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ICU PATIENT HEALTH MONITORING SYSTEM OVER IOT

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ABSTRACT

This paper presents a wearable health sensor network system for the Internet of Things (IoT) connected safety and health applications. The safety and health of ICU patients are important in the hospital workplace; therefore, an IoT network system which can monitor all health parameters and update through wireless. The proposed network system incorporates multiple wearable sensors to monitor environmental and physiological parameters. The wearable sensors on different subjects can communicate with each other and transmit the data to a gateway via IoT platform medical signal sensing network. In the proposed system has heart rate, temperature, and vibration sensors all integrated into the parallel processing microprocessor. Health parameters are measured by sensors and given the ARDUINO module. This module analyzes the data and monitors in LCD and posts the same in internet of the things-based server. We continuously monitor, and if any changes are found like low heart rate, high heart rate, high temperature, or patient movement iot alerts the authorized person regarding health A smart IoT gateway is implemented to provide data processing, a local web server, and a cloud connection. After the gateway receives the data from wearable sensors, it will forward the data to an IoT cloud for further data storage, processing, and visualization.

Keywords: IoT, Arduino, LCD, Health monitor, heart attack, ICU

1. INTRODUCTION

Specialists throughout the healthcare sector are increasingly leveraging the areas of concern that these developments carry in and can allow considerable improvement in and beyond the medical administrations. Similarly, the capabilities of Electronic Health apps and EHealth (therapeutic organizations managed by ICT) are utilized by countless regular consumers to develop, support and strengthen their healthcare network. The SMS is submitted to the specialist or to any family member in some fundamental situation. Health analysts slowly misuse the points of value these developments add to the social security market in the healthcare setting, thus creating a crucial change. Likewise, endless standard customers are helping and helping their health experts by using the M-Health (Mobile Health) applicants and EHealth. Health analysts slowly misuse the points of value these developments add to the social security market in the healthcare setting, thus creating a crucial change. Likewise, endless standard customers are helping and helping their health experts by using the M-Health (Mobile Health) programs and EHealth. A dependable and rapidly persistent portion of this corresponding technique. Structure-like look (PMS). One of the biggest issues for society is the lack of social security. As the World Health Organization (WHO) parliaments demonstrate, the most elevated feature of the Medical system is a great best thing for a person. In order to persuade and render people look, it is important to have a flash similar to the new mending machine. The system for social insurance will include stronger remedial connections for people wherever they are, in a sustainable and careful manner. Provided that such contraptions

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support the Internet, they boost the environment and insure that organizations and social security become continually safe and logically drawn. The whole idea of IOT remains on sensors, portion as well as remote systems that allow customers to grant and access the application/information. No place, however, is the IOT across all zones more apparent than it was in the areas of prosperity treatment. As a cliché states, 'Prosperity is money,' the movement towards greater results is phenomenally important. Therefore, it is necessary to connect to an IOT framework that provides secure and prosperous analysis. At present, the contraction of human institutions, the conventional way of coping with a technologically advanced personally driven-oriented system, is being traded.

2. RELATED WORK

We have reviewed the various studies performed using existing techniques that have been applied in the field of patient health monitoring. This survey includes current trends in patient monitoring systems and related work on the remote patient monitoring system. In [2], a design of IoT based health monitoring system using Rasberry Pi is proposed. In this paper, they have utilized the Internet of Things (IoT) and cloud computing technologies. The proposed model monitors the Heart Rate, Oxygen level, and Blood Temperature of a patient. Cloud computing enables persistent storage of data. Hence the data gathered by the wearable sensors placed on a patient's body is saved in the cloud so that it can be accessed from anywhere across the globe. The doctor can log in to the website to access the patient's data and generate a health report. Patients can access the health report by logging into the website. A chat option is provided in the website for doctor and patient communication. The system acts as a bridge between doctor and patient avoiding the distance barrier. In rural areas where adequate medical facilities are not available, it is a very beneficial and cost-effective solution. In [3], a health Monitoring system using Arduino is proposed considering the needs of elderly people.

In the aging population world, there is an increased need for a specialized health monitoring system. In this context, the proposed system monitors body temperature, blood pressure, and heart rate and sends the data to doctors. These parameters are generally measured during basic health checkups as their values are important signs of a patient's health condition. In case of an emergency, an alert button is provisioned so that the doctor will receive an SMS when an alert button is pressed. Data is pushed to the web server so that the doctor and patient can view the values.

The main challenge observed was the hesitation of the elderly to use this new technology. They need to be educated to use new technological devices like smartphones and computers. In [4], Wireless Bluetooth technology with Android is explored for the remote assessment of health and fall detection. The system monitors the health parameters like ECG, temperature, 'body posture', 'fall detection' and present GPS location. Multiple simultaneous Bluetooth connections are established with an android phone to transfer the collected data. An android application analyses and processes the data which is also sent to the server using the internet. Data is sent to an emergency contact person in case of an emergency. Being a portable, energy-efficient, lightweight, and scalable design, it is mostly suitable for persons that are at high risk like soldiers guarding at high altitudes, trekkers, manual laborers, etc.

3. EXISTING SYSTEM

In the existing system of a health monitoring system, many sensors are used to measure the health parameters temperature, body motion, and pulse rate all are measured and displayed in LCD only. In the existing model, we don't have data transfer through longer distances using any wireless communication. To secure the patient's

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health the proposed model implemented with the IOT setup automatically sends alerts to doctors and relatives in case of emergency.

4. PROPOSED SYSTEM

In the proposed system of the health monitoring system, we used temperature sensors, heartbeat sensors and humidity sensor for monitoring the human body health parameters and display in LCD and IOT server. If the heart rate fluctuations mean if we got low BP or HIGH BP then buzzer module automatically alerts and same thing will update in server. This methodology is intended to build a structured remote observation system for well being. The goal is to track the patient's body's temperature and heart rate that the NRF innovation specialist will be faced with.

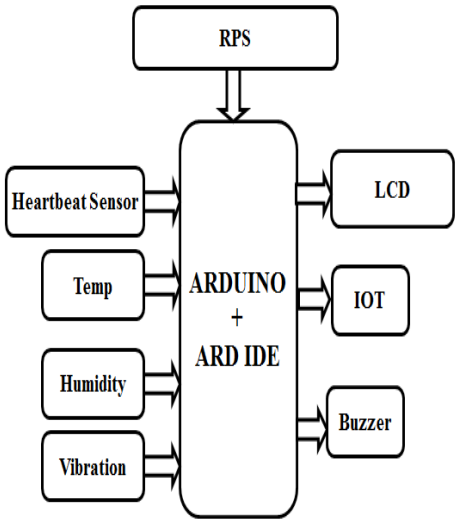

Fig.1. Block diagram

The care services in medical centers are consistent with the assessment of the well-being of the patients. The body of the patient is continuously monitored for temperature and pulse and registered. This interface is simple, illustrating the usage of ESP8266 and Arduino IoT Patient Safety Monitoring Program. Temperature sensors Pulse and LM35 monitor separately BPM and Ambient Temperature. The Arduino designs the application and shows an LCD panel with 16 * 2. Starts sending the data to the IoT application server via WLAN ESP8266 unit partners with both the WiFi. Thing speaks is the IoT server used in this. Finally, data from anywhere in the world can only be verified by identifying the channel Thing speak. Hardware modules used in this proposed system is explained in below.

5. EMBEDDED MODULES

Arduino:

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The Arduino Uno R3 is an open-source microcontroller board based on the ATmega328 chip. This Board has 14 digital input/output pins, 6 analog input pins, an Onboard 16 MHz ceramic resonator, a Port for a USB connection, an Onboard DC power jack, An ICSP header, and a microcontroller reset button. It contains everything needed to support the microcontroller. Using the board is also very easy, simply connect it to a computer with a USB cable or power it with DC adapter or battery to get started. The recommended range is 5v to 12v for Arduino Uno. **Features:-**Microcontroller: ATmega328P, Operating Voltage: 5V, Input Voltage: 7-12V, Digital I/O Pins: 14 (of which 6 provide PWM output), Analog Input Pins: 6, DC Current: 40mA, Flash Memory: 32 KB, SRAM: 2 KB, EEPROM: 1 KB, Clock Speed: 16 MHz.

Fig.2. Arduino

LCD Monitor:

Liquid Crystal Display is used to display the parameters for the status of the proposed system. This can display 32 characters having 2 columns. When each sensor is activated the corresponding message will be displayed in 16*2 LCD modules. In this, we use four data pins using these pins we transfer the data from the micro preprocessor to LCD.

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Fig.3. 16X2 LCD

IOT- Module:

The Internet of things is used for controlling any device or monitoring the device's status through the internet. This proposed system uses this IOT module for taking all parameters data and posts into the cloud called server. ESP8266 modules as IOT modules it can operate through the wifi frequency concept.

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Fig.4. ESP 8266

Buzzer

Buzzer is the output module for alerting of any parameter changes. if any sensor increases the threshold value or if increases then microprocessor alert us by using this system.

Fig.5. Buzzer

Software

Software is an important parameter to make the device automated. In the proposed implementation we used embedded c programming language and compiler Arduino IDE we used. Here we used Arduino IDE software for programming write-up and execution of entire system

HEART BEAT SENSOR;

The beat is the notable parameter in the evaluation of prosperity. The actual human tone has a heartbeat of 60 to 100 thumps almost any second. The beat calculation is, commonly speaking, an irregular strategy. This prototype has a beat sensor with a sharp Q beat. This consists of a fundamental sensory structure. The heart rate may be genuinely measured for two regions of the wrist and back, the revolving rhythm (carotid rhythm), by monitoring the beats of each other. With a Heart Beat detector, the light is a c customed through the blood, when the heart rate varies, based on the optical force range. The beat sensor relies on the photography norm. The adjustments in blood pressure that pass from each organ in the body induce a light strength shift across this org an (territory of the vascular)

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Fig.6. ECG Sensor

DHT11- Humidity and Temperature Sensor

DHT11 digital temperature and humidity sensor is a calibrated digital signal output of the temperature and humidity combined sensor. It uses dedicated digital modules capture technology and temperature and humidity sensor technology to ensure that products with high reliability and excellent long-term stability. The sensor includes a resistive element and a sense of wet NTC temperature measurement devices, with a high-performance 8-bit microcontroller connected. Humidity Sensor is one of the most important devices that has been widely in consumer, industrial, biomedical, and environmental, etc. applications for measuring and monitoring Humidity. Humidity is defined as the amount of water present in the surrounding air. This water content in the air is a key factor in the wellness of mankind. For example, we will feel comfortable even if the temperature is 00C with less humidity i.e. the air is dry. But if the temperature is 100C and the humidity is high i.e. the water content of air is high, then we will feel quite uncomfortable. Humidity is also a major factor for operating sensitive equipment like electronics, industrial equipment, electrostatic sensitive devices and high voltage devices etc. Such sensitive equipment must be operated in a humidity environment that is suitable for the device.

Fig.7. Temperature sensor

Hence, sensing, measuring, monitoring, and controlling humidity is a very important task. Some of the important areas of application for sensing, measuring, and controlling Humidity are mentioned below. **Domestic**: Sensing and controlling humidity in our homes and offices is important as higher humidity conditions will affect the blood flow. Other areas include cooking, indoor plantation, etc. **Industrial**: In industries like refineries, chemical, metal, or other industries where furnaces are used, high humidity will reduce the amount of oxygen in the air and hence reduces the firing rate. Other industries like food processing, textile, paper, etc. also need control of humidity. **Moisture**: Generally, the term Moisture means the water content of any material or substance. But practically, the term Moisture refers to the water content in solids and liquids. The term Humidity refers to the water content in gases (air). Absolute Humidity: Absolute Humidity (AH) is the

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ratio of the mass of the water vapor to the volume of the air. If m is the mass of the water vapor and V is the total volume i.e. volume of air and water vapor mixture, then Absolute Humidity AH is given by

Mercury switch

A mercury switch is an electrical switch that opens and closes a circuit when a small amount of the liquid metal mercury connects metal electrodes to close the circuit. There are several different basic designs (tilt, displacement, radial, etc.) but they all share the common design strength of non-eroding switch contacts.

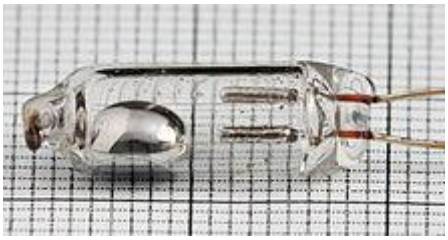

Fig.8. Vibration sensor

The most common is the mercury tilt switch. It is in one state (open or closed) when tilted in one direction with respect to horizontal, and the other state when tilted in the other direction. This is what older-style thermostats used to turn a heater or air conditioner on or off. The mercury displacement switch uses a 'plunger' that dips into a pool of mercury, raising the level in the container to contact at least one electrode. This design is used in relays in industrial applications that need to switch high current loads frequently. These relays use electromagnetic coils to pull steel sleeves inside hermetically sealed containers.

6. RESULTS

We designed the electronic health monitoring system hardware using Arduino. We integrate the input modules heartbeat sensor, temperature sensor, humidity, and vibration sensor. The output data of all the sensors will be displayed in LCD and the internet of things. The buzzer module here will alerts the low heartbeat, high heartbeat and high-temperature alerts in internet of things using thing speak database.

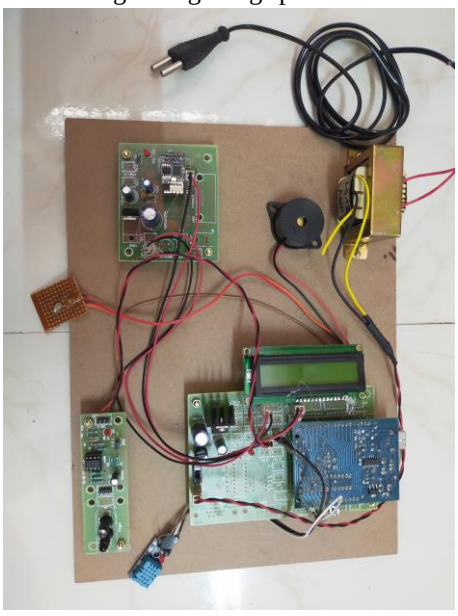

Fig.9. Hardware Model

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All sensors heart beat sensor, temperature and humidity are integrated to Arduino. All the sensors data firstly displayed in lcd module as showed in the below figure 11. Below figure 11shows the heart rate 95 in case1 and case 2 shows the heart rate 125. This is the case of high heart rate. This time buzzer automatically alerts and sends the high heart rate data to the IoT. Heart rate and body temperature is displays in LCD module with high hart rate alerts. All sensors heart beat sensor, temperature and humidity are integrated to Arduino. All the sensors data firstly displayed in LCD module as showed in the below figure 12. Below figure 12 shows the heart rate 25. This is the case of high heart rate. This time buzzer automatically alerts and sends the high heart rate data to the IoT. Heart rate and body temperature is displays in LCD module with low hart rate alerts

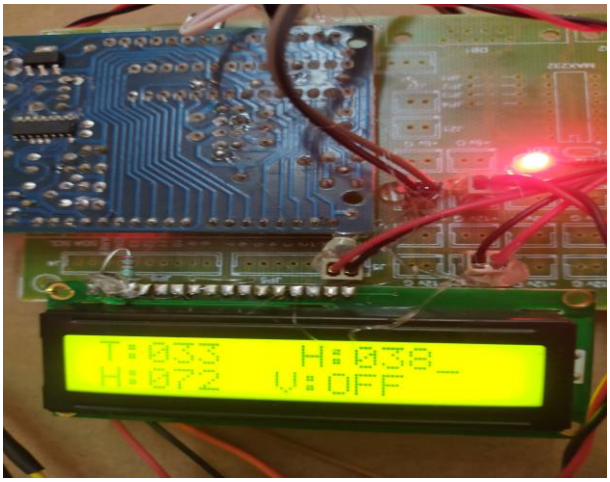

Fig.10. LCD data of Health monitor

The health parameters temperature humidity and heart rate data displayed in internet of things using server. And it alerts us through high heart rate and low heart rate of data when the patient in emergency situation. Figure 13 shows the all sensor data posted into iot server and continuous monitoring the data.

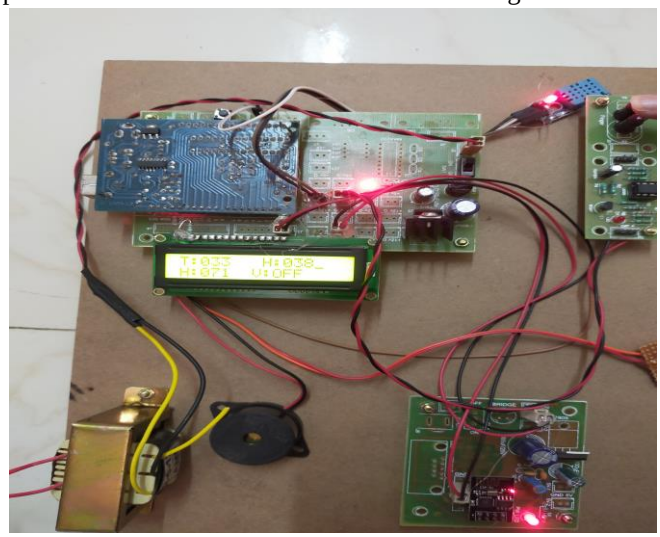

Fig.11. Hardware Model output

CONCLUSION

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We designed and implemented Arduino Based E – Health System over Internet of Things with integrating of all input modules like temperature, humidity, position motions, heart rate monitoring sensors, output modules LCD, buzzer and wireless communication system called the internet of things through Arduino processor. In this proposed system, the various health parameters such as pulse rate, temperature, angle movement of fingers, and eye blink were monitored and recorded in the Thing Speak platform. The values of these parameters were analyzed and alerted in this proposed system. In the future, we will add some other sensors which enhance the health monitoring system like glucometers and body fat device measurement.

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