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Smart ICU Patient Monitoring System

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Abstract: Innovation assumes a significant job in healthcare for tangible gadgets as well as in correspondence, recording and display devices. It is essential to screen different clinical parameters and post-operational days. Consequently, the most recent pattern in Healthcare specialized strategy utilizing IoT (Internet of Things) is adjusted. Internet of Things fills in as an impetus for the medicinal services and assumes a noticeable job in a wide scope of healthcare applications. Right now it is utilized as an entryway to convey to the different sensors, for example, Temperature sensor, Heartbeat sensor, Oxygen sensor and, Blood Pressure sensor. The microcontroller gets the sensor information and sends it to the system through Wi-Fi and consequently gives constant observing of the social insurance parameters for specialists. If there should be an occurrence of any irregular perceptions the caution will be enacted at the assistance work area. The information can be viewed by the specialist at any time. The sensors are controlled by a battery. Since this is an exceptionally touchy framework the battery seepage ought to be viewed along these lines, the battery waste here is demonstrated by a caution. This framework is effective with low force utilization ability, simple arrangement, superior and time to time reaction.

Keywords: Blood Pressure sensor, Heartbeat sensor, Oxygen sensor and Temperature sensor**.**

I. INTRODUCTION

Pulse, Body Temperature, Oxygen and, Circulatory strain are the indispensable signs/body parameters that should be observed to get the data about the wellbeing/prosperity of an individual. Internet of Things (IoT) in these days discovering extraordinary use in applications like savvy homes, brilliant urban communities, shrewd retail, keen network, wearable's, associated wellbeing and so on. IoT is where the sensors or gadgets or articles present in the system can discuss either with one another or with different items in the system, and send the information over the internet without human obstruction. This diminishes the framework blunders as well as make the framework progressively effective and solid. The use of IoT in Smart ICU patient monitoring systems is seeking more attention. Currently, there is a need for a modernized approach. In the traditional approach, healthcare professionals play a major role. They need to visit the patient's ward for necessary diagnosis and advising. There are two basic problems associated with this approach. Firstly, the healthcare professionals must be present on the site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for some time. To solve these two problems, the patients are given knowledge and information about disease diagnosis and prevention. Secondly, a reliable and readily available Patient Monitoring System (PMS) is required. To improve the above condition, one can make use of technology in a smarter way. There is a major difference between SMS based patient health monitoring and IOT based patient monitoring system. In IOT based system, details of the patient health can be seen by many users. The reason behind this is that the data needs to be monitored by visiting a website or URL. Whereas, in GSM based patient monitoring, the health parameters are sent using GSM via SMS. A smart sensor-based Cloud Computing system is composed of several sensors based on top of the physical wireless sensors and data collection layer, which can receive and transmit data automatically and wirelessly by users based on application demand. The integration of the Internet of Things (IoT)[4], sensor technology and Cloud Computing is aimed at overcoming resource constraints as it enables different networks to cover large geographical areas so that they can be connected and used by several users at the same time when required. Or, the recent emergence of Cloud Computing and sensor awareness of infrastructure- architecture methods, service-oriented architecture, software delivery and, development models are also contributing factors to a smart environment. To provide real-time healthcare informatics, hospitals need some type of monitoring system to track objects and medical equipment in which security, efficiency and, safety are ensured, with reduced occupational risks. The key feature of the smart monitoring system is to provide identification of users and objects so that adequate service customization can be obtained. Accordingly, in this paper, a framework for integrating Cloud Computing technology and wireless sensor technology within the healthcare environment is proposed. The purpose of this framework is to apply the ever- expanding sensor data to our community-centric sensing applications that can be used as a real-time service in the Cloud. Several techniques can provide this framework with the ability to receive and transmit data automatically and wirelessly to multiple users. The proposed system monitors the vital Temperature, Blood Pressure, Heart rate, Oxygen and transmits through IoT. The transmitted data is displayed in the Liquid Crystal Display (LCD) and webpage. This data gets updated into database

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continuously. This enables the doctor to receive the current status of the patient in real time. If any parameter of a particular patient goes beyond a pre- assigned threshold value, an automated notification will enable a buzzer and display.

II. OBJECTIVE

The main objective of the project is to help fast communication and identifying emergency cases and initiate communication with healthcare staff. It also helps to initiate proactive and quick treatment and to reduce 24*7 manual monitoring of the patient and also to alert paramedical staff upon abnormal conditions and battery drainage. The Doctor will get the call in case of emergency.

III. PROPOSED SYSTEM

A. Block Diagram

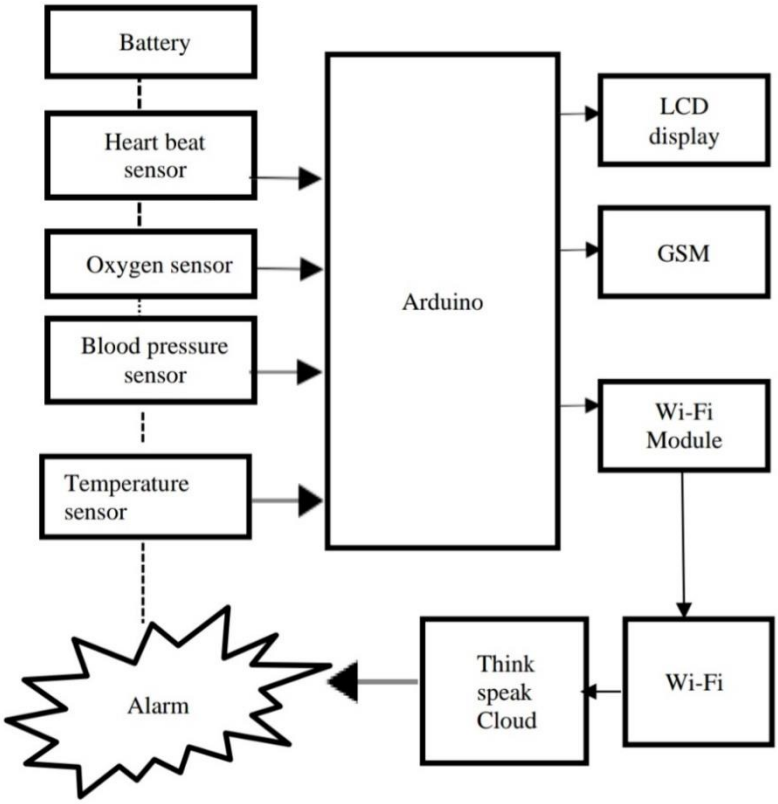

Fig. 1 Block Diagram

The main aim of the project is to monitor the patients continuously. Here, we have used four different types of sensors to monitor the patient's health parameters. The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heart beat pulses causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in form of electrical signal and is proportional to the heart beat rate. The MG-135 gas sensor senses the gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, 171 sulphide and smoke. Here, we have used this MG-135 to detect the Oxygen values. The Blood Pressure Sensor is a non-invasive sensor intended to measure the human pulse. It estimates systolic, diastolic and mean blood vessel pressure using the oscillometric technique. The Temperature sensor LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The MG series of Gas sensor uses small heater inside with an electro chemical sensor. Global System for Mobile communication (GSM) system was developed as a digital system using time division multiple access technique. Here, we have used SIM900 GSM Module. This means the module supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in 900MHz band. Arduino is used for controlling the sensors. In this way, the sensor will collect the values. In this place, we have used the microcontroller Arduino to control the sensors. Initially, all the sensors will be powered with the help of the battery. We cannot give

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direct power supply to Arduino because it will accept the power supply only at 5v. So, we have used battery divider. This battery divider will convert the voltage into 5v and the power will be given to the Arduino board. Arduino will obtain the values from each sensor. We have assigned different threshold values for every sensor. The obtained value will be displayed on the LCD as well as on the webpage. We have designed a separate webpage for monitoring the health parameters of the patient. In this webpage, the values of the Temperature sensor, Heartbeat sensor, Oxygen sensor and Blood Pressure sensor will be displayed. The LCD will be fixed in the Intensive Care Unit (ICU) for the reference of paramedical staff. With the help of this, they can know about the present status of the patient at any time they need. The doctor can use the webpage to know the condition of the patient at anytime from anywhere. In case of any changes in the threshold value, the alert will be enacted. Simultaneously, the call will be sent to the doctor over GSM. The alarm will be fixed at the help desk for the quick response of the paramedical staff. And we have employed a separate controller to fix the alarm at the help desk. The controller fixed at the ICU will obtain the values from the sensor. It will transmit those values to the sensor fixed at the help desk over the Wi-Fi module. Here, we have used the ThingSpeak cloud to store the data. The values will be transmitted to the cloud with the help of the Wi-Fi module. In case of any changes in the threshold value, the alert will be shown on the web page. Here, we have also added the battery drainage alert to make this system more effective.

1) Buzzer:

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or key stroke. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices.

Fig. 2 Buzzer

2) Temperature Sensor

LM35 is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). It does not require any external calibration circuitry. The sensitivity of LM35 is 10 mV/°C. As temperature increases, output voltage also increases. E.g. 250 mV means 25°C. It is a 3-terminal sensor used to measure surrounding temperature ranging from -55°C to 150°C. LM35 gives temperature output which is more precise than thermistor output at one moment, the yield is around 70% of the worth.

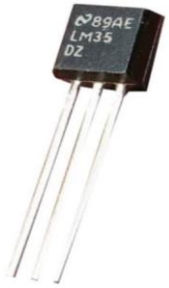

Fig. 3 Temperature Sensor

3) WiFi Module:The ESP8266 is the Wi-Fi module used. Wi-Fi Module is defined as a Security Operations Center (SOC) that contains within itself integrated TCP/IP protocol stack. This provides access to any kind of microcontroller to possess access to the Wi-Fi. The EPS8266 is capable enough for carrying out an application as well as capable of off-loading all the Wi-Fi networking connections from another processor. It is prominently used in the development of IoT embedded applications.

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Fig. 4 WiFi Module

4) Oxygen Sensor

The MQ135 gas sensor has high sensitivity in ammonia, sulfide, benze steam, smoke and in other harm full gas. It is low cost and suitable for different applications. There are different types of alcohol sensors like MQ-2, MQ-3, MQ-4, MQ-5, MQ-6, etc.

Fig. 5 Oxygen Sensor

5) GSM Module

The abbreviation of the term GSM is Global System for Mobile Communication. It is a very trustworthy wireless communication system. It is very easy to use and access. The subscription fee as well as the price of the transceiver module is very low. When subscribed by a mobile operator it operates just like a mobile phone.

Fig. 6. GSM Module

6) Pulse Sensor

The pulse sensor is also known as Heartbeat sensor. Generally the pulse is measured by placing two fingers in the wrists and counting the heartbeat for 30 seconds and multiplying it with 2. Here, in pulse sensor it uses the principle of photo phlethysmography is employed. It measures the volume of blood through any organ. Blood possess the property of absorbing light. Thus, it measures the flow of blood by passing light. Whereas flow of blood corresponds to the heartbeat. Here in this system the pulse sensor is added to have a basic check on the person's pulse rate.

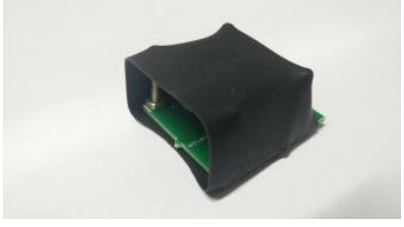

Fig. 7 Pulse Sensor

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7) Blood Pressure Sensor

Blood Pressure can be estimated both by intrusive and non-obtrusive strategies. In the non-intrusive strategy, no puncturing is required and is anything but difficult to utilize. Blood Pressure Sensor is utilized to gauge the blood pressure utilizing the non-obtrusive strategy. It is similar to sphygmomanometer but instead of mercury segment, a pressure sensor is utilized to identify the Blood Pressure.

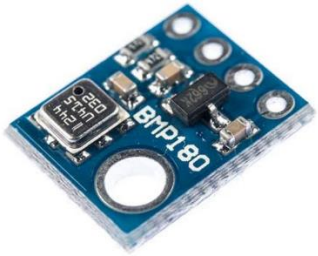

Fig. 8 Blood Pressure Sensor

8) Arduino

The Arduino Uno is a microcontroller board dependent on the ATmega328. It has 14 computerized Input/Output pins (of which 6 can be utilized as PWM yields), 6 simple information sources, a 16 MHz precious stone oscillator, a USB association, a force jack, an ICSP header, and a reset button. It contains everything expected to support the microcontroller; essentially interface it to a PC with a USB link or force it with an AC-to-DC connector or battery to begin. The Uno contrasts from every single going before board in that it doesn't utilize the FTDI USB-to-sequential driver chip. The Uno and form 1.0 will be the reference adaptations of Arduino, pushing ahead**.**

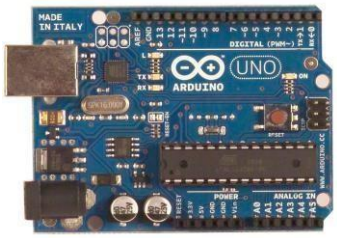

Fig. 9. Arduino

9) Arduino IDE

The open-source Arduino Software (IDE) makes it simple to compose code and transfer it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and dependent on Processing and other open-source programming. This software can be utilized with any Arduino board.

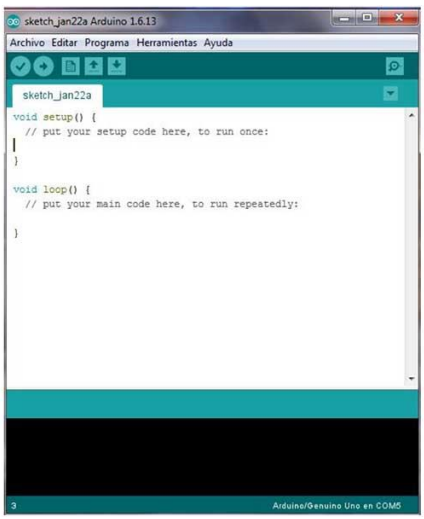

Fig. 10 Arduino IDE

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IV. RESULTS

The results is shown as a notification containing the Temperature, Heartbeat, Oxygen and Blood Pressure of the individual and the results of the working of GSM is shown through the alert message that the web page receives.

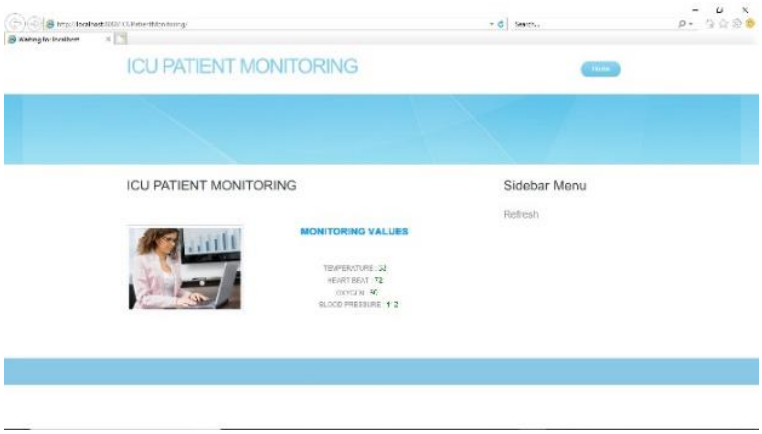

Fig. 11 Values in web page

This figure here shows the correct reading of Temperature sensor, Heartbeat sensor, Oxygen sensor and Blood Pressure sensor for an individual.

Fig. 12 LCD Display

This figure shows how the values is being displayed in a LCD which is obtained from all the sensors of an individual. Also, when the sensor values crosses the threshold value alert message is send through GSM and led blinks

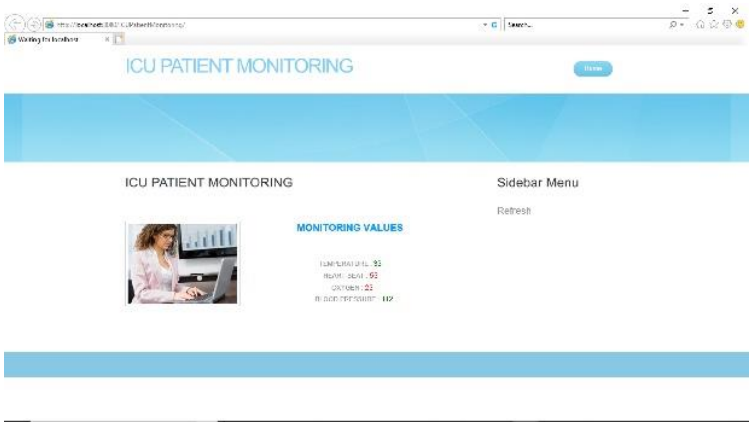

Fig. 13 Alerts in web page

This figures shows the reading of all the sensor for an individual along with how the alert is shown to the doctor who monitors the patient health through web page and this alert is also shown in LCD display by led light and through GSM module.

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V. CONCLUSION

The proposed ICU patient monitoring system is integration of embedded and web application, gives a stage in cost effective way, answer for patient and specialist situated at a remote area. The specialist can come up to a resolution by looking at and observing the wellbeing parameters of the patients at remote locations. The unusual change in estimations of patient's wellbeing parameters can alarm the specialist and help in taking the vital activities that are conceivable. A Remote human services gives continuous perusing of crucial parameters of patients alongside its socio economics, which will help in tolerant wellbeing analysis and in basic wellbeing condition.

VI. FUTURE SCOPE

In the future, IoT health monitoring will provide increased independence and mobility for elderly, sick, and physically or mentally disabled patients and reduce stress for family and doctors who can be alerted and react immediately as soon as issues arise. The bio sensor developed by MC10 can measure a patient's blood pressure, temperature, and heart rate and is so unobtrusive it has been compared to wearing a tattoo or bandage.

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