

IoT based HRV monitoring system

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ABSTRACT In this paper, we present a functioning model of an IoT based Heart rate monitoring system. This system can help everyone by monitoring their heart rate, pulse rate, body position and temperature. It is very useful in special conditions like bad weather conditions and pandemic situations which we are facing today. This system avoids direct contact with the doctors by sending data collected from the patients to the server present at doctor interface and receives the medication from the doctor which is displayed in lcd and prescription is read aloud by the speaker. This system has a two interfaces one is present at the patient side and other is at doctor interface.

Keywords: Arduino NANO, LM35 , MAX30100, MEMS, ESP826, LCD.

I INTRODUCTION

Heart patient number incrementing instantaneously irrespective of age, 6 out of 10 people are suffering from cardiovascular diseases. One in 4 deaths of India are now because of cardiovascular disease. In this proposed system the patient will be under the observation of doctor without going to hospital. The patient condition will be monitored by the doctor through observing the body condition of patient through the sensors data which is coming through IoT. According to the patient condition doctor sends medication by voice message which is transferred to the patient through IoT.

By monitoring regularly we can control sudden deaths which are due to cardiovascular diseases. The proposed real-time monitoring system extracts medical information from the patients with help of sensors like LM35, SPo2. These cardiac parameters are helpful in detecting the cardiovascular diseases such as heart attacks, arrhythmia, hypotension, blood clots in hearts, hypertension, and hyperthermia and abnormal heart rhythms. We can respond to the patients who needed immediate help.

The developed system has two interfaces, one for patients for extracting medical data and other for the doctor to receive the extracted data from the patients. The patient interface consists of wearable sensors which extract medical information of the patients, Arduino nano and wi-fi module for receiving and transmitting data to the server that is doctor interface. By analyzing the data received from patient the doctor sends the prescription.

II. MOTIVATION

The motivation for making this product comes from observing the patients who are going to hospitals regularly for their checkup especially in present hazardous situation. Hypertension has become a serious threat to cardiac mortality and stroke mortality more over show loss supervision at instances. So we develop a low cost system which avoids regular contact and in case of emergency situation the care taker or doctor are alerted through IoT service for providing immediate medical help to the patient.

III. MAJOR COMPONENTS USED

Major components used in our monitoring system are Arduino NANO, LM35, MEMS, MAX30100, heart rate sensor, wifi module ESP8266, LCD display.

A. Arduino NANO It is a micro controller developed based on atmega328p consisting of 30 pins. Among those pins 14 pins are digital and pins are used for analog signals. 2 reset pins and 6 power pins are present. All the data collected and received are managed by the Arduino. It manages the receiving and transferring of data to the server through wifi module.

B. ESP8266-----The ESP8266 is low cost Wi-Fi with full TCP/IP stack and micro controller capability. It enables micro controller to connect with 2.4 GHZ wi-fi. Data transfer to the server and receiving from the server is done through the module.

C. LCD Display----- In this prototype we used 16X2 alphanumeric LCD. It is capable of displaying 224 different characteristics and symbols. The data collected from the patient and prescription received from the doctor are displayed for the user in the display.

D. Sensors -----we used four types of sensors. LM35, MAX30100, MEMS, Heart rate sensors for temperature, pulse rate, body position and heart rate variability measuring.

- 1) **LM35 sensor:** It consists resistance temperature detector which consists of two dissimilar metal plates which generate electric voltage which is indirectly proportional to the change in temperature.
- 2) **Heart rate sensor:** This sensor has super bright red led and light detector. When we place the finger on the sensor then bright light spread throughout the finger and detector detects the light from the sensor.
- 3) **MEMS:** This sensor consists both mechanical and electrical components. Micro electro mechanical system (MEMS) has two capacitor plates. Mass is suspended in between two capacitor plates. Body position of the person is identified with the position of capacitor plates and its suspended mass.
- 4) **SpO2 sensor:** SpO2 sensor is a pulse sensor which calculates pulse. It calculates by based on the differential absorption characteristics of oxygenated and deoxygenated hemoglobin.

IV. PROPOSED MODEL

In this design. We proposed low cost heart rate variability monitoring system to avoid going to hospitals and to provide immediate help in emergency situations. Cardiovascular diseases are monitored by seeing HRV of the patient. So heart rate and pulse rate are monitored and data is send to the servers. In case of emergency the care taker and the doctor are alerted.

MQTT (message queuing telemetry transport) protocol is used to transfer message between the devices. The data collected and medication is shown in the LCD screen.

This approach can help heart patients to take medication under the guidance of doctor without going to hospital.

The block diagram and prototype of the proposed model are shown in fig. 1, fig. 2 respectively.

V. SOFTWARE

Arduino IDE provides environment for the development of integrated chips and circuits. It is friendly used tool to develop code and implement on the kit. It provide easy of access to implement code.

It is an open source to create a new code or to develop existing code. We can download our code or store it in the cloud for later usage. Arduino Ide is a tool especially designed for Arduino boards. The tool can be worked on Linux, windows operating systems.

The IDE layout is mainly divided into three sections

1. Menu Bar
2. Text editor
3. Output panel

VI. BLOCK DIAGRAM

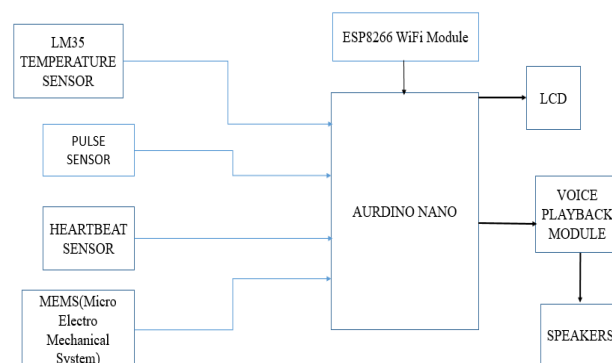


Figure.1. Block Diagram of the Proposed Model

VII. RESULT

The Equipment has high working efficiency and serves the purpose of avoiding direct meeting with doctor especially in these pandemic times.

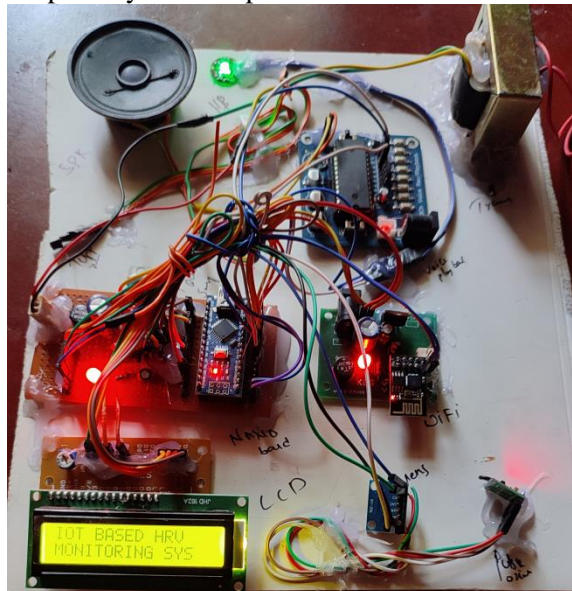


Figure 2. proto type of HRV monitoring system

In the prototype, all the above-mentioned components are embedded together as shown in the above figure. The data collected from the sensors is displayed in Lcd screen and send to the server through IoT.



Figure 3.



Figure 4

Figure 3,4 Prototype of HRV monitoring system with LCD indications.

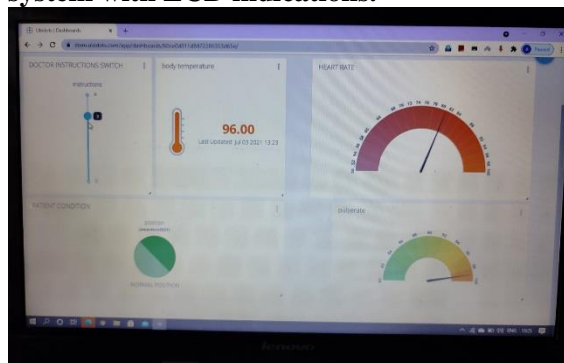


Figure 5: The parameters are shown in this website which are sent through IoT. According to the condition of patient the slider is changed. When the slider is changed according to the condition, the voice of doctor is listened through speakers and the patient condition is displayed in the LCD.

VIII.CONCLUSION

This approach can help heart patients to take medication under the guidance of doctor without going to hospital. Patients find an easy way to recover as the medication comes through voice output. We can absorb the sudden changes occurred in the patient body and provides immediate help to that patient.

IX.FUTURE SCOPE

The extension or future scope of this innovative idea is to implement more sensor technology such that we can improve more parameters. The GSM technology can also be implemented such that we can avoid internet issues.

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