Smart Health MonitoringSystem using IoT

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Abstract— *Health has become one of the global challenges for humanity. Cardiac diseases, Lung failures and heart related diseases are increasing at rapid rate. The IOT is the network of physical objects that contain embedded technology to communicate and sense or interact with their states of the external environment. Monitoring health of elderly people at home or patients at hospitals is necessary but it requires constant observation of Practitioners and Doctors. IOT consists of physical devices, such as sensors and monitoring devices for patients to connect to the internet and transforms information from the physical world into the digital world. The proposed system, with the help of IOT's such features, will help to keep the necessary details and reports of a patient organized and available to all doctors in the system.*

Keywords— Health, Cardiac Diseases, IoT, Monitoring Health, ElderlyPeople

I. INTRODUCTION

Health is always a major concern in every growth the humanrace is advancing in terms of technology.[1] Without even atrace of the specialists, the patient can't counsel the specialists because of which crisis circumstance may likewise be made. The personal health monitoring of every individual is considered vital in view of the ascent in wellbeing issues in today's world. The expanding upsetting way of life is negatively affecting general wellbeing. With the ever- expanding lines at emergency clinics and an expanding number of patients, the specialist expenses have soar which is influencing particularly those patients who can't manage the cost of the charge or who are not experiencing significant afflictions yet become acquainted with so solely after paying a strong charge to the specialist.[2]

Smart health monitoring devices determine the health parameters i.e. pulse rate, body temperature,ECG and SpO2 by using sensors. The sensors are connected and controlled through microcontroller-based system i.e. Arduino. The Arduino collects the data using sensors. The collected biomedical data is stored in ThingSpeak with the help of Node MCU. From the stored data, the device can decide whether the patient's condition is normal or abnormal.[3]

If patients condition is abnormal the buzzer will give alert by buzzing.This system provides real-time health care observation for doctors and medical assistants where they can use the data anytime. Here the main advantage is that the device has low power consumption, better performance, high sensitivity and easy setup.

II. METHODOLOGY.

This section discusses about hardware used, software development and the working of the system.

A. Hardware Specifications

1. **Arduino:** Arduino is the versatile device used in project because it provides huge amount of application. The board can work on an external supply of 6v-20. The Atmega328 has 32 kb of flash memory for storing code. All the 14 digital pins on the Arduino board can be used as an input or output using pinMode(), digitalWrite() & digitalRead() functions.[4]

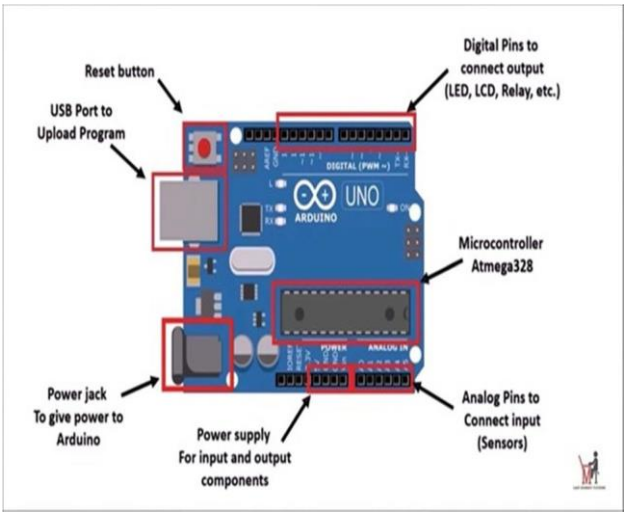


Fig 1. Arduino UNO Development Kit

2. Node MCU: The ESP8266 ESP-01 could bea Wi-Fi module that enables microcontrollers access to a Wi-Fi network. This module could be a self-contained SOC (System On a Chip) that doesn't necessarily need a Arduino to govern inputs and outputs as you'd normally do, as an example, because the ESP-01 acts as alittle computer. depending on the version of the ESP8266, it's possible to possess up to 9 GPIOs (General Purpose Input Output). Thus, we will give Arduino internet access just like the Wi-Fi shield does thereto, or we can simply program the ESP8266 to not only have access to a Wi-Fi network, but to act as a microcontroller also. This makes the ESP8266 very versatile, and it can prevent some money and space in your projects.

Fig 2. Node MCU

3. MAX30102 Sensor: The MAX30102 is an incorporated pulse oximeter and heart rate monitor module. It coordinates a red LED and an infrared LED, photodetector, optical parts, and low-noise electronic circuitry with encompassing light concealment. - The MAX30102 highlights a 1.8V power supply and a separate 5.0V power supply for internal LEDs for the pulse and blood oxygen acquisition in wearable devices, worn on the fingers, earlobe, and wrist.

Fig 3. MAX30102 Sensor

4. AD8232 Module: The AD8232 heart Monitor is an affordable board acclimated measure the electrical action of the middle. This electrical movement are frequently graphed as an ECG or Electrocardiogram and yield as a simple perusing. ECGs is incredibly loud, the AD8232 single lead beat screen goes about as an operation amp to assist with acquiring a straightforward sign from the PR and QT Intervals without any problem. The AD8232 indispensable sign screen breaks out nine associations from the IC that you just essentially can weld pins, wires, or different connectors to. SDN, LO+, LO-, OUTPUT, 3.3V, GND give fundamental pins to working this screen with an Arduino or other advancement board.In like manner gave on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to join and use your own custom sensors.

Fig 4. AD8232 Sensor

5. DS18B20 Sensor: It is easy to use once you have to measure something secluded, or in wet conditions. While the sensor is nice up to 125°C the cable is jacketed in PVC so we propose keeping it under 100°C. Because they're digital, you do not get any signal degradation even over long distances! These 1-wire digital temperature sensors are fairly precise (±0.5°C over much of the range) and might hand over to 12 bits of precision from the onboard data converter. They work great with any microcontroller employing a single digital pin, and you'll even connect multiple ones to the identical pin, every one features a unique 64-bitID burned in at the factory to differentiate them.Usable with 3.0-5.0V systems.

Fig 5. DS18B20 Sensor

6. LCD 16x2 Display: LCD 16x2 Display that gives an easy and low cost solution for adding a 16×2 Black on RGB Liquid Crystal Display into your project. The showcase is 16 character by 2 line display has an extremely clear and high difference dark text upon a yellow foundation/backdrop illumination. This is an incredible yellow backlit LCD display. It is phenomenal for Arduino based venture. This LCD 16x2 Display with Yellow Backlight is exceptionally simple to connect with Arduino or othermicrocontrollers

Fig 6. 16x2 LCD Display

7. Buzzer: It is a basic gadget which can create beeps and tones. Working rule of the gadget ispiezoelectric impact. The fundamental of this device is a piezo crystal, A unique material that change shape when a voltage applied to it.

Fig 7. Buzzer

B. Software Implementation

The project mentioned in the paper uses an Arduino which required a program for the execution and operation of the integrated circuit and Node MCU for uploading data on website. Since Arduino program is an easy language to implement and is a commonly used program for the development of the microcomputer. The code inserted inside the Arduino helps the Arduino to control different sensors.

The execution of this software design and created with analyzing the health of the patient and update it on website so that doctors from anywhere can track patients health and can give suitable treatment to them. When there is emergency i.e. when temperature>40 C, heart rate>100 bpm and heart rate<50 bpm and SpO2<95.In this way the system can be programmed with smart health system effectively and efficiently.

C. Flow Chart

Fig 8. Flowchart of Project

D. Circuit Diagram

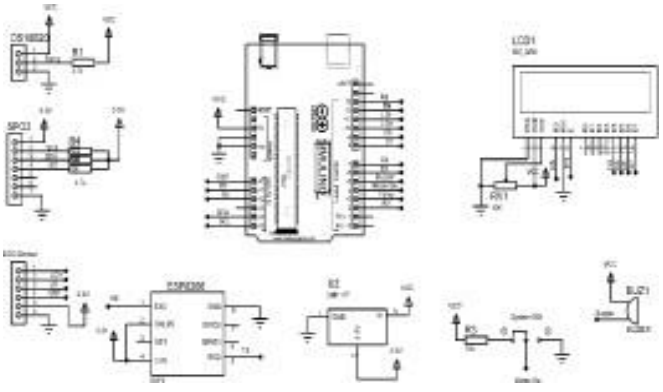


Fig 9. Circuit Diagram of Project

III. OPERATION

The model has two modes. The user can switch between these two modes by using a Switch. In mode1, MAX30102 and DS18B20 sensors are activated to detect the heart rate, blood oxygen and the body temperature of the user. In mode 2, AD8232 sensor is activated to plot the ECG on the serial plotter.

MAX30102: In MAX30102 sensor, an infrared radiation is emitted and reflected back by hitting the user's finger and then the amount of oxygen present in blood is estimated by measuring the wave amplitude. The time series of the radiation is then analysed to obtain the heart rate

DS18B20: The sensor reads and converts the temperature to store the value in a scratchpad memory. Using the Dallas library, the scratchpad memory is then read via the One-wire bus.

AD8232: It calculates the electrical movement of the heart and then charts it like an Electrocardiogram (ECG). The biopotential signals which are small in the noisy conditions are amplified, extracted and filtered by this sensor.

The data from MAX30102 and DS18B20 is displayed on LCD display. If the values of these sensors are within the specified range i.e. normal values then, 'Normal' is displayed on the LCD display. If the value of these sensors turns out to be higher than the normal values, then 'Emergency' is displayed on the LCD display and also the user is altered with the help of a buzzer that has been integrated in the circuit.With the help of NodeMCU, the data from MAX30102 sensor and DS18B20 sensor is uploaded to the IoT Cloud ThingSpeak along with the ECG plot from the AD8232 sensor. This data can be access at any time, so that the user can keep a track of his/her health condition. The LCD display also displays 'Updated on web' to indicate that the data has been uploaded on ThingSpeak.

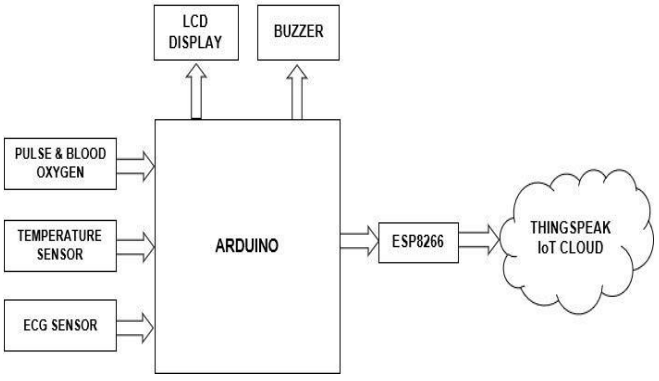


Fig 10. Block Diagram of Project

IV. RESULTS AND DISCUSSION

According to the final result of the project which leads to health care monitoring system . Through this project we have learn the actual use of esp module which provide a huge variety when it comes to the use of IOT . Its is more convenient of the user as well as for the heath examiner(doctor) to interact with the patient without going for a visit its a best way to go further in future

Fig 11. Working Model

PARAMETERS	NORMAL VALUES	CRITICAL VALUES
HEART RATE	> 50 and < 100	< 50 and > 100
BLOOD OXYGEN	> 95	< 95
TEMPERATURE	< 40	> 40

Table 1. Normal and Critical values of the parameters.

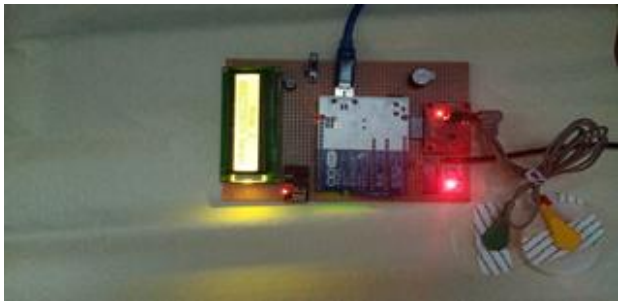


Fig 12. ECG Module Working

Fig 13. ECG ThingSpeak Graph

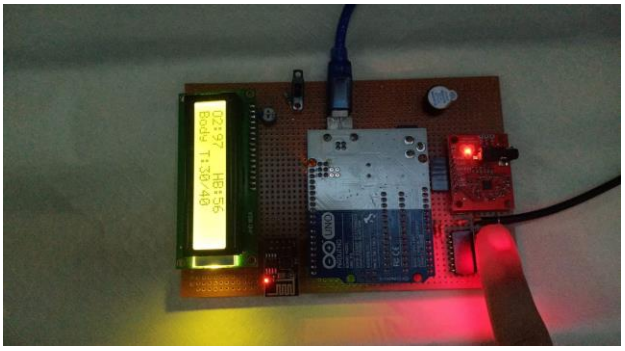


Fig 14. Heart Rate & SpO2 Sensor Working

Fig 15. Heart Rate ThingSpeak Graph

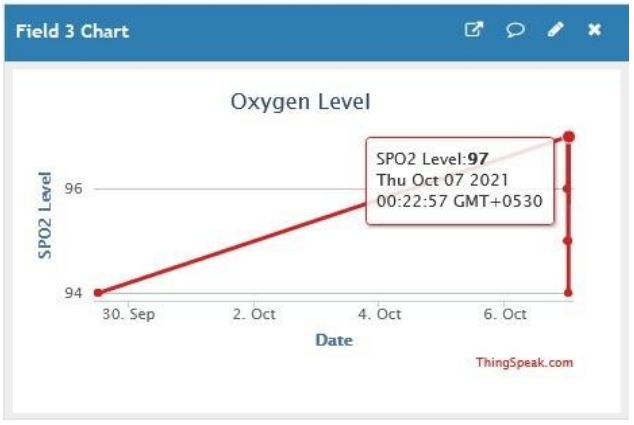
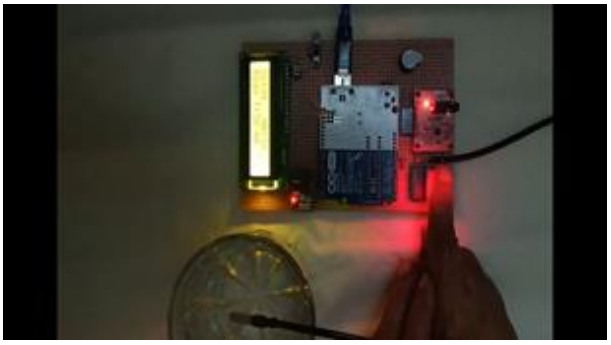


Fig 16. SpO2 ThingSpeak Graph

Fig 17. Temperature Sensor Working



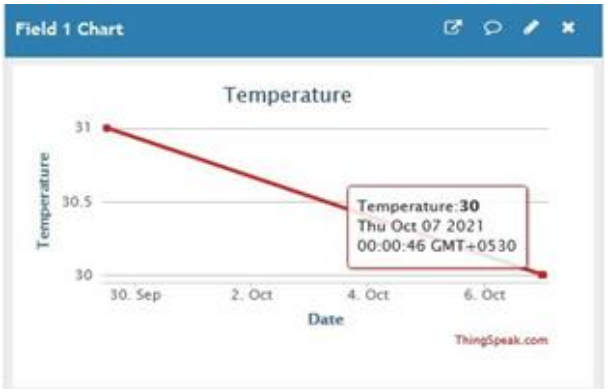


Fig 18. Temperature ThingSpeak Graph

V. ADVANTAGES

1. Cost efficient and economical way to measure health-related parameters.

2. Since the data is saved on ThingSpeak cloud, the user can access the saved data anytime to keep a trackof their health conditions.

3. The LCD display would indicate 'Emergency' if any of the parameter value is higher than the normal value and would display 'Normal' otherwise.

4. The buzzer would alert the user if any of the parameter value is higher than the normal values.

5. This model can be used at home thereby avoiding a visit to any hospital.

VI. FUTURE SCOPE

This model can be further updated and can also be used for various other purposes. Some ideas regarding the sameare:

1. Alert and tracking
2. Smart medical Assistant
3. Cost efficiency
4. Faster Diseases Diagnose
5. Location tracking device
6. Connectivity and affordability

VII. CONCLUSION

The system introduced smart healthcare to monitor the basic important signs of patients like heart rate, body temperature, the success rate of the project isabove 97.97% this device was made to improve the medical health of the patient and smart interaction between doctors and patients this gadget was significantly made by seeing the future of the humanity , device consist of basic tool which will help the patient and doctor to save their precious time and also to diagnose the patient far away from thebirth land too.

VIII. REFERENCES

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