International Journal of Scientific Research and Engineering Development-– Volume3 Issue 1, Jan-Feb 2020

Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

SMART HEALTH CARE MONITORING BASED ON INTERNET OF THINGS (IoT)

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***ABSTRACT*:**Inthisproposedwork,realtimepatienthealthmonitoringsystemhasbeendesignedbyusinginternetofthings(IOT).Various parameters like body temperature, blood pressure (B.P), heartbeat, and ECG are monitored usingsensors.Humidity of the patient surroundings has been monitored in the proposed work. In this paper ARDUINO-NANO, GSM has been utilized for the design of the prototype. The main focus of the project is to monitor the important parameters of the patient in remote mode. IoT in healthcare is the key player in providing better medical facilities and it facilitates the doctors to monitor the patient's health condition continuously. The proposed system consists of various medical devices such as sensors, mobile and web-based applications, which communicate via network connected devices to monitor and record patient's health data and medical information in the remote mode. The collected information is used to analyze the patient's health condition continuously such that some critical conditions can be avoided by knowing in the preliminary stage itself through the projected design.

***KEY WORDS*:**Internet of Things, cloud server, Patient , Monitoring, Smart Health .

I.INTRODUCTION

A remote health monitoring system is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Health care services such as medical monitoring, data access and communication with the health care provider in emergency situations through SMS is achieved.

Health monitoring is the major problem in today's world. Due to lack of proper health monitoring, patient suffer from serious health issues. There are lots of IOT devices now days to monitor the health of the patient over internet [1-4]. Health experts are also taking advantage of these smart devices to keep an eye on their patients. With tons of new healthcare technology start- ups, IOT is rapidly revolutionizing the health care industry. Here in this project, we will make an IOT based health monitoring n system which records the patient heart beat rate and body temperature and also send an email/SMS alert whenever those readings go beyond critical values. Pulse rate and body temperature readings are recorded over Thingview so that patient health care can be monitored anywhere in the world over internet. A buzzer is attached near to the patient to the kit so that the relatives of the person can know the patient's critical condition.The proposed system mainly focuses on the situation where the doctors and patients are at distant location and it is very important to give the entire details about the heart beat and temperature of the patient to the doctor [5,6]. The IoT technology has the opportunities and challenges in accessing the medical data. The computing resources is a challenge since the data used is huge and that is Big Data, so the data need to be decentralized.More over the data is of heterogeneous in nature since the data is distributed data the software approach to deal this data is with the cloud computing platform. These are designed to coordinate with the hybrid data. A cloud platform is developed to deal the heterogeneous data [7,8]. An IoT for health care data is used for industrial applications. Data collections are done using sensors [9]. Data collection is done using a hard wired in assessing the operational performance. The data collected is correlated with the technician's readings and thus the performance is checked and decided based on data[10].

II.EXISTING METHODS

At present patient's health is monitored in hospitals by using corresponding instruments. The presence of doctor is compulsory in such cases. To overcome this, a number of researchers have proposed various models for IoT in Healthcare and the prediction of various types of diseases using various techniques. The sensors used here are Temperature Sensor, BP Sensor, and Heart Beat Sensor and ECG (electro cardio gram) sensor. This methodology has been earlier implemented using Arduino-Uno, raspberry-pi asthe controller. In this work we have used ARDUNIO-NANO.

III.PROPOSED METHODOLOGY

The proposed model's block diagram is shown in fig.1.The block diagram shows all the components of the hardware connected to the ARDUINO NANO, which is linked with the processor. A Remote Patient Health Monitoring System (RPHMS) has been designed which has heartbeat detection, temperature detection, humidity detection, B.P measurement. A doctor or health specialist can use the system to monitor remotely of all vital health parameters of the patient or person of interest.

IV.SYSTEMARCHITECTURE

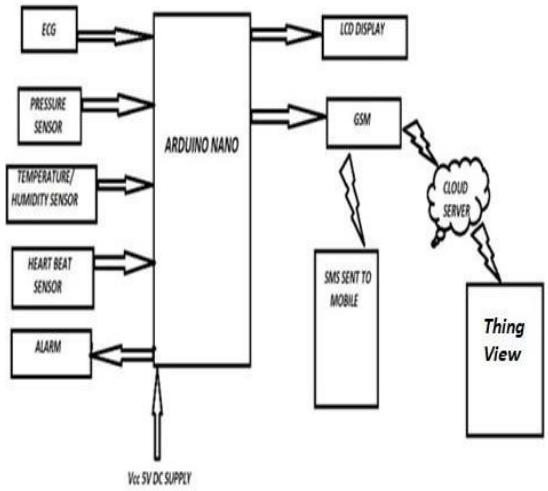

Figure1. Block diagram

V.ARDUINONANO

The Arduino Nano is a small, complete, and breadboard- friendly board based on the ATmega328P from fig.2; offers the same connectivity and specs of the UNO board in a smallerform factor. The Arduino Nano is programmed using the Arduino software(IDE).Arduino boards are widely used in robotics, embedded systems, and electronic projects where automation is an essential part of the system. These boards were introduced for the students and people who come with no technical background. The design of Arduino-nano board is shown in fig.3

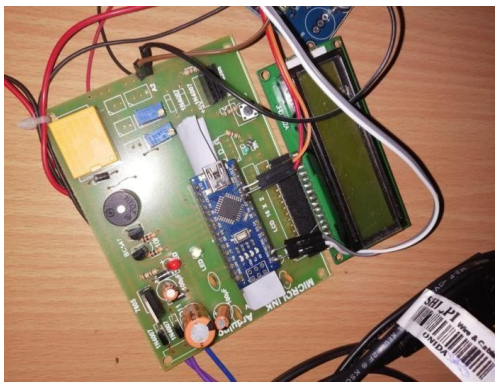

Figure3. Arduino nano connections on PCB

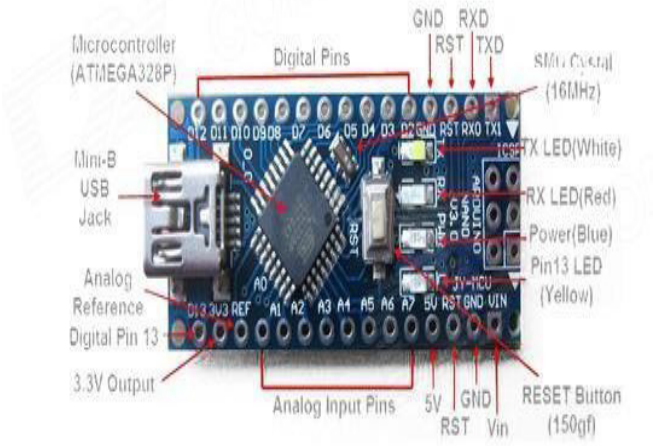

Figure2. Arduino NANO

VI. DHT11 TEMPERATURE/ HUMIDITYSENSOR

This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor capability. It is integratedwith a high- performance 8-bit microcontroller. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sensor for wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high performance.Each DHT11 sensors features extremely accurate calibration of humidity calibration chamber. The calibration coefficients stored in the OTP program memory, internal sensors detect signals in the process, we should call these calibration coefficients. The single-wire serial interface system isintegrated to become quick and easy. Small size, low power, signal transmission distance up to 20 meters, enabling a variety of applications and even the most demanding ones. The product is 4-pin single row pin package. Convenient connection, special packages can be provided according to users need fromfig.4.

Specification

Supply Voltage: +5 V Temperature range :0-50 °C error of ± 2°C Humidity :20-90% RH ± 5% RH error Interface: Digital

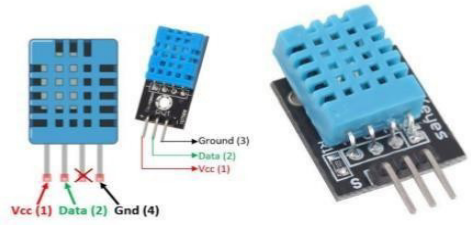

Figure4. Temperature and humidity sensor

VII.HEARTBEATSENSOR

The heartbeat sensor is also called as pulse sensor. Pulse Sensor is a well-designed plug-and-play heart-rate sensor for Arduino. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. It also includes an open-source monitoring app that graphs your pulse in real time.The front of the sensor is the covered with the Heart shape logo. This is the side that makes contact with the skin. On the front you see a small round hole, which is where the LED shines through from the back, and there is also a little square just under the LED. The square is an ambient light sensor, exactly like the one used in cellphones, tablets, and laptops, to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the amount of light that bounces back. That's how it calculates the heart rate. The other side of the sensor is where the rest of the parts are mounted. Pulse Rate Sensor Pulse Sensor is a well-designed plug-and-play heart-rate sensor for Arduino from fig.5. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. It also includes an open-source monitoring app that graphs your pulse in real time.

Figure5. Heartbeat sensor

VIII.*ECG(Electro Cardio Gram)SENSOR*

The ECG Signal is divided into three fundamental intervals, the PR interval, ST and the QT interval mentioned below**.**

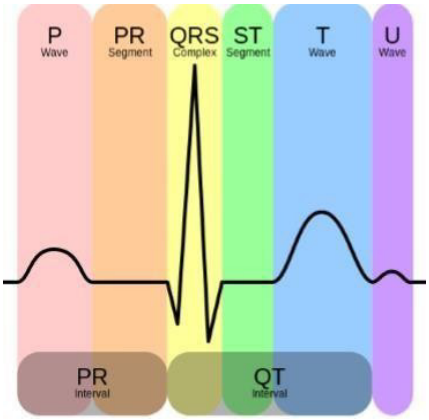

Figure6. ECG waves and Heart interval Time Slots Notation

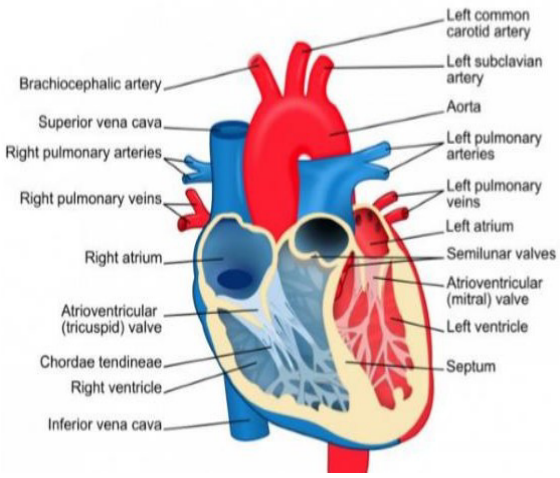

Figure7. Internal Cross-Sectional View of heart

PR INTERVAL NOTATIONS

The PR time period is the underlying fundamental electrical drive wave that movements from the correct chamber to one side chamber from fig.6. The correct chamber is the known as the main chamber to see electrical motivation Response. The chambers were depolarized by this electrical signal shock. It leads to force it to contract, pumping de-oxygenated blood from the upper and lower vena cava into the whole right ventricle as shown in fig.7. It then antecedents the left atrium to contract over the edge of the brain as the electrical impulse is passes.

CONNECTING THE HARDWARE

In this, we will interface an Arduino NANO controller Board to the AD8232 Sensor Module. We will create a simple ECG monitor to allow you to measure your heart's electrical activity in real time.

PIN CONNECTIONS

The AD8232 ECG Module Monitor breaks out of nine IC links.The module consisting of three ECG Pads Those is Black Acts asa Common Node, Blue acts as a LA (Left Arm) and Red Acts asRL (Right Leg) from the fig.8 and the description is shown in table1.

IC AD8232 ECG	*Pinouts*	*Pin Connection with Arduino*
GND	Ground	GND
3.3 Volts	3.3V Power Supply	3.3Volts
OUTPUT Pin	Output Signal	A0
LO (minus)	Leads off Detect minus	11
LO(plus)	Leads off Detect plus	10
SDN	Shut down	Not used

Table1. Pin description

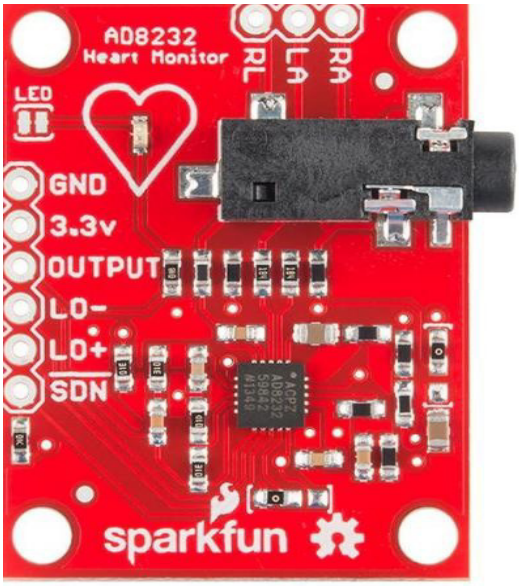

Figure8.pin configuration of AD8232 ECG Module

The very closer the chest pads are, the better the measurement is possible moreover to use the jelly for body quick respond purpose. The cables were color coded to give determine the correct orientation based on Einthoven's triangle as shown in the below table.2. And they can be placed on the chest very closer to the arms and above the lower right abdomen, as shown on the below fig.9 on the right-side image in the belowdiagram.

Table2. Cable Color of ECG sensor

Cable Color	Signal
Black	RA (Right Arm)
Blue	LA (Left Arm)
Red	RL (Right Leg)

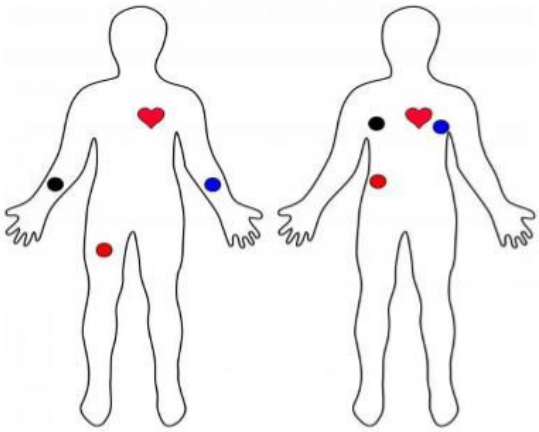

Figure9.Arrangement of ECG Pads.

IX. BLOOD PRESSURE SENSOR

This pressure sensor is a BMP-180 from fig.10 based digital barometric pressure sensor module and is functional compatible with older BMP-085 digital pressure sensor with less power consumption smaller in size and more accurate.BMP180 combines barometric pressure, temperature and altitude. The I2C allows easy interface with any microcontroller. On board 3.3V LDO regulator makes this board fully 5V supply compatible. BMP-180 can measure pressure range from 300 to 1100hPa (+9000m to -500m relating to sea level) with an accuracy down to 0.02hPa (0.17m) in advance resolution mode. BMP-180 is an improved replacement for BMP-085 sensor.BMP-180 uses piezo-resistive technology for high accuracy, linearity, EMC robustness and stability for a longer period of time.

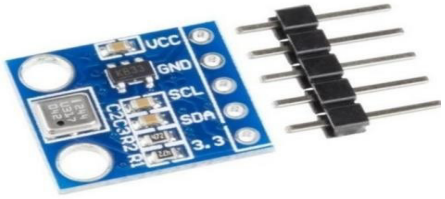

Figure10. Blood pressure sensor

X. THINGVIEW -THINGSPEAK VIEWER

According to its developers, "Thingview is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network from fig.11.Thingview enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates.

Figure11(a). Thingview app

Figure11(b). Sample graphs(X axis: time, Y axis: temperature, pulse)

The hardware design of the proposed methodology is shown in fig.12.

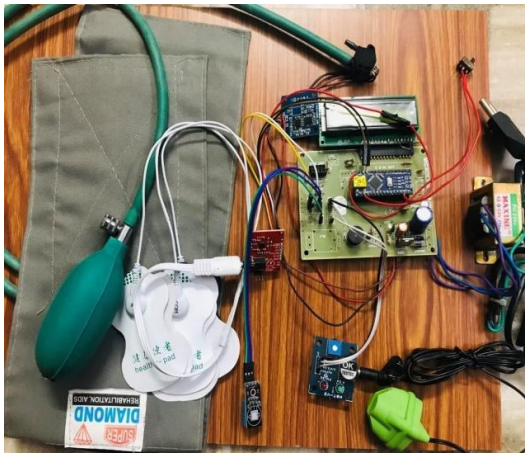

Figure12. Hardware kit

XI. RESULTS AND DISCUSSIONS

The corresponding code has been uploaded to ardunio-nano. The system is set up for home use by patients who are not in a life-threatening situation but need to be monitored in a timely manner by the doctor or the family. As per the paper work, the design of the health monitoring system is based on the idea to meet the needs of patient's health condition. The values obtained in the mobile are shown in fig.13. All these parameters are also displayed on LCD.

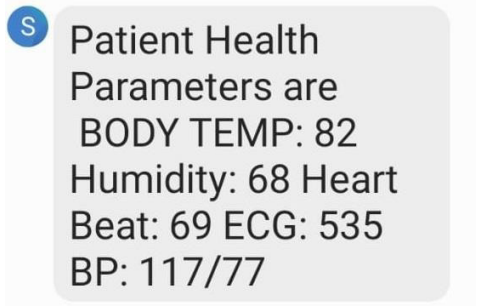

Figure13. Obtained parameter values in mobile.

XII. CONCLUSION

In this work, Patient Health Monitoring system has been designed and it took less than a minute to monitor the parameters- ECG, blood pressure,heart beat and temperature.The values are obtained from the mobile in the form of SMS and also parameters ECG,temperature,heart beat has been viewed through ThingView application in the form of graphical representation.The proposed design has major advantage to monitor the condition of the patient in remote mode.

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