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REAL TIME HEALTHCARE MONITORING AND ANALYSIS SYSTEM USING IOT

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Abstract: Advancements in Internet of Things technology have played a key role in the development of the healthcare sector, greatly increasing access and affordability to the healthcare sector through user-friendly applications for virtual and remote interaction with patients. I'm here. Given the power of IoT technology, the difficulty of physically unstable patients visiting doctors on a regular basis can be overcome.This work has resulted in a prototype of an IoT-based remote patient monitoring system. The prototype consists of health sensors such as a heart rate sensor, body temperature sensor, and tilt sensor. All these sensors are integrated in a single system with a microcontroller. Data collected by sensors is stored in Firebase. You can also view this data on your Android phone. IoT integrated into health wearables can overcome the need to go to the hospital for primary health issues. This will also significantly reduce medical costs for patients. In addition, doctors can monitor the patient's health status over time through the application and prescribe the necessary medicines. A detailed analysis of the signals was performed in relation to changes in physical and environmental activity to understand how the sensors used work.

IndexTerms:**Tilt, IoT, ESP8266 Node MCU, Firebase, BWSN.**

I. INTRODUCTION

Advances in technology have allowed this generation to use miniature versions of modern ones. Through this further development a health monitoring system is made [1]-[3]. The use of remote health monitoring systems has become widespread in recent years for personal health care, fitness, and medical awareness. This type of device allows patients or paralyzed people to be monitored remotely by health care providers and authorized personnel. Cloud-based health monitoring systems can detect medical emergencies and provide biofeedback through early warning. This system allows elderly patients to stay in touch with their families, who are always informed about their condition. This is a remote monitoring device that can capture all information and transfer the data to the cloud for later access by healthcare providers and authorized personnel. These devices can increase the chances of survival from unforeseen illness [4].

A. Internet of Things Architecture

The Internet of Things is a web-enabled system of embedded sensors, processors, and communication hardware that all work together to collect, transmit, and process data from the environment. This principle of the Internet of Things allows operators to remotely access connected devices using wireless cloud technology. Devices must have high connectivity so that they can communicate with other smart devices over long distances without external intervention.

There are basically four phases to designing the Internet of Things (IoT). Different stages perform different operations. Level 1 is how many are connected to get primary data that can be used for further analysis. It usually consists of multiple wired or wireless sensors. Stage 2 collects relevant data for linking to the Internet. Analog-to-digital conversion is also enabled at this stage. In Stage 3, the IT system preprocesses the data and moves on to the final stage (Stage 4). At this stage, the filtered, analyzed, and processed data is stored in a cloud-based storage system in traditional back-end data systems [5].

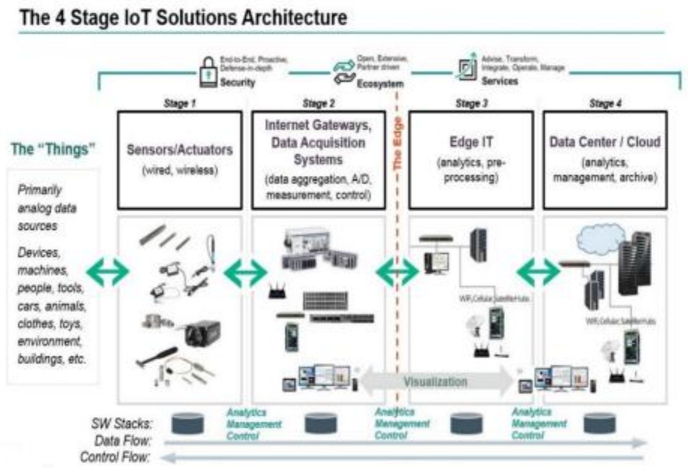

Figure 1: Stages of IoT Architecture (5)

II. Aims and Objectives

The purpose of this study is to propose patient monitoring and telemedicine. In this work, a prototype architecture is proposed to provide an advanced medical system used to monitor patient health and well-being from any location. The main objectives of the proposed work are:

1. Research and develop a medical system architecture his prototype that enables services such as patient monitoring and interaction between providers and patients in a wireless environment.
2. Developing wireless infrastructure solutions to deliver healthcare services that improve the accessibility and quality of healthcare systems.
3. Use mobile-based technology to provide a model of high-level privacy in the healthcare system.
4. Define and develop an access control model to provide controlled data availability.Controlled Access to Patient Data. This study aims to research and develop optimized solutions to achieve these goals of remote patient monitoring.

III. System Design

1. ESP8266 NODE MCU:

The ESP8266 integrates an 802.11b/g/n HT40 Wi-Fi transceiver, so it can not only connect to WiFi networks and interact with the Internet, but also set up its own network for other devices to connect directly. We can also manufacture. This makes the ESP8266 NodeMCU even more versatile. Since the ESP8266 has an operating voltage range of 3V to 3.6V, the board is equipped with an LDO voltage regulator to keep the voltage constant at 3.3V. If the ESP8266 consumes up to 80mA during RF transmission, this should be more than enough. The regulator output is also split to one side of the board and labeled 3V3. This pin can be used to power external components.

The ESP8266 NodeMCU is powered via the integrated MicroB USB connector. Alternatively, if you have a regulated voltage source of 5V, you can use the VIN pin to directly power the ESP8266 and its peripherals.

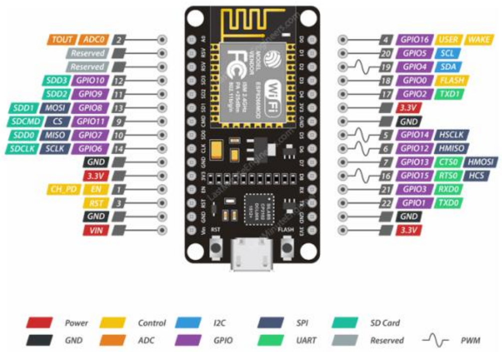

Figure 2: Node MCU Pin Out

2. DHT11 Sensor

DHT11 humidity and temperature sensors are available as sensors and modules. The difference between this sensor and module is the pull-up resistor and power on LED. DHT11 is a relative humidity sensor. This sensor measures ambient air using a thermistor and a capacitive humidity sensor. The DHT11 sensor consists of a capacitive humidity sensing element and a thermistor to measure temperature. Moisture sensitive capacitors have two electrodes with a moisture retaining substrate as a dielectric between them. A change in capacitance value occurs with a change in humidity level. The IC measures these changing resistance values, processes them, and converts them to digital form.

To measure temperature, this sensor uses a thermistor with a negative temperature coefficient. This causes the resistance to decrease as the temperature increases. This sensor is usually made of semiconducting ceramics or polymers in order to obtain high resistance values with small temperature changes.

The DHT11 has a temperature range of 0 to 50 degrees Celsius with an accuracy of 2 degrees. The sensor has a humidity range of 20-80% and an accuracy of 5º. The sampling rate of this sensor is 1 Hz. That is, a read is done every second. The DHT11 is small and has an operating voltage of 3-5 volts. The maximum current used during measurement is 2.5 mA.

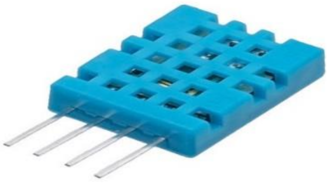

Figure 3: DHT11 Sensor

3. ECGSensor

An electrocardiogram (EKG) is a technique for collecting electrical signals produced by the human heart. When a person experiences physiological arousal, the level can be known by the electrocardiogram sensor, but it is also used to understand the psychological state of the person. Therefore, we use the AD8232 sensor to calculate the electrical activity of the heart. This is a small chip that can record electrical effects like an ECG (electrocardiogram). An electrocardiogram can help diagnose many heart conditions. This article provides an overview of the AD8232 ECG sensor.

The AD8232 ECG Sensor is a commercial board for calculating the electrical motion of the human heart. This behavior can be graphed like an electrocardiogram and its output is an analog measurement. The ECG is very noisy, so the AD8232 chip can be used to reduce the noise. The ECG sensor's working principle is like an operational amplifier, which helps to get a clear signal easily from an interval. The AD8232 sensor is used for signal conditioning in ECG and other biopotential measurement applications. The main purpose of this chip is to amplify, extract and filter low biopotential signals in noisy conditions such as those produced by remote electrode exchange or movement [6].

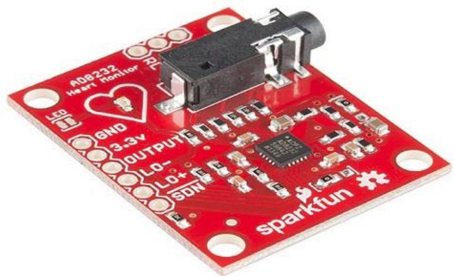

Figure 4: AD8232-ECG-sensor

4. TILT Sensor

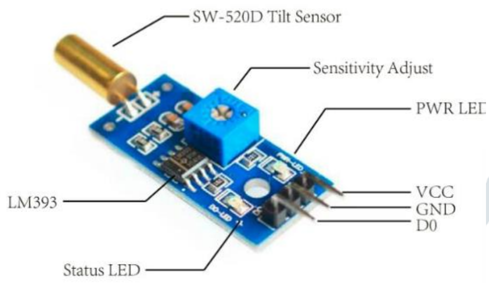

Figure 5: Tilt Sensor

Tilt sensors are essential components in today's security alarm systems. A standalone tilt sensor detects tilt angle or movement. Tilt sensors can be implemented using mercury and trackball technology and can be attached with mechanical threads, magnets, or adhesives, depending on the type of surface to which they are attached. Recent technological advances in inclinometer manufacturing have improved accuracy, reduced cost, and increased durability. The SW-520D is a commonly available trackball type inclinometer with two conductive elements (poles) and a conductive free ground (trackball) enclosed in the same package. With the tilt sensor end facing down, the mass rolls over the bar and shorts it out. This will act as a shift stroke. We also offer a SW-520D-based tilt sensor module for microcomputers at an affordable price.

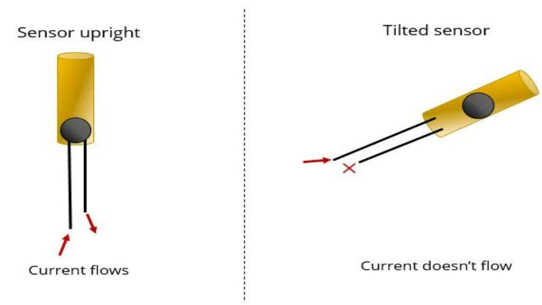

Figure 6: Current flows when tilted

The electronics behind this tiny module are usually centered around the LM393 dual comparator chip. The module features a tilt sensor, a signal booster, a standard 4-pin header, a power indicator to let you know the module is properly powered, and a status indicator that lights up when tilt is detected by the tilt sensor. increase. When the tilt sensor is in an upright position, a ball within the tilt sensor he bridges the two contacts, completing the circuit. Tilt the board to move the ball and open the circuit. The module outputs 0V (L) when upright and 5V (H) when tilted through the digital output (DO) connector on the 4-pin header. If the analog output (AO) of the module is connected to the analog input of the Arduino (e.g. A0), a value of 0 (0V) in upright position and 1023 (5V) in tilted position can be expected [7].

5. Firebase

Firebase Features

- Real-time Database − Firebase supports JSON data and all users connected to it receive live updates after every change.
- Authentication − We can use anonymous, password or different social authentications.
- Hosting − The applications can be deployed over secured connection to Firebase servers.

Firebase Advantages

- It is simple and user friendly. No need for complicated configuration.
- The data is real-time, which means that every change will automatically update connected clients.
- Firebase offers simple control dashboard.
- There are a number of useful services to choose.

Firebase Limitations

- Firebase free plan is limited to 50 Connections and 100 MB of storage.

Firebase - Environment Setup

- How to add Firebase to the existing application. We will need NodeJS. Check the link from the following table

Sr.No.	Software & Description
1	***NodeJS and NPM*** NodeJS is the platform needed for Firebase development. Checkout our NodeJS Environment Setup.

IV. PROPOSED SYSTEM

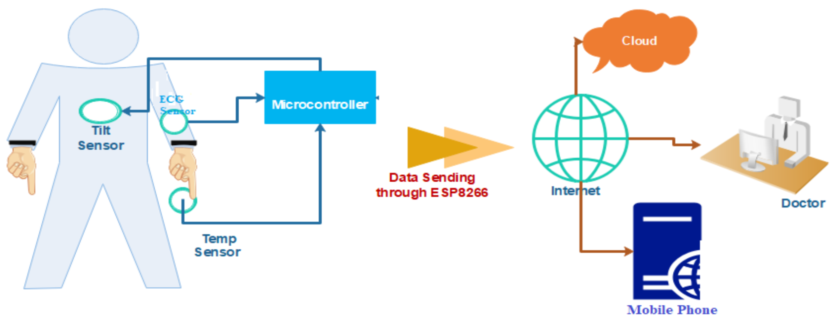

Figure 7 Real Time Health Monitoring and Analysis System (RTHMAS)

Firstly, we are using open-source microcontroller, by using this microcontroller various sensors are attached to it (Here we are using max 2-3 sensors). These sensors provide us various numerical values as per its function, using firebase the data can be fetched. The fetched data processed and will shows the cause of patient. For example, if we use Blood Pressure sensor then it will show the BP of patient if its high then it will display on Android screen that is BP is high. The data will not be stored anywhere, only live data can be fetched and display. No database for this system. The data retrieved from Firebase only, so IOT can be achieved. Here we will get online data only not offline.

V. IMPLEMENTATION

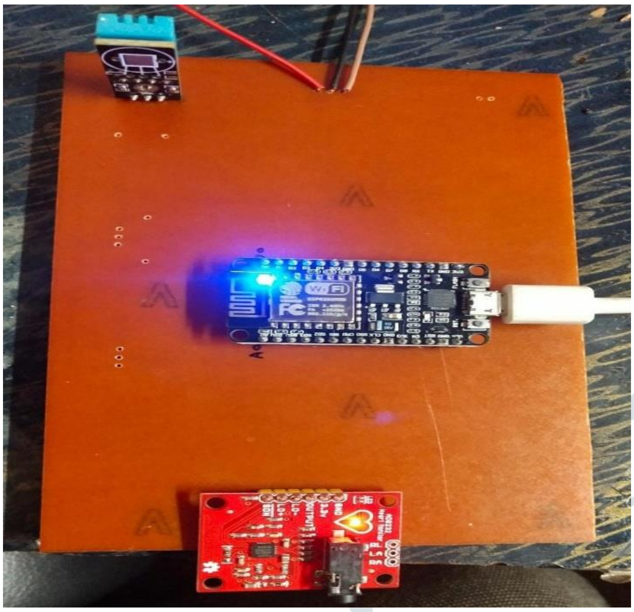

Figure 8 Front view of connections

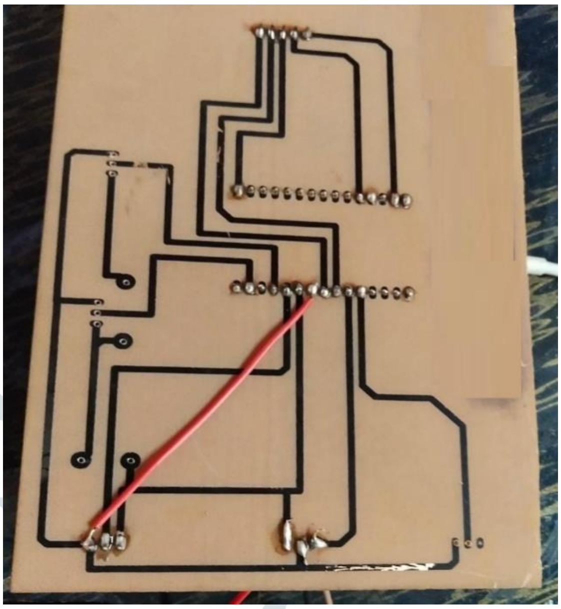

Figure 9 Back view

The above figure depicts the front and back view of PCB, attached all required components to it with its proper connections.

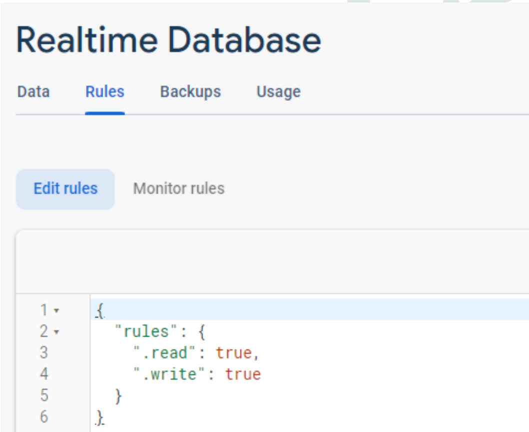

Figure 10 Firebase Database

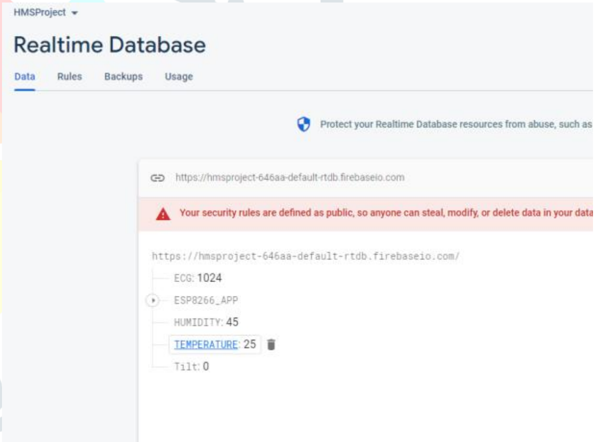

Figure 11 Read-write data

The above figure depicts the Realtime database using Firebase. It is used to store live data fetched from sensors. It will get updated time to time means as it gets new values from sensors it will get changed.

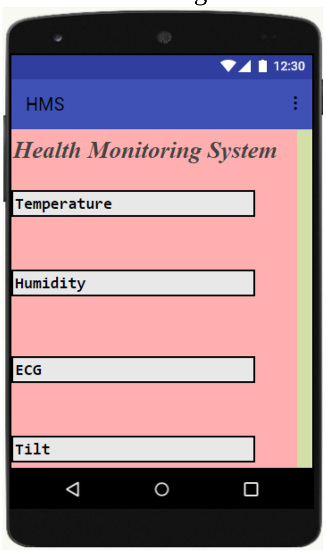

Figure 12 Android GUI

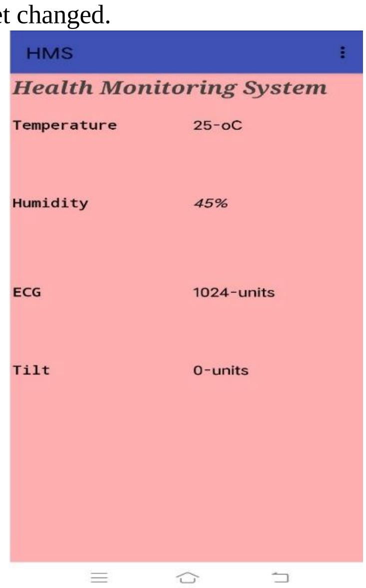

Figure 13 Access values from firebase

The above figure depicts the GUI design of Android, it is designed using MIT App inventor online tool. The values get from firebase it will fetched and shows on display.

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