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Revolutionizing Heart Monitoring with Oximetry

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Abstract:- Innovative medical gadgets are now critically needed to monitor and analyze the situation, especially in light of the COVID-19 pandemic. In light of this, a portable, affordable, IOT-based heart rate and SpO2/level sensor device with effective performance has been developed. In order to publish data to a software web page and display data on the OLED, the suggested system has an integrated LED with basic internet access. Its mobility, user-friendliness, and distinctive method of sending collected data are its key qualities. data online, enabling it to perform better than the solutions that are currently on offer in a number of ways. The project is designed in such a way that the analogue quantities which are to be recorded continuously are taken and converted into corresponding digital values using a six-channel ADC. Here we consider temperature and monitor the heart rate. The processed data from ADC is sent to the microcontroller. With the help of a six-channel ADC, the project's architecture transforms the analogue numbers that must be continuously recorded into equivalent digital values. Here, we keep an eye on the heart rate and take the temperature into account. The microcontroller receives the data from the ADC that has been processed. The microcontroller is designed to continuously monitor the status of the sensors. To transfer sensor data to the server web page in the form of a database, the microcontroller and the Wifi Module will be interfaced using serial connection. Monitoring physiological data, such as electrocardiogram (ECG) signals, offers a new avenue for ease of control and prevention in modern healthcare. Consequently, a new era of proactive, intelligent healthcare would emerge—especially considering the major barrier of scarce medical resources. It was shown how to use a mobile ECG monitoring service hosted in the cloud. With the use of a pulse oximeter and a wireless transmission method like WI-FI, these may identify ECG signals and display them on a screen. IOT based on ECG monitoring has been the subject of various works.

Keywords:- *Patient Monitoring, IOT Based, SpO2, OLED.*

I. INTRODUCTION

A special-purpose system with one or more devoted functions, sometimes with real-time computing limitations, is called an embedded system. Usually, it is integrated into a full gadget that also includes mechanical components and hardware. On the other hand, a personal computer or other general-purpose computer can do a wide range of functions based on its programming. Due to their widespread usage in many everyday products, embedded systems have grown in importance. Because of the embedded system's specialization, design engineering can optimize it to lower the product's size and cost or boost its performance and dependability. Due to economies of scale, some embedded systems are manufactured in large quantities. In terms of physical form, embedded systems can be found in everything from small, portable gadgets like MP3 players and digital watches to massive, fixed installations like traffic lights, industrial controllers, or the systems that operate nuclear power plants. A single microcontroller chip can have a modest level of complexity, while numerous units, peripherals, and networks arranged inside a sizable chassis or enclosure can have a very high level of complexity. The term "embedded system" is generally ill-defined because many systems possess some degree of programmability. For instance, handheld computers and embedded systems are similar in that they both have microprocessors and operating systems, but they are not fully embedded systems as they permit the loading of different applications and the connection of peripherals. A computer hardware and software combination that is either programmable or fixed in capabilities and created especially for a specific type of application device is called an embedded system. Numerous

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devices, including toys, cars, medical equipment, industrial machines, cameras, home appliances, and PDAs (in addition to the more apparent cell phones and PDAs) are potential hosts for embedded systems. Programmable embedded systems have a programming interface and may be programmed. Programming embedded systems is a specialized field. Some language platforms or operating systems are designed specifically for embedded market, including Windows XP Embedded and embedded Java. On the other hand, some low-end consumer items have a single operating system and application, and relatively cheap microprocessors with little storage. Here, the software is not loaded into RAM (random access memory) like applications on a personal computer, but rather is written permanently into the system's memory.

II. LITERATURE SURVEY

The "IOT" study was extensive and included several limitations and montages. The primary objective of "IOT" is to guarantee that Internet-based communications and information sending and receiving are normally available when used in conjunction with "electronic sensors" equipment. A research stated that there were 28.4 billion IOT users in 2017 and the number is expected to increase to 50.1 billion by 2020. However, the primary goal of IOT is to integrate software development; often, recycling sensors with accelerometers and compression-embedding camps serve as the program's initial components. Sensitivity and mobility have both improved with the sensors. Additionally, parking, grids, and smart dwellings. “Consequently, integrating enterprises is the primary objective of IoT. Heart-related health issues are increasingly common in today's world, and machines are always sending out messages. As with software development in general, the first view for the "IoT phase is divided into criteria, specifications, and implementation." The final section, which includes the corporate procedure, is a crucial technique". Eskelinen provided two questions and incorporated them into the design phase in order to comprehend the requirements of any Internet of Things project.

They have become known for their upscale and various wireless control systems above other common devices. The WSN is a major component of IOT and is also crucial to its healthcare applications. The importance of using the WSN for oxygen saturation and pulse rates was highlighted by Rotaries and Manta in 2012. In contrast, ECG and blood pressure sensors were installed on mobile phones in 2016 by Xuedong et al. The wireless network gets better with the IOT approach in the health analogue, he claimed all employed Wifi technology in the control area for its 2012 work to transmit messages on several bodily functions, including oxygen saturation, body temperature, pulse rate, and blood pressure. Wannenburg and J. J. R. When Bluetooth was added.

To protect the transmission of medical data between gateways, sensors, and health information services. In the context of personal linked health, the CDG is an open platform for the safe and understandable interchange of health data. In order to guarantee a uniform and interoperable ecosystem of personal connected health devices, the CDG offers a set of precisely defined interfaces that permit the secure flow of medical data among sensors, gateways, and end services. This eliminates ambiguity in the underlying standards.

III. TABLE OF CONTENT

Table 1 The Average Heart Rate of Human Beings

Age	Average Heart Rate
Newborn	140
7 Year	85-90
14 Year	80-85
Adult	70-80
Athletes	60-100

The typical heart rate of humans is shown in the table under five stages. The stages that are taken into consideration in the table include the new born stage, sometimes referred to as the early stage or the post-birth period, is the first stage. The heart rate would be approximately 140 beats per minute in the second stage, 85–90 beats per minute on average in the adolescent stage, and 80–85 beats per minute on average in the teenager stage, which is the third stage The average heart rate in the fourth stage, which is regarded as the adulting stage, is between 70 and 80 beats per minute. The average heart rate in the fifth stage, which is the athletic stage, is between 60 and 100 beats per minute.

The following stages are included in the tabular form of the average heart rate of people in five states. The heart rate is shown in three different scenarios.

Low Rate of Pulse When the heart rate per BPM (beats per minute) is greater than 40 and less than 60, the low pulse rate is indicated. The patient needs to see a doctor because of the low pulse rate, which could result in medical issues (e.g., low blood pressure).

- Normal Pulse Rate: The patient's pulse rate falls within the normal range, often between 60 and 100, meaning that there are no issues.

- High Pulse Rate: A patient with a high pulse range, potentially leading to heart-related conditions, such as high blood pressure, is said to have a high pulse rate, range of 100 to 150.

IV. OBJECTIVES AND METHODOLOGY

A. Objectives

The main goal is to raise awareness of heart disorders, which have become more prevalent in recent decades and are a major cause of death for many individuals. Heart illness should therefore not be taken lightly. Therefore, there ought to be equipment that can periodically check on the patient's cardiac behaviour. Several heart conditions can be avoided by examining or keeping an eye on the ECG signal in the early stages. This project involves connecting the AD8232 ECG Sensor to the ESP8266 Node MCU Board and using a

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serial plotter screen to view the ECG waveform. Similarly, users may use a PC or even just a smart phone to send the ECG waveform over the IOT Cloud platform and view the signal online from anywhere in the globe. Staying in the hospital is not necessary to monitor heart health. simply because it is possible to monitor the item remotely via he internet. As a result, the Patient Health Monitoring system is deemed to have advanced.

In the current environment, health issues are highly prevalent. One of the leading causes of death for both men and women is heart disease. Approximately one million people die from it each year. A vital component of the heart's operation is heart rate. In order to preserve heart health and research heart function, heart rate monitoring of the heart rating is essential. In addition to cutting down on visits and hospital triage wait times, this will also—and perhaps most importantly—lower the cost of staffing and administrative support.

Patients benefit from this convenience because it frees them up to engage in other activities rather than commute to the hospital or clinic and wait in lengthy triage lines.

B. Methodology

The suggested model's block diagram is displayed in Figure. It shows how every piece of hardware is connected. which is linked to the computer in turn. It is possible to divide the elements of the system into two categories: software and hardware.

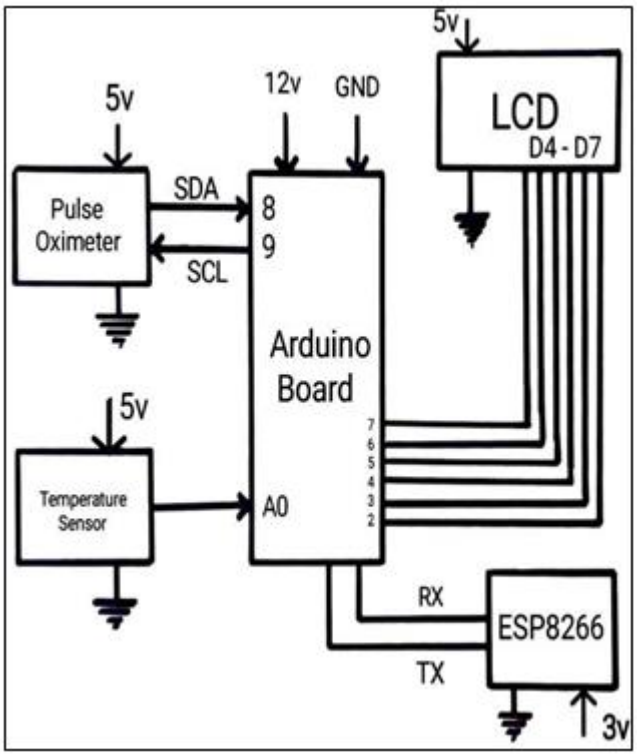

Fig 1 Block Diagram

V. HARDWARE IMPLEMENTATION

A. Arduino Uno:

As previously stated, Arduino is the brains of the project; you can connect to the same PINs described in the schematic using any Arduino board that you have on hand. The data must be gathered, displayed, and sent to the ESP8266 via the Arduino. A USB or "Vin" pin (9v–12v) can be used to power the entire circuit. It can be powered by a rectangular 9-volt battery or a barrel connector that takes voltages ranging from 7 to 20 volts. The term "Uno" was chosen to signify a significant revamp of the Arduino hardware and software. "Uno" means "one" in Italian.

B. Temperature Sensor:

To monitor the ambient temperature and to determine the pulse rate, the Arduino is interfaced with an LM-35 temperature sensor and a pulse sensor. By sending data to a Wi-Fi access point, the recorded temperature and pulse rate are sent to the cloud platform and shown on a character LCD interfaced with the Arduino. A temperature sensor monitors temperature and responds to it by producing varying voltage signals. There are three pins on it: one that goes to ground, one that goes to five volts, and one that outputs.

C. Pulse Oximeter:

Heart rate and blood oxygen levels are measured with a pulse oximeter. If you have any of the following medical problems, you may experience low oxygen saturation. Your reading may also be impacted by your skin tone. A non-invasive test that determines your blood's oxygen saturation level is pulse oximetry. It can quickly identify even minute variations in oxygen concentrations. The efficiency with which blood carries oxygen to the parts of your body that are farthest from your heart—your arms and legs—is shown by these levels. The pulse oximeter is a little gadget that resembles a clip. It fastens to a body component, usually a finger.

D. ESP8266 Wi-Fi Module:

The ESP8266 Wi-Fi module allows internet and Wi-Fi access for your projects. It is a very affordable device that adds a lot of power to your projects. It is the most popular device on the Internet of Things platform and can interface with any microcontroller. Find out more about ESP8266 and Arduino usage here. Next, attach the Arduino to the pulse sensor.

E. LCD Display:

The real-time data from the sensors is shown on an LCD, which is configured to display the heartbeat and body temperature in beats per minute. You may optimize the LCD's legibility by adjusting its contrast with the 10k potentiometer that is included.

F. Power Adaptor:

An electrical device called a power adaptor is used to change the voltage and current's shape. The high-voltage, high-current power supply from an outlet is usually converted into a lower-voltage, lower-current power supply so that the board can receive the current energize electrical

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equipment. Typically, the adaptor is made up of a voltage regulator, rectifier, and transformer. While the rectifier transforms the AC voltage into DC voltage, the transformer steps down the voltage. The output voltages are kept steady and within the acceptable range for the electrical device by the voltage regulator. Depending on the purpose and kind of device, power adapters are available in a variety of sizes and designs. As an illustration, an adapter for laptop power could be rectangular or cylindrical in design, yet a phone charger might be tiny and portable. In addition, the plug types and voltage ratings may vary based on the country and region in which they are utilized.

G. Heart Beat Sensor:

Heart sensors offer an easy approach for studying heart function, which may be quantified using the psycho-physiological signals theory applied as a stimulus to the virtual reality system. The finger's blood volume varies with time. Because light is scattered or absorbed as it passes through the blood when the heartbeat varies, the optical power variation can be used to quantify the heartbeat. The photo plethysmography principle serves as the foundation for the heartbeat sensor. Any change in blood volume passing through a biological organ that results in a change in the intensity of light passing through that organ (a vascular area) is measured.

VI. DESIGN IMPLEMENTATION

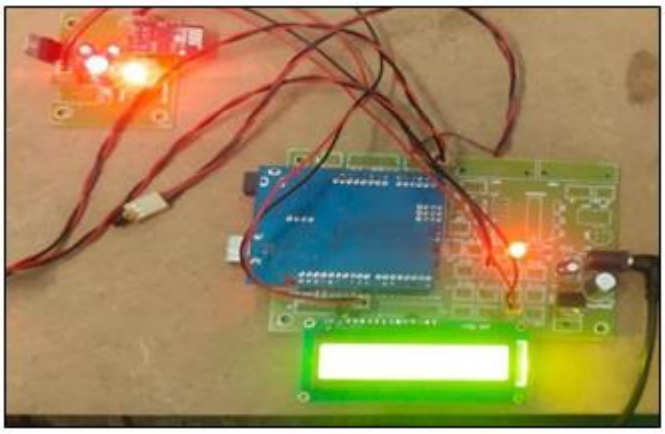

Fig 2 Design Implementation

The design and execution of the pulse oximeter-based Internet of Things-based cardiac monitoring system. The Arduino base board, which is located under the controller board in green, provides power to all of the devices connected to it. Other components include the ESP8266 Wi-Fi module, which is used to send data from the controller to the server, the temperature sensor LM35, which measures body temperature, and the pulse oximeter sensor, which provides the pulse rating for the oxygen value. First, the 12-volt DC supply should be provided via the adaptor. Since the Arduino board only needs a 5V DC voltage source, the adapter uses a voltage regulator to convert the 12V DC to 5V. The board has two capacitors, which serve as the filters. The purpose of the LED is to show whether or not the controller board is receiving a 5-volt DC supply. The controller begins running the code that was sent to the Arduino board, searching the internet for the source. Thus, the hotspot and cell phone are used to produce the internet source. The Arduino board has two serial ports connected to it; one is used for direct communication via a Wi-Fi module, and the other is for the receiver. The IR sensor will detect blood circulation if the finger is put on the pulse oximeter sensor. The LCD will also display the heart rate, body temperature, and oxygen saturation rate.

VII. RESULTS AND OBSERVATIONS

The display in the figure depicts a person's body temperature, heart rate, and oxygen saturation level. Following are the recorded values for an individual's heart rate, oxygen saturation, and body temperature:
ECG reading: 95 bpm
Level of oxygen: 98
Temperature of the body: 30 degrees

Fig 3 Graphical Representation of Temperature, Heat Rate, and Oxygen Level.

The temperature at a specific time interval is shown graphically in the figure. The spo2 concentrations at various intervals.

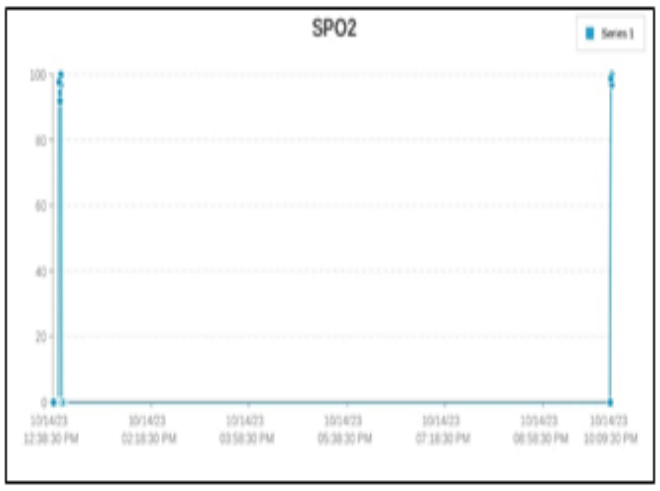

Fig 4 The Temperature

The oxygen level at a specific moment in a human's beginning is graphically represented in the figure. Haemoglobin in blood has the capacity to carry up to four oxygen molecules. The body receives its blood and oxygen from the cardiovascular system, a complex network of vessels. The quantity of oxygen needed by the heart to function is known as myocardial oxygen demand.

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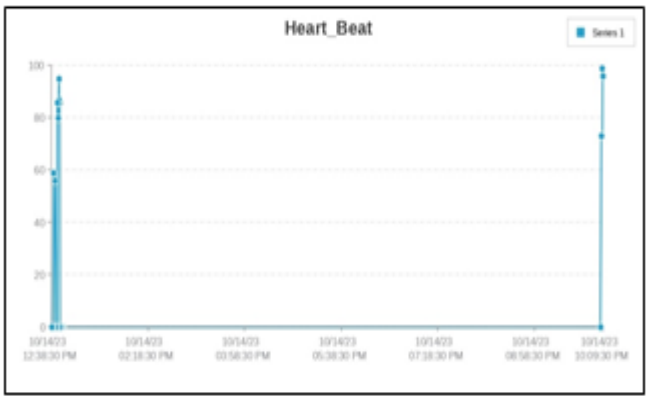

Fig 5 The Oxygen Level

The coronary arteries' ideal performance and myocardial oxygen delivery. Myocardial oxygen supply and demand are equal when the organism is functioning at optimal physiological conditions.

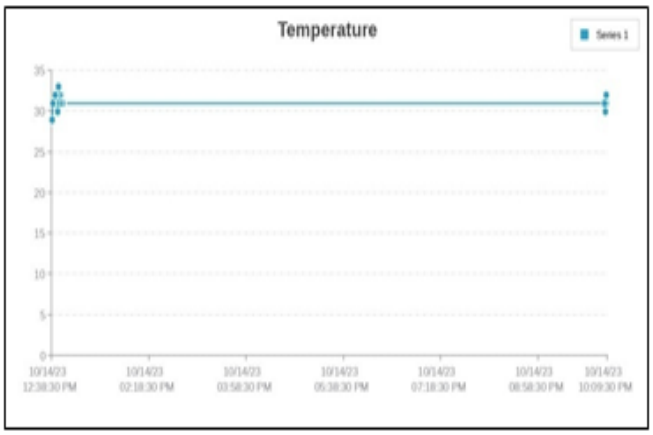

Fig 6 The Coronary Arteries'

VIII. CONCLUSION

In the field, the idea of IOT and cloud computing for medical applications has been put out. The main goal of creating patient monitoring systems is to lower healthcare expenses by minimizing hospital stays, ER and doctor visits, and diagnostic tests. New applications can be easily adapted to by many modern wireless transmission protocols and technologies. One of the most significant applications of IoT was described as the primary distributor of health care systems. helps to improve healthcare delivery by removing constraints related to time, location, and other factors while simultaneously expanding coverage and efficiency. People can now receive high-quality care at fair prices because to the IOT health revolution. Large volumes of sensor data are produced by these applications, which must be appropriately managed for handling and monitoring. With its Base, cloud computing offers a viable method for effective knowledge processing in the medical field. The architecture offered is unique and can manage patient-specific network data and cloud devices. The cloud application, which is based on IOT and its design principles, makes it possible for sensor devices to communicate directly with one another while also being adaptable and efficient in serving users, stored data, and sensors.

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