e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 6, June 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

6381 907 438 6381 907 438 ijmrset@gmail.com www.ijmrset.com

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly Peer Reviewed & Referred Journal |

| Volume 7, Issue 6, June 2024 |

| DOI:10.15680/IJMRSET.2024.0706006 |

IoT-Enabled Health Tracking with Automated Alert Systems

Snehal Patil[*1], Muskan Mulla[*1], Kritika Hulke[*1], Pankaj Jain[*2]

Scholar, Nanasaheb Mahadik College of Engineering, Peth, Sangli, India[*1]

Professor, Nanasaheb Mahadik College of Engineering, Peth, Sangli, India[*2]

ABSTRACT: The Internet serves for many important things. The Internet of Things (IOT) connects all the objects to the internet. IoT is expected in various fields but more benefited in the field of healthcare, where a system is necessary to constantly monitor the persons vital signs and these vital parameters are stored in cloud. Applications of IoT in Smart Health Care includes Remote health monitoring emergency notification, tracking persons internal body temperature, heart pulse, Blood Pressure. The health monitoring sensors are employed to collect health related data like heartbeat value, pulse value and temperature value, for information acquisition. Communication for transmitting information worldwide has been established by the controller. The IoT analytics platform investigate live data streams for better solution to person. The proposed system, is a low-cost IOT mechanism to protect the valuable human life. This system will act as a lifeguard to the all-human being.

KEYWORDS: Heart pulse sensor, Temperature sensor, Blood pressure sensor, Internet of Things (IoT), Node MCU, Alert system.

I.INTRODUCTION

In the rapidly evolving landscape of healthcare technology, the integration of Internet of Things (IOT) has proven to be a revolutionary force, particularly in the realm of persons health monitoring [1]. As the world grapples with an aging population and an increasing prevalence of chronic diseases, there is a growing need for efficient and proactive health monitoring solutions [2]. The application of IOT with healthcare offers a promising a venue to address this challenge by providing real-time insights into an individual's health status, enabling timely interventions, and ultimately improving overall healthcare outcomes [3].

The integration of IOT technology into healthcare has ushered in a new era of personalized and proactive person care. Many researchers had gone through this integration. In the year 2019 and 2020, Sunil Joshi discussed a "Sensor-Based Secured Health Monitoring and Alert Technique Using IoT," highlighting the need for real-time health monitoring and multiple alert mechanisms for enhanced emergency response [4] and O.Y. Tham et al. demonstrated an "IoT Health Monitoring Device for Oxygen Saturation (SpO2) and Heart Rate Levels," featuring a pulse oximeter and heart rate sensor integrated into a wearable device for real-time monitoring and remote data transmission to personal devices [5], respectively.

With the same mindset in the year 2021, V. Baby Shalini presents a "Smart Healthcare Monitoring System Based on IoT" focusing on developing an IoT-based Health Monitoring System (HMS) capable of monitoring the blood pressure and pulse rate of individuals. IoT encompasses a network of interconnected devices, apps, and sensors, facilitating data collection and exchange [1]. In the same year, Padmavati Kora et al. propose an "IoT-Based Wearable Monitoring Structure for Detecting Abnormal Heart Conditions," emphasizing the use of portable ECG devices to detect cardiac anomalies. This data is then analyzed and transmitted to healthcare centers for prompt intervention [2]. Following the researches in the same year, Anjali K et al. introduce an "IoT-Based Smart Healthcare System for COVID Symptom Detection," enabling the measurement of vital signs such as body temperature and oxygen saturation to identify potential COVID cases and alert relevant authorities [3] and Riyaz Ulla Rahman et al. present a "Health Monitoring and Prediction System Using IoT and

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Machine Learning," aiming to mitigate biases in datasets used for machine learning models, thereby improving personalized healthcare [6]. Overall, the reviewed studies highlight the transformative impact of IoT technology on healthcare, enabling continuous monitoring, early detection of health issues, and personalized interventions.

The convergence of IOT and healthcare aims to provide timely and efficient monitoring of individuals' health parameters, ensuring rapid response in critical situations. IoT-Enabled Health Tracking with Automated Alert Systems utilizing Node MCU, an innovative, versatile and cost-effective open-source IOT platform. One of the key features of this IOT-based health monitoring system is the utilization of Node MCU, a compact and powerful development board based on the ESP8266 Wi-Fi module. Another key features of this IOT-based health monitoring system are its alert mechanism which promptly detect anomalies or critical health parameters, and trigger immediate alerts to healthcare providers or designated individuals.

The main aim of this work is to provide effectiveness and potential impact of IOT-based health monitoring system in enhancing the quality of healthcare delivery also to explores the design and implementation of an IOT-based HMS equipped with an advanced Alert System. IoT-Enabled Health Tracking with Automated Alert Systems aims to contribute to this field by focusing on three main objectives:

1. **Monitoring Health Parameters:** The primary objective is to monitor crucial health parameters using a variety of sensors, including oxygen sensors, temperature sensors, and heart rate sensors. These sensors will provide continuous data on vital signs, allowing for proactive health monitoring.
2. **Embedded Circuit Design:** Another objective is to design an embedded circuit that incorporates these sensors and interfaces seamlessly with a microcontroller. This circuitry will serve as the backbone of the IoT-based health monitoring system, enabling the collection and processing of sensor data.
3. **Data Transmission and Monitoring:** The system will be designed to transmit the gathered data to the controller of the HMS through IoT technology. This ensures that the collected health data is effectively relayed to the HMS, facilitating continuous monitoring of health parameters. Ultimately, this system empowers users to monitor their health status conveniently and proactively.

II. MATERIALS AND METHODS

Methodology:

IoT-Enabled Health Tracking with Automated Alert Systems involves several sequential steps. Initially, appropriate sensors (**Max Sensor, Temperature Sensor**) capable of accurately measuring identified parameters are selected. Subsequently, a method for secure data transmission, such as Wi-Fi, Bluetooth, or cellular networks, is established to transmit sensor data to a central system or cloud platform. This platform serves as the hub for receiving, storing, and processing data from various sensors. Data processing algorithms are then implemented to analyze the collected data, identifying patterns or anomalies indicative of health conditions. An alert mechanism is developed based on predefined thresholds or abnormal patterns detected in the data. User-friendly interfaces are created for healthcare providers and users to access real-time data and receive alerts. Robust privacy and security measures are implemented to safeguard sensitive health data. The system undergoes thorough testing to ensure accuracy, reliability, and responsiveness of alerts. Regulatory compliance with relevant healthcare regulations and standards is ensured throughout the process. Finally, feedback from users and healthcare professionals is gathered to iteratively improve the system. Fig. 1 shows the methodology of IoT-Enabled Health Tracking with Automated Alert Systems.

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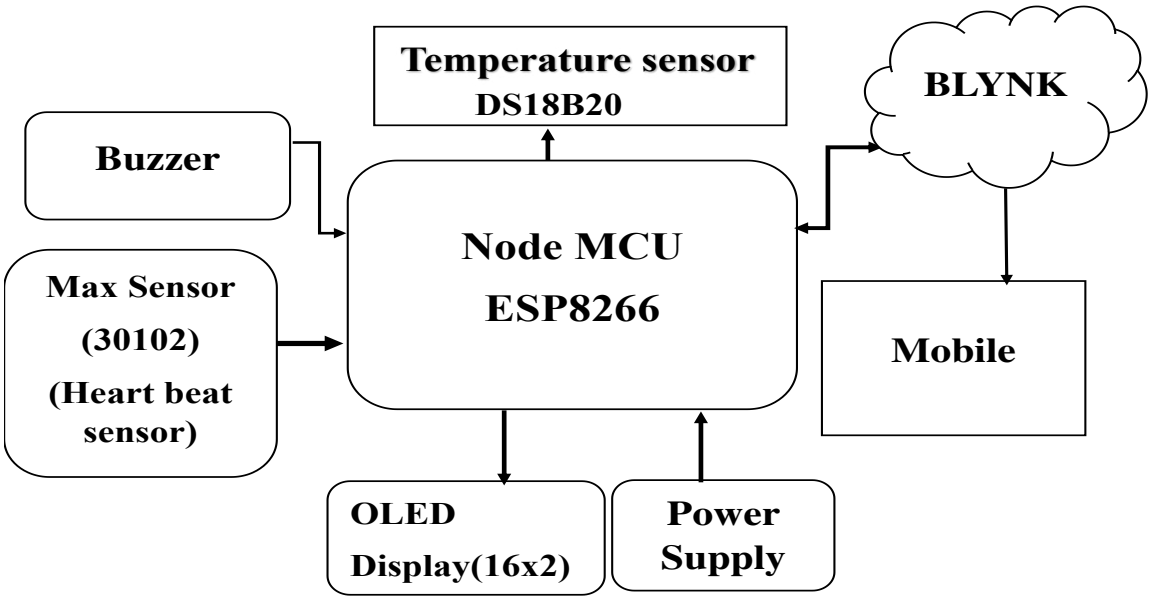

Fig. 1 Methodology of IoT-Enabled Health Tracking with Automated Alert Systems

Node MCU (ESP8266)

The ESP8266 shown in fig. 2, is a very user-friendly and low- cost device to provide internet connectivity to your projects. The module can work both as an Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making the Internet of Things as easy as possible. It can also fetch data from the internet using API's hence your project could access any information that is available on the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user-friendly. The ESP8266 module works with 3.3V only, anything more than 3.7V would kill the module hence be cautious with your circuits.

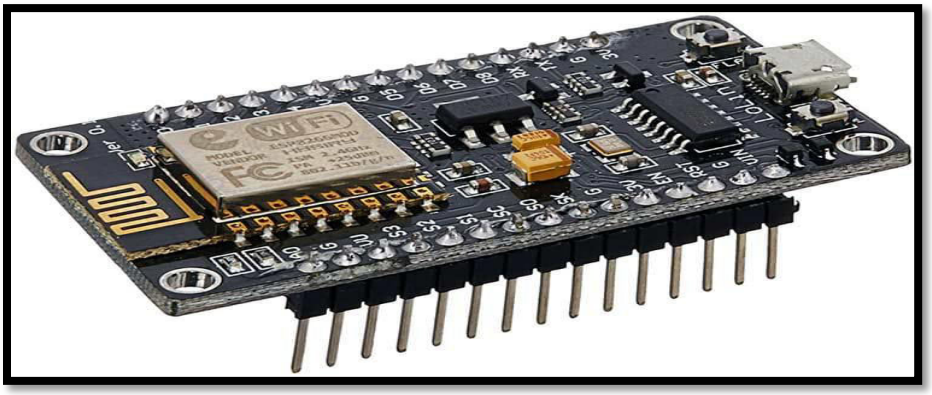

Fig. 2 Node MCU(ESP8266) [7]

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Max Sensor (30102)

The MAX (30102) shown in fig. 3, is an integrated pulse oximetry and heart-rate monitor biosensor module. It includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30102 provides a complete system solution to ease the design-in process for mobile and wearable devices.MAX30102 is a sensor that combines a pulse oximeter and a heart rate monitor. It's an optical sensor that measures the absorbance of pulsating blood through a photodetector after emitting two wavelengths of light from two LEDs - a red and an infrared one. The MAX30102 heart rate and oxygen sensor operates based on the principle of light absorption by blood in tissues and blood vessels. MAX30102 utilizes infrared (IR) and red-light reflection technology to measure the oxygen saturation (SpO2) and heart rate (HR) of the user.MAX30102 is a sensor that combines a pulse oximeter and a heart rate monitor. It's an optical sensor that measures the absorbance of pulsating blood through a photodetector after emitting two wavelengths of light from two LEDs - a red and an infrared one. This particular LED colour combination is designed to allow data to be read with the tip of one's finger. It is fully configurable through software registers and the digital output data is stored in a 16-deep FIFO within the device. It has an I2C digital interface to communicate with a host microcontroller.

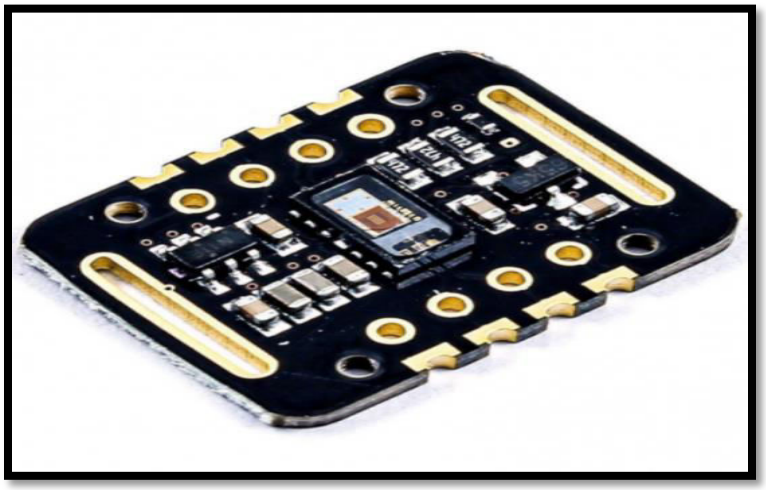

Fig. 3 Max Sensor (30102) [8]

Temperature Sensor (NTC)

Thermistors are temperature-detecting components made of semiconductors material that has been sintered to show enormous changes in obstruction with respect to title changes in temperature. This obstruction can be estimated direct current, or dc, went through the thermistor to quantify the voltage drop created. These strong state temperature sensors really carry on like electrical resistors that are temperature delicate. That is where the name, a reasonable mix of the words warm and resistor, comes from. Fig. 4 shows the NTC, or negative temperature coefficient thermistors.

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Fig.4 Temperature Sensor (NTC) [9]

III. RESULT & DISCUSSION

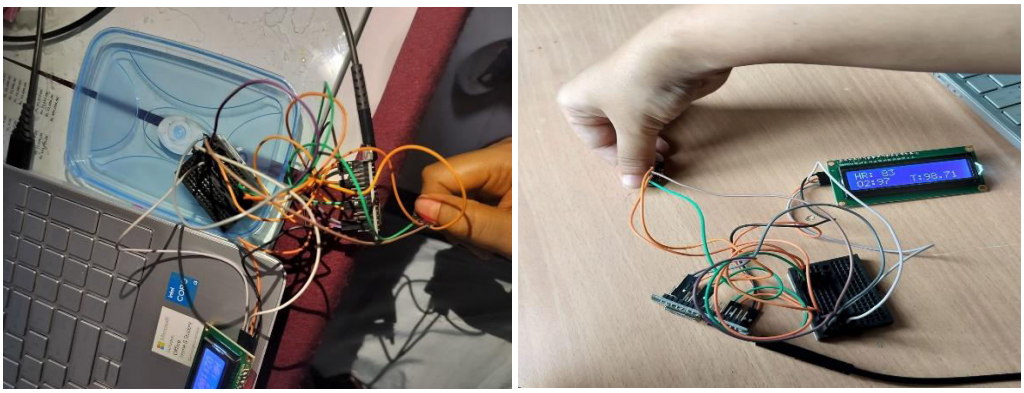

Fig. 5 Circuit connection and display of vital parameter in IoT-Enabled Health Tracking with Automated Alert Systems

Fig. 5 shows the connection and final output of the work, including components and connections. An IoT-Enabled Health Tracking with Automated Alert Systems is designed to continuously track and manage various health parameters of persons in real -time, leveraging the IOT technology. The system continuously collects data on vital signs such as heart rate, blood pressure, body temperature, and oxygen saturation. Utilizes wearable sensors and devices to gather health metrics with minimal discomfort to the patient. Health data is transmitted wirelessly to a central database using technologies such as Wi-Fi, Bluetooth, or cellular networks. Data is stored securely in the cloud, ensuring accessibility and scalability. The system uses data analytics to identify trends, anomalies, and potential health issues.

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IV. CONCLUSION

The IoT-Enabled Health Tracking with Automated Alert Systems can monitor health parameters data of the persons all the time. By using this system, persons health parameter is monitor in regular interval, and data will be loaded in cloud through IOT. As a result, any examiner can examine the persons from anywhere and anytime. The IoT-Enabled Health Tracking with Automated Alert Systems utilizes Node MCU presents a robust and efficient solution for real-time health tracking. The seamless integration of Node MCU with various health sensors facilitates continuous data collection, enabling timely detection of anomalies. The alert system ensures swift notifications to caregivers or medical professionals in case of critical health parameters, enhancing proactive intervention. In future depression and mood monitoring can be implemented. Micro components can also be used to make device compact and portable. Improving health monitoring systems using machine learning involves leveraging advanced algorithms to provide more accurate, timely and personalized healthcare insights.

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