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An IoT based Health Monitoring System using Arduino Uno

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Abstract: Internet of Things (IoT) is an online system. IoT devices used in several application areas that makes the lifestyle of the users comfortable. IOT based health monitoring system normal used to collect temperature, pressure level, and etc.

Corona virus (COVID-19) is caused by the severe acute metastasis syndrome corona virus two (SARS-CoV-2) that's speedily spreading across the world. The clinical spectrum of SARS-CoV-2 sickness (respiratory disorder) ranges from delicate to critically ill cases and needs early detection and observance, at intervals in clinical atmosphere for vital cases and remotely for delicate cases. The worry of contamination in clinical environments has led to a dramatic reduction in on-the-scene referrals for routine care. There has additionally been a perceived ought to unceasingly monitor non-severe COVID-19 patients, either from their quarantine website reception, or dedicated quarantine locations (e.g., hotels). Thus, the pandemic has driven incentives to introduce and enhance or produce new routes for providing aid services at distance. Specifically, this has created a dramatic impetus to search out innovative ways in which to remotely and effectively monitor patient health standing. The most common symptoms of Covid-19 is increase in body temperature, a high or irregular heart rate and dry cough. Our project detects these symptoms and ensures the monitoring of an individual's basic health. Monitoring an individual's heart rate and body temperature is usually very important as irregularities in either can indicate other underlying illnesses such as cholesterol, high blood pressure, low blood pressure, flu, etc. And in times of pandemic, importance of healthcare monitoring system has elevated even more than ever before.

Key Words: Arduino uno ATMEGA328P, Heartbeat sensor, Digital humidity, Temperature sensor, GSM module, WI-FI module, Internet of Things.

1 INTRODUCTION

In low- and middle-income countries, an increasing number of people have chronic illnesses due to a different risk factors like eating habits, inactivity, and alcohol consumption among others. According to World Health organization, 4.9 million people die from lung cancer through snuff use, 2.6 million obese people, 4.4 million high cholesterol and 7.1 million high blood pressure. Chronic diseases vary greatly in their symptoms evolution and their therapies. Some, if not observed and treated early, can end a patient's life.[1]

For many years the standard method for measuring blood sugar, blood pressure, and heart rate was traditional tests in specialized health facilities. With the advent of technology today, there is a huge diversity of sensors that learn important signals such as a blood pressure monitor, a glucometer, a heart rate regulator, including electrocardiograms, which allows patients to take essentials daily. Daily readings are sent to doctors and they will recommend medication and exercise procedures allow them to improve the quality of life and overcome such diseases.

The internet of materials used in the care of patients is becoming increasingly common in the field of health, which improve the quality of life of the people. Internet of Things is defined as the integration of all devices connected to a network, which can be controlled from the web and provide information in real time, allowing communication with the users.

On the other hand, the Internet of Things can be seen from three paradigms, namely the middleware centred on the Internet, objects information-oriented and informative senses.[2]

Arduino is a tool that can be programmed to understand and interact with its environment. It is a good open source a microcontroller platform that allows electronics enthusiasts to build quickly, easily and at low cost with minimal use and monitoring projects. The combination of IoT and Arduino is a new way to introduce the Internet of Things to Health Care Monitor the patient system. The Arduino Uno Board collects data from sensors and transmits wirelessly to the IoT website.[3]

Communication of medical information, correct decision-making of knowledge collected and knowledge patient could be a difficult task in IoT. For this project, the IoT primarily based Patient Health Monitoring System (PHMS) is being employed Arduino is projected to gather the specified parameters and examine the information obtained from sensory devices. PHMS with Arduino conjointly provides patient notifications of preventative measures. This program advises the patient with medical facilitate and also the next step to follow within the event of Associate in Nursing emergency. IoT combination with Arduino could be a new thing to introduce net of Things to the Patient Health Care System. Arduino Uno Board collects information from sensors and transmits wirelessly to the IoT web site. The projected PHMS system is certainly being tested parameters like pulse rate, vital sign, pressure level etc.

2 SYSTEM BLOCK DIAGRAM

The proposed IoT-based health monitoring system was developed using Arduino microcontroller which is the brain of the project.

Arduino collects real-time health data from a pulse sensor that measures heart rate in minutes or BPM (beats per minute). An Arduino digital temperature sensor measures the patient's body temperature. One temperature sensor is connected to Arduino to measure room temperature so that

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we can adjust the room temperature according to our health and body temperature, and we use a humidity sensor to measure the humidity in the area so that it does not affect health.

The buzzer produces beeps that are audible when the patient's heartbeat occurs / is detected. This provides a brief understanding of health care professionals of how a patient's heart works in a particular health condition. Unusual heartbeat can be detected by listening only to the beeps.

The standard ESP8266 IoT module connects to Arduino via UART, is responsible for connecting the machine to the internet and sending health data to the IoT (Thingspeak) server for storage and monitoring.
This region can not only send patient health data to the server but can also display real-time data on a 16 × 2 LCD display. This is helpful for health care professionals who actively monitor the patient on site.

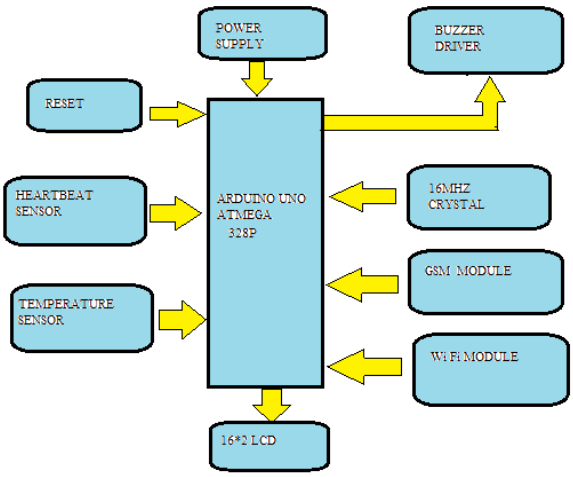

Fig.1 System block diagram

3 HARDWARE DESCRIPTION

The hardware required for this project are
-Arduino UNO
-Pulse sensor/ Heartbeat sensor
-Temperature sensor
- ESP8266
-LCD display

3.1 Arduino UNO

Arduino board opensource micro controller based on ATmega 328p micro controller. It is one of the most popular development boards used for experimental purposes and serves as an Internet of Things (IoT) link.
The board contains other items such as serial connection, crystal oscillator, voltage regulator etc. It contains 2 kB of RAM, 1 kB of ROM, flash memory of 32 kB and can be easily formatted with opensource Arduino IDE software.
There are many GND pins in Arduino, any of them can be used to grind your circuit. 5V (4) & 3.3V (5): there is one 5V pin provides 5 volts power to Arduino UNO, and the 3.3V pin provides an influence of 3.3 volts. most straightforward the components
used with the Arduino vary jubilantly from five or 3.3 volts. ANALOG(6):subtitle space beneath 'Analog In' label (A0 to A5 in UNO) by Analog In pins ... DIGITAL (7): on the far side the analog pins digital pins (0 to 13 in UNO). These pins is used for each digital input (such as telling once a button is pressed) and digital output (such as semiconductor diode power supply). PWM (8): These anchors act as standard digital pins, however also can be used with one thing referred to as Pulse-Width breadth Variation.

Fig.2 Arduino UNO

3.2 Pulse sensor/ Heartbeat sensor

Heartbeat is the rate of the contraction of heart per minute. The unit of heart beat is bpm. The normal hear beat of human being is called sinus rhythm. The sinus rhythm is from 50 bpm to 90 bpm depending upon the physical needs and activities of the body. The heart rhythm is the exchange of sodium and potassium ions. The sodium and potassium ions can be change with various factor such as hyponatremia (low sodium ions concentration), hypokalemia (low potassium ions concentration), hypothermia (low body temperature), hypoxia (low oxygen supply to the body) and acidosis (low P value with high concentration of hydrogen ions). These mentioned factor can cause the heart rhythm. Heartbeat rhythm should count in order to protect the human beings from the mentioned factors. The heart rate can be measured with help of wrist heart beat monitor and heart beat sensor. Heart beat sensor in device that is used to measure the heart rhythm of human body. Heart beat can be measured in any part of the body such as index of fore finger, wrist of hand neck, elbow and toes of feet. But here in this research, heart beat can be measured with apex of forefinger. The Proteus simulation of heart beat sensor has been given in figure.3

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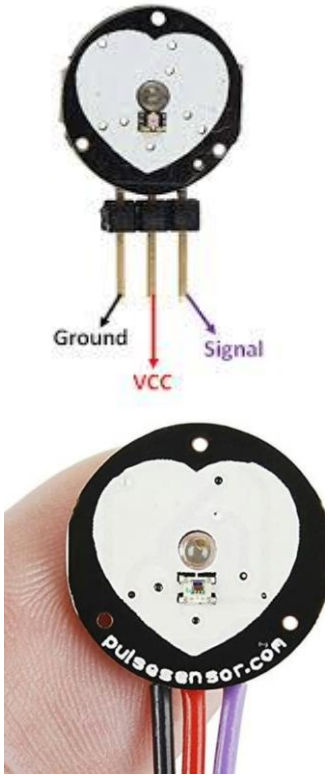

Fig.3 Heartbeat Sensor

3.3 Temperature sensor

The LM35 series is a well-integrated heat-resistant heat exchanger with Centigrade temperature. The LM35 device has an advantage over Kelvin's limited direct temperature sensors, as the user does not have to emit large, uninterruptible power outages for easy Centigrade measurements. The LM35 device does not require external measurement or cutting to provide normal details of ± ¼ ° C at room temperature and ± ¾ ° C in addition to the full temperature range of −55°C to 150°C.

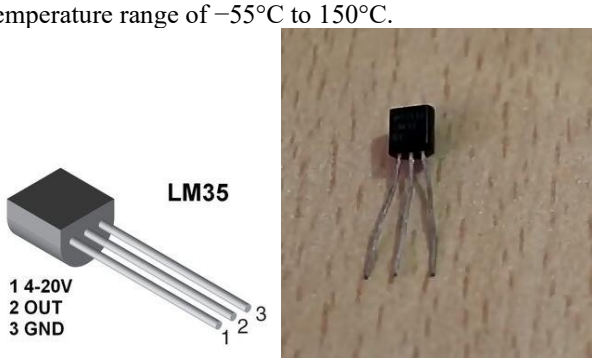

Fig.4 Temperature Sensor

3.4 ESP8266

ESP8266 can be a very simple and cheap tool for net production. The module will work individually as an Associated Objective access point (can display hotspot) and as a channel (can connect to Wi-Fi), where it will simply download information and transfer it to the web creating a Web of things as simple as accessibility. It can also download information from the web exploitation API where any project can access any information available on the web, so it builds smarter. Another interesting feature of this module is that it is often programmed to exploit Arduino IDE which makes it easy to use a lot. The ESP8266 module works with 3.3V only, sometime 3.7V can kill the module when it alerts you and your circuits. Here is the description of its anchors.

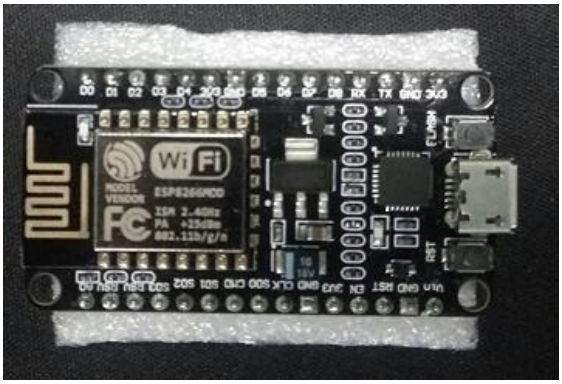

Fig.5 ESP8266

3.5 LCD Display

LCD is a flat optical display device which uses liquid crystals' light-modulating properties combined with polarizers. Liquid crystals do not directly emit light, but use a backlight or reflector to create colour or monochromeimages.

Fig.6 LCD Display

4 METHODOLOGY ANDDESIGN

An IoT-based health observation system works on the patient's body observation system such as pulse rate and body temperature. Heartbeat device hooked up to the patient's fingers and temperature the sensing element is additionally hooked up to the patient's body. Temperature sensing element could be a sensing element supported resistance its resistance is set by dynamic the patient's vital sign, and pulse rate sensing element, vibration sensing element or flow in its price it's transmitted within the variety of associate signalling. 2 the quantity of sensors obtained by Arduino UNO, nice or wise management of this when receiving these values, these values are saved showed on the display and at a similar time sent to the IoT system exploitation the Wi-Fi module with Wi-Fi modules within the IoT display system these numbers area unit for various websites and applications Wi-Fi sources, and chat area unit used for this employing a web site or app, doctors will track pulse rate and their patients from anyplace.

In this system two sensors are used for one heat sensor another heart rate sensor. To filter the details with drawings, we have used BLYNK Android app and data transfer to IoT

cloud using mobile technology and IoT technology. To use this application user needs a Wi-Fi connection. Arduino board connects to Wi-Fi network functionality using Wi-Fi module. Arduino board learned sin from two senses. After that this installation is sent to IoT cloud with the help of Wi-Fi module. Rated inputs displayed on LCD screen. At the same time this data is sent to the IoT cloud and the measured data is displayed on the screen when the application is opened. The limit value range is set to system. If the available value is greater than or below the limit value range a notification message will be sent to the smartphone screen.

5 EXPERIMENT SETUP

Experimental setup for our system as shown in Fig.11 consisting of sensors with its accessories like Biomedical pads and sensors cable ,Raspberry pi camera, Arduino UNO, Raspberry pi 2 and wi-fi dongle has been shown in figure. All the connections either between sensors and Arduino board or between raspberry pi and other devices (pi camera, wi-fi dongle ,HDMI and power supply) can be clearly seen Experimental setup for our system as shown in Fig.11 consisting of sensors with its accessories like Biomedical pads and sensors cable ,Raspberry pi camera, Arduino UNO, Raspberry pi 2 and wi-fi dongle has been shown in figure. All the connections either between sensors and Arduino board or between raspberry pi and other devices (pi camera, wi-fi dongle ,HDMI and power supply) can be clearly seen Experimental setup for our system as shown in Fig.11 consisting of sensors with its accessories like Biomedical pads and sensors cable ,Raspberry pi camera, Arduino UNO, Raspberry pi 2 and wi-fi dongle has been shown in figure. All the connections either between sensors and Arduino board or between raspberry pi and other devices (pi camera, wi-fi dongle ,HDMI and power supply) can be clearly seen Experimental setup for our system as shown in Fig.11 consisting of sensors with its accessories like Biomedical pads and sensors cable ,Raspberry pi camera, Arduino UNO, Raspberry pi 2 and wi-fi dongle has been shown in figure. All the connections either between sensors and Arduino board or between raspberry pi and other devices (pi camera, wi-fi dongle ,HDMI and power supply) can be clearly seen Experiment setup for our system as shown in fig consisting of sensors with its accessories like Biomedical pads and sensors, Arduino UNO, Lcd display, Wi Fi dongle and other devices and components. All the connections either between sensors and Arduino board or between other devices are clearly seen.

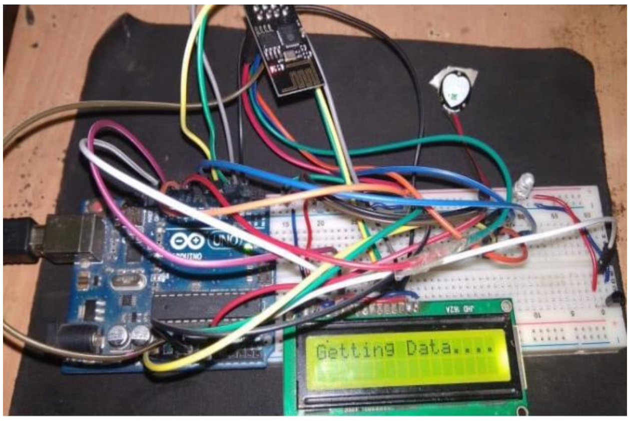

Fig.7 Hardware Setup

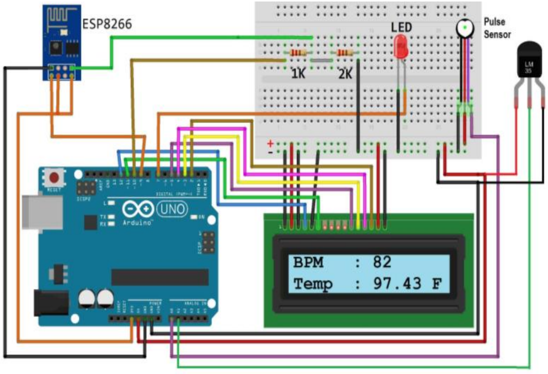

Fig.8 Components connections

6 RESULT

In our work we have used three senses. First the LM35D temperature sensor that we used to measure the patient's temperature. The best accuracy is achieved when the temperature sensor is placed on the armpit or tongue. Another sensor that used in this project was heartbeat sensor, it measures the heart rate by measuring the back light LED hitting the back on the light sensor on the front side. Better accuracy is achieved when the person place this sensor on the fingernails and ear. All sensors were connected to the analogue pins of the Arduino board. All of these sensors provided a power difference based on the input parameter and these power variables were converted to output, the output of the LM35 sensor was converted to a temperature by degrees Celsius and the output of the DIY pulse sensor was converted to a heart rate in BPM (beats per minute) on the Arduino system. The image was taken from the serial architect of Arduino IDE software. As a result the heartbeat was marked in the form of spikes. For analogue input, Arduino offers digital output from 0 to 1023 levels as the Atmega328 small controller on board has 10 bit in built-in ADC. Set a limit of 520 to estimate the number of pulses. Therefore the output rate that was higher than the limit was considered to calculate and measure the heart rate in BPM (Beats per Minute). These results are displayed on the LCD screen.

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-OUTPUT

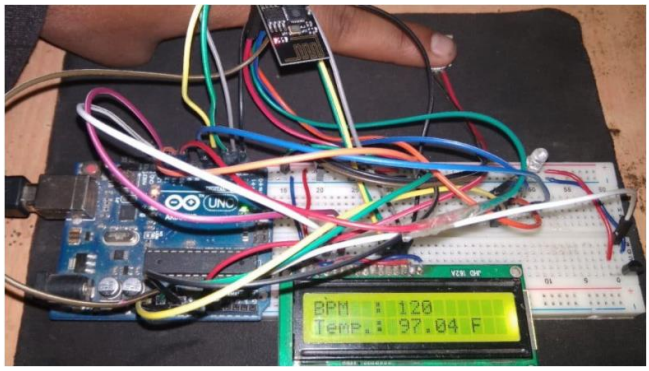

Fig.9 Output Shows in LCD screen

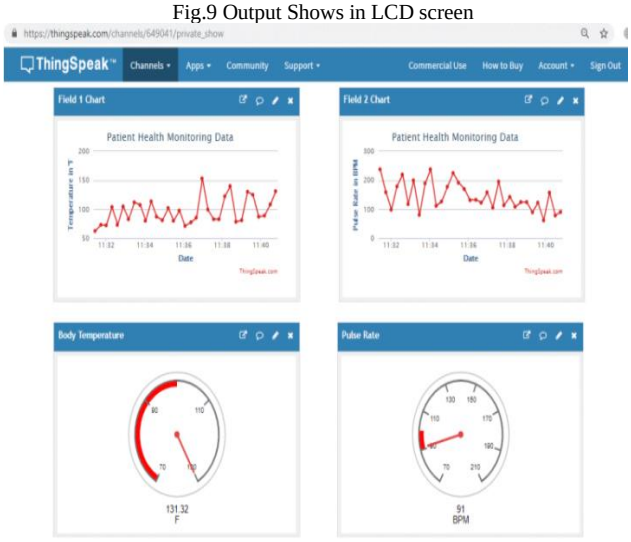

Fig.10 Output shows in Thingspeak software

-Sensors data with patient Information

Health Care Monitoring Data					
Sl. No	Temperature (F)	Pulse	Heart rate	Patient Information	Timing
1	97.04	OK	120	Richa	March 10,2021 10:05 AM
2	97.00	OK	84	Richa	March 10, 2021 01:00 PM
3	95.09	OK	80	Richa	March 10, 2021 08:40 PM
4	96.06	OK	178	Richa	March 11, 2021 09:50 AM
5	96.00	OK	87	Richa	March 11, 2021 02:33 PM
6	97.00	OK	61	Richa	March 11, 2021 11:00 PM
7	96.09	OK	179	Richa	March 12, 2021 10:30 AM

Table.1 Health Care Monitoring data

7 CONCLUSION

The proposed patient health monitoring system can be used extensively in an emergency conditions as they can be monitored daily, recorded and stored as a database. In the future Iot device can be integrated with computer computing so that the database can be shared across intensive care and treatment hospitals**.** And also in this pandemic this health monito-ring is very useful, we can avoid go to hospital regularly in this pandemic and check our self in our house only.

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