Another data which they have taken is of a glucose level contained on a bottle. The paper is based on a microcontroller configured with GSM module and some sensors. Heart beat rate is measured using IRD sensors, where IRD refers to Infra Red Device. A threshold value will be set in the program by the programmer. If the value of heat beat at sensor or temperature sensor exceed the threshold values prescribed then the GSM module sends a text message to the doctor's phone number

The main task of the base station is mainly to coordinate two transmitting nodes by sending data request periodically. Base station includes an Arduino Uno microcontroller, a receiving ZigBee module and a WiFi module. They have designed the system where system will operate only within 30m range from base station. They have designed a website to display result using php and html. MySQL has been used to prepare database. The data from sensors have transmitted to website wirelessly through Wi-Fi shield. Whenever a new record is found, by refreshing it is displayed to the users. The server also keeps the previous data saved for any kind of future necessity. The paper also contained reliability by comparing accuracy using industrial sensors and experimental sensors where both gave almost similar result.

III. RESEARCH METHODOLOGY

A. Microcontroller Arduino

The UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power with a AC-to-DC adapter or battery to get started. Anyone can tinker with the UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

The board features an Atmel ATmega328 microcontroller operating at 5 V with 2Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins.

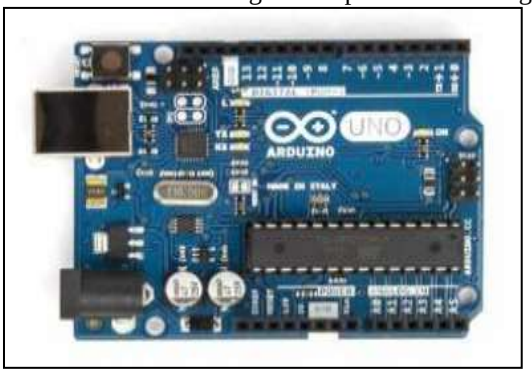

Fig. 1:

B. One Pulse Sensor

Pulse Sensor is a well-designed plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart rate data into their analysis.. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. It also includes an open-source monitoring app that graphs your pulse in real time.

The Pulse Sensor can be connected to arduino, or plugged into a bread board. The front of the sensor is the pretty side with the Heart logo. This is the side that makes contact with the skin. On the front you see a small round hole, which is where the LED shines through from the back, and there is also a little quare just under the LED. The square is an ambient light sensor, exactly like the one used in cellphones, tablets, and laptops, to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the light that bounces back. The back of the sensor is where the rest of the parts are mounted.

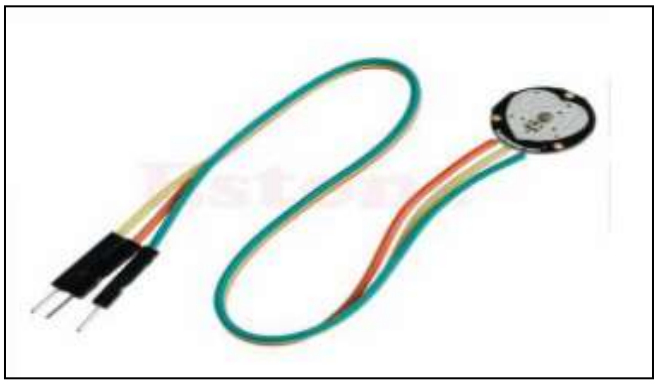

Fig. 2:

C. *GSM Module*

GSM (Global System for Mobile communications) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets.

It was first deployed in Finland in December 1991. As of 2014,it has become the global standard for mobile communications – with over 90% market share, operating in over 193 countries and territories. 2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony.

This expanded over time to include data communications, first by circuit-switched transport, then by packed data transport via GPRS(General Packet Radio Services) and EDGE(Enhanced Data rates for GSM Evolution, or EGPRS).Subsequently, the 3GPP developed third-generation (3G) UMT Standards, followed by fourth-generation (4G) LTE standards, which do not form part of the ETSI GSM standard. "GSM" is a trademark owned by the GSM association. It may also refer to the (initially) most common voice codec used full rate.

Fig. 3:

D. *Program for GSM*

```
void setup()
{
Serial.begin(9600);
}
void loop()
{
delay(1200);
Serial.print("AT");
delay(1200);
```

```
bool bOK = false;
while (Serial.available() > 0)
{
char inChar = (char)Serial.read();
bOK = true;
}
if(bOK)
{
index = 0;
Serial.println();
Serial.println("AT+CMGF=1"); // sets the SMS mode to text
delay(100);
delay(1200);
bool bOK = false;
while (Serial.available() > 0) {
//Serial.write(Serial.read());
char inChar = (char)Serial.read();
bOK = true;
}
if(bOK)
{
Serial.println();
Serial.print("AT+CMGS=1"); // send the SMS number
Serial.print("+918270547820");
Serial.println("hi");
delay(1000);
Serial.print("A new post is created by Zain."); // SMS body
delay(500);
Serial.write(0x1A);
Serial.write(0x0D);
Serial.write(0x0A);
}
}
}
```

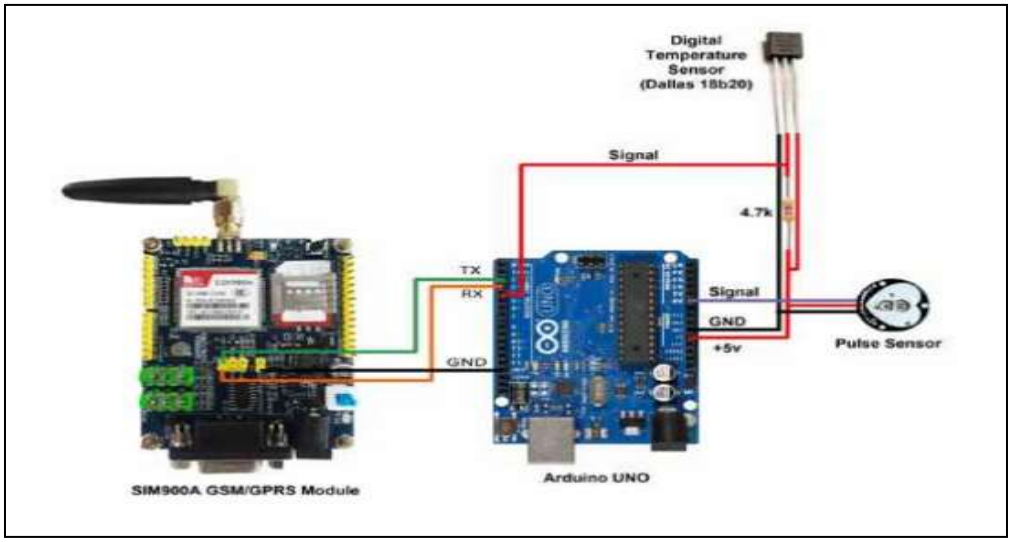

Fig. 4:

After building the whole circuit we test it, testing procedure is given in below, this paper should satisfy some features. Features to be tested as follows:

1) LM35 should detect temperature properly.
2) Pulse Sensor to detect Pulse.
3) Arduino should give required (according to program) outputs GSM Module.
4) GSM Module should send message to the given Mobile Number.

E. Testing Tools, Test Cases and Environment

For testing of the proposed system we require some tools, like to test Arduino program we require a software called Arduino IDE using this we can check the program that program is working properly or not. For hardware checking we require power supply and proper range of temperature. The proposed system requires three inputs. The inputs are as follows:

1) Power supply:

Power supply is the basic need of any electronic circuit. Here we use 5v dc battery to give power Arduino and sometimes we can give Power directly from the computer.

2) Temperature:

It uses Body temperature as input.

3) Pulse:

Pulse Sensor fits over a fingertip and uses the amount of infrared light reflected by the blood circulating inside to do just that. When the heart pumps, blood pressure rises sharply, and so does the amount of infrared light from the emitter that gets reflected back to the detector.

IV. CONCLUSION

The system that was proposed was a prototype system model. The main objective is to focus on health monitoring with wireless body area network. However we have successfully implemented the prototype and came up with an accurate result analysis. Basically wireless body area network is a vast area to expand. Implementing computer science on medical science has become a new era to develop. Introducing a health monitoring system with an application will really be helpful to people of developing country. The main motive is to create a real time communication between doctor and patient in an easier way. Though our model has implemented and tested but to introduce it in real life a lot more improvements and also equipment are needed. Actual goal of our system is fulfilled when we can use the health monitoring system and "healthpal" application in real life and people will be benefited. While building the entire system we had to face some challenges. The sensor is not so expensive and the output is reliable.

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