IoT Based Healthcare Monitoring System

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***Abstract-** This paper describes a Thing Speak platform and an Arduino device-based healthcare monitoring system. Patients don't need to constantly be close to the doctor because they can monitor vital signs like body temperature, heart rate, and oxygen levels from a distance. To ensure that it functions properly and displays correct data quickly, we put it through an intensive testing procedure. By demonstrating how Thing Speak may improve patient health and reduce the demand on healthcare professionals, this innovative technology has the opportunity to improve healthcare for all.*

***Index Terms-** Arduino, Heartbeat Sensor, IOT, Node-MCU, Pulse Oximeter, Temperature Sensor, etc.*

I. INTRODUCTION

The Internet of Things (IOT) is developing as an essential instructor of remote monitoring solutions, which are changing the way patients are cared for in today's healthcare system through innovations in technology. This work provides an innovative Internet of Things (IOT) healthcare monitoring system that combines the ThingSpeak platform with Arduino microcontrollers. The need for remote patient monitoring is growing, especially when it comes to monitoring vital signs like oxygen saturation, pulse rate, and temperature. This system provides real-time monitoring from any place, which addresses this need. Healthcare professionals can acquire useful insights into patient's health states and make appropriate treatments by utilizing ThingSpeak for data storage and visualization. By conducting this study, we hope to develop remote healthcare technology by assessing the system's efficacy and dependability in improving patient outcomes and lowering healthcare costs.

II. LITERATURE REVIEW

The utilization of Internet of Things (IOT) technology in healthcare has attracted a lot of interest recently, as many studies have demonstrated how beneficial it may be for managing and monitoring patients remotely. Healthcare systems with Internet of Things (IOT) capabilities provide a new way to track vital signs and provide quick interventions, particularly in situations where patient health depends on continuous monitoring.

IoT devices, including Arduino microcontrollers, have been investigated in a number of studies for usage in healthcare applications. In Suryadevara et al.'s (2018) study, for example, it was shown that it is possible to monitor vital signs like heart rate and temperature using Arduino-based sensors. In a similar vein, Khan and colleagues (2019) created an Internet of Things (IOT) healthcare monitoring system with GSM and Arduino, allowing for remote patient health parameter monitoring.

In addition, studies have looked into the potential uses of IOT platforms like ThingSpeak in the medical field. Remoting patient monitoring devices can benefit from ThingSpeak's easy-to-use platform for data visualization, analysis, and archiving. A smart healthcare monitoring system that incorporates many sensors for real-time data collection and processing was developed by Jindal and Garg (2019), for example, using ThingSpeak.

Additionally, a number of studies have stressed the significance of remote patient monitoring in enhancing healthcare results. For example, Wu et al. (2020) carried out a comprehensive evaluation that demonstrated how successful remote monitoring programs are in managing chronic diseases and reducing hospital admission rates. In a similar vein, Omboni et al. (2021) noted how remote monitoring technology can improve patient involvement and treatment regimen adherence.

According to the body of research, IOT-based medical monitoring devices have the potential to improve patient outcomes and reduce healthcare costs when used in conjunction with platforms like ThingSpeak. However, further research is needed to evaluate these systems' accuracy, scalability, and durability in real-world healthcare settings.

III. SYSTEM BLOCK DIAGRAM

The proposed method leverages embedded systems and advanced technologies to overcome the limitations of conventional heart rate monitoring. By integrating an Arduino microcontroller with a heartbeat sensor, pulse-oximeter, temperature sensor, and Temperature sensor LCD display, this method offers several advantages. Heart rate monitoring is achieved through sensor readings processed by the Arduino, which then displays the heart rate on the LCD screen.

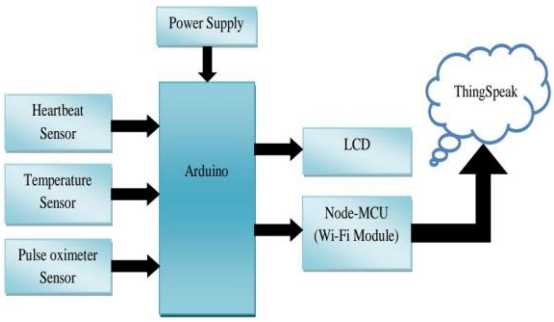

Fig.1 : Block Diagram

The use of an embedded system ensures automation, reducing the risk of human error present in manual methods. Additionally, the incorporation of guaranteeing that users are promptly notified even if they are not actively observing the display. This comprehensive approach Combines data processing, communication, and feedback mechanisms into a single unit, accessibility, and user awareness. Through the utilization of embedded systems, the proposed method significantly advances heart rate monitoring capabilities, fostering more efficient and proactive healthcare management.

Arduino UNO


Fig.2 : Arduino UNO

One platform for electronics is the Arduino Uno. Its hardware and software foundations are open source. It is built around the low-power ATmega328P microcontroller. The AVR is 8-bit. It has input and digital pins. It converts the light input on a sensor into an output that turns on an LED. By writing code on the Arduino board, instructions can be sent to this board. It is cross-platform and reasonably priced. It is an easy-to-understand programming environment. It contains an in-circuit serial programming header, a USB connector, a power jack, six analog pin inputs, and fourteen digital pins.

Node MCU


Fig.3 : Node-MCU

Node-MCU is an open source IoT Platform. It includes both firmware which runs on the ESP8266 Wi-Fi SOC, and hardware which is based on the ESP-12 module. The applications in these samples that are running on Node-MCU are written using Lua scripting language which is quite simple and easy to understand.

LCD Display

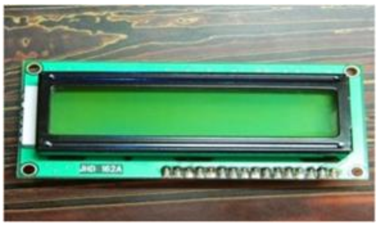
Fig.4 : LCD Display

This 16x2 LCD has two lines and displays 16 characters per line. It shows the pulse rate and temperature.

Heartbeat Sensor

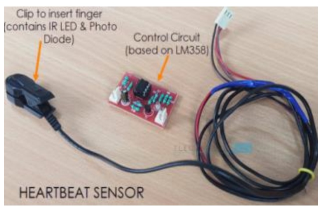

Fig.5 : Heartbeat Sensor

The pulse rate is determined by the Heartbeat sensor, which also produces digital output. The number of times the heart contracts or expands in a minute is indicated by the heartbeat, which is measured in beats per minute, or bpm.

DS18B20 Temperature Sensor

Fig.6 : DS18B20 Temperature Sensor

This DS18B20 temperature sensor is used to measure the body temperature of a subject. It is a combination of three pins. In this sequence, they are ground (GND), output (OUT), and voltage (V). This sensor has a temperature of -67˚F to +257˚F or -55˚C to +125˚C with +-5% accuracy.

Pulse Oximeter

Fig.7 : Pulse Oximeter

An combined pulse oximetry and heartrate monitor sensor is the MAX30100. It uses low-noise analog signal processing, improved optics, a photodetector, two LEDs, and low-noise analog signal processing to detect heart-rate and pulse oximetry signals. The MAX30100 runs on 1.8V and 3.3V power sources and may be turned down via software that uses a small standby current, allowing the power supply to always be connected.

IV. WORKING

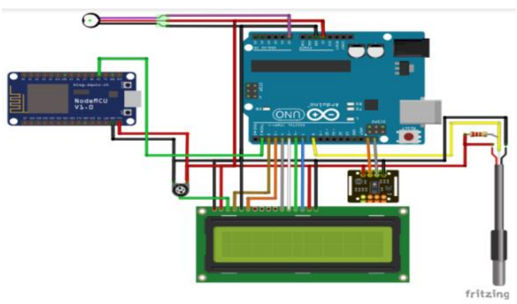

Fig.8 : Interfacing Diagram

The Arduino UNO is connected to the temperature sensor, oximeter, power supply, and Node-MCU. When the patient comes into contact (via the wrist) with the sensors, the temperature sensor takes their body temperature, the pulse sensor measures their pulse, and the oximeter takes their oxygen saturation level. The patient's data will be displayed on an LCD display by the Arduino after it has processed the code. The data will be monitored on the IOT server via internet connectivity provided by the Wi-Fi module Node-MCU. As a result, the patient's physicians and family members have remote access to the data, enabling them to monitor the patient's health and take appropriate action.

The doctors can diagnose problems remotely based on the values obtained from the data. An advantage over linear temperature sensors measured in Kelvin is the precision integrated-circuit temperature device, or LM35, which provides an output voltage linearly equal to the temperature in centigrade. An inexpensive, highly manageable solution for giving your projects internet access is the ESP8266. Additionally, by using APIs to retrieve data from the internet, your project will be more intelligent since it will have access to all online data. The Arduino hardware consists of an open-source circuit board with an input/output (1/0) pin layout for controlling physical items (LEDs, servos, buttons, etc.) and a CPU for communication. To power additional hardware and sensors, the board will be powered by either an external power supply or a USB. The Arduino UNO is connected to the blood pressure sensor, oximeter, temperature sensor, power supply, and ESP8266.

When the patient comes into contact with the sensors, the sensor records the patient's parameters. The patient's data will be shown on an LCD display by the Arduino when it has processed the code. The Node-MCU ESP8266 Wi-Fi module provides internet connectivity, allowing the data to be monitored on the IOT server.

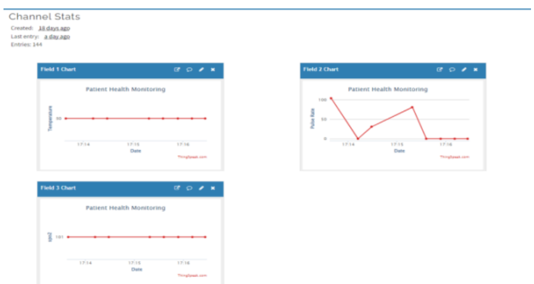

Fig.9 : Output On Thingspeak

Flowchart

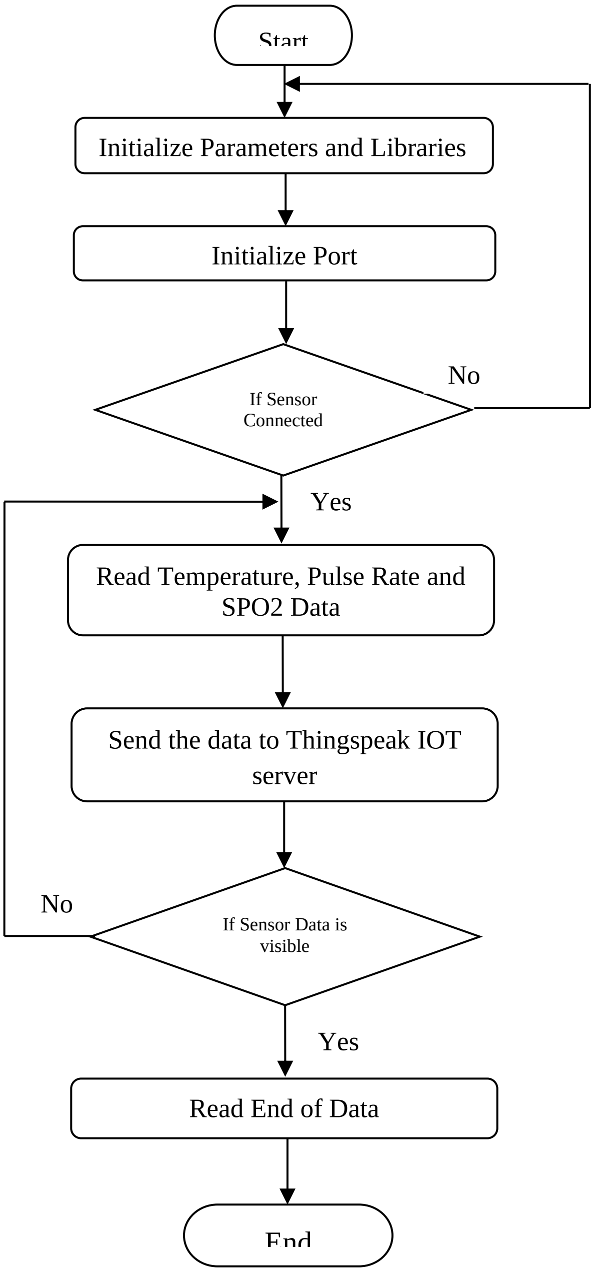

Fig.10 : Flowchart of the System

Initialize the Arduino libraries and port then if the sensor is connected properly, then read the temperature, pulse rate and oxygen level from the patient body and send data to the thingspeak IOT server with the help of Node-MCU (ESP8266 Wi-Fi) module and read the data on Thingspeak IOT server. If the data is in the range of sensor then it is normal and the patient is fit and healthy, otherwise the data is above the range of sensor it is abnormal and patient need to take suggestion from the doctor.

V. RESULT

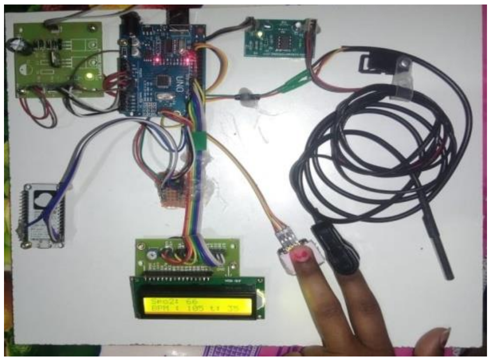

Fig.11 : Actual Connection

Fig.12 : Sensor Output On Display

VI. APPLICATION

1) It is very easy for users to measure oxygen level and temperature.
2) The application of Internet of Things technologies for early disease detection.
3) It can be used to monitor the location of medical devices in real time.
4) Electrocardiograms can be obtained with great easily using it.
5) It is additionally utilized to view measured data from the ThingSpeak server login.

CONCLUSION

It can be concluded from the above that a modified system has been suggested to monitor the patient's health via the Internet of Thinks (IOT), in order to create a 24/7 monitoring system to follow up on patients. Also, this field is getting a lot of attention for its ability to give patients continuous, reasonable medical care. The use of more biosensors will allow the current work to be improved. To create a more thorough monitoring system, these devices will monitor a variety of physiological parameters.

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