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DESIGN AND IMPLEMENTATION OF AN ARDUINO-BASED HEALTH MONITORING SYSTEM

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ABSTRACT

Health monitoring has recently become an important application of embedded systems, with the aim of improving healthcare and early disease detection. This paper presents the design and development of a low-cost BioPulse Health Monitoring System using the Arduino Uno microcontroller. The proposed system measures heart rate, blood oxygen saturation (SpO_2), and body temperature in real time using the MAX30102 and LM35 sensors. The measured values are displayed on an I^2C LCD module for easy monitoring.

A buzzer alert is included to notify users whenever any health parameter exceeds the normal range. The experimental results show that the system provides accurate measurement, reliable performance, and fast response. Due to its simple design, low cost, and portability, the proposed system is suitable for home healthcare and can be further enhanced by integrating Internet of Things (IoT) technology for remote patient monitoring.

KEYWORDS: Arduino Uno, BioPulse, Health Monitoring, MAX30102, LM35, SpO_2, Heart Rate, Embedded System.

I. INTRODUCTION

With the rapid advancement of embedded systems and biomedical technology, health monitoring systems have become an important part of modern healthcare. Continuous monitoring of vital parameters such as heart rate, blood oxygen saturation (SpO_2), and body temperature helps in the early detection of health problems and The proposed BioPulse Health Monitoring System combines heart rate, SpO_2, and body temperature monitoring with

a buzzer alert in a single low-cost and portable device. It provides reliable real-time monitoring and can be upgraded with IoT technology for remote healthcare applications.

PROPOSED BIOPULSE HEALTH

Improves patient safety. Traditional monitoring methods often require expensive medical equipment and frequent hospital visits.

II. MONITORING SYSTEM

A. System Architecture

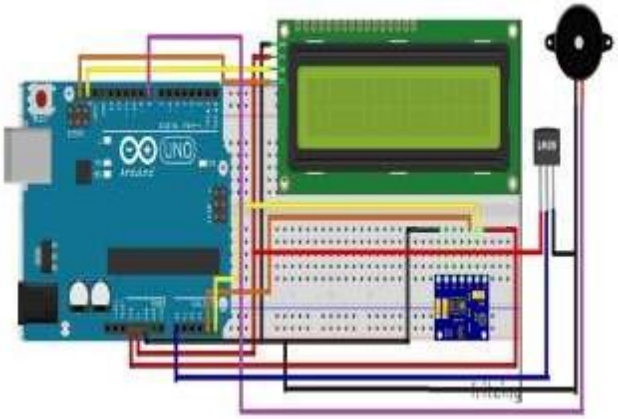
The proposed BioPulse Health Monitoring System is a low-cost and portable solution based on the Arduino Uno microcontroller. It uses the MAX30102 sensor to measure heart rate and SpO_2, and the LM35 sensor to measure body temperature. The measured values are displayed on an I^2C LCD, while a buzzer provides an alert when any parameter exceeds the normal range. The system is suitable for home healthcare and can be upgraded with IoT technology for remote monitoring.

III. RELATED WORK

Many researchers have developed health monitoring systems using Arduino and biomedical sensors. Systems based on the MAX30102 sensor provide accurate measurement of heart rate and blood oxygen saturation (SpO_2), while LM35 and MLX90614 sensors are widely used for body temperature monitoring. Recent Arduino-based health monitoring systems offer real-time display of vital signs, making them suitable for personal healthcare and educational applications.

The proposed BioPulse Health Monitoring System consists of an Arduino Uno microcontroller, MAX30102 sensor, LM35 (or MLX90614) temperature sensor, 16×2 I^2C LCD, and a buzzer. The Arduino collects data from the sensors, processes the readings, and displays the heart rate, SpO_2, and body temperature on the LCD in real time. Whenever any parameter exceeds the normal limit, the buzzer generates an alert to notify the user. This simple and low-cost design provides reliable real-time health monitoring

B. Hardware Components



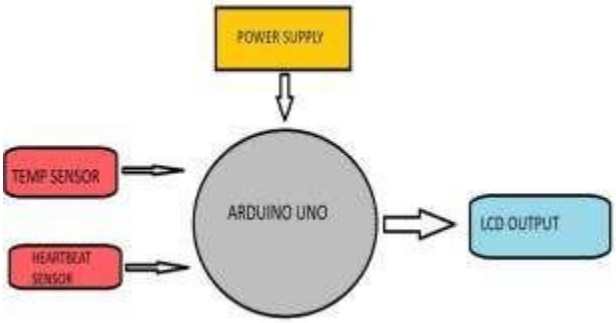
- **Arduino Uno:** The Arduino Uno is the main controller of the system. It receives sensor data, processes the readings, and controls the LCD display and buzzer.
- **MAX30102 Sensor:** The MAX30102
- sensor measures heart rate (BPM) and blood oxygen saturation (SpO_2) using the Photoplethysmography (PPG) technique. It communicates with the Arduino through the I^2C interface.
- **LM35 / MLX90614 Temperature Sensor:** The relay module ensures electrical isolation between the control circuit and the high-voltage appliances in the house. It enables the safe switching of loads like lights and fans.
- **I^2C LCD Display:** The 16×2 LCD displays heart rate, SpO_2, and body temperature readings in real time, allowing users to monitor their health easily.
- **Buzzer:** The buzzer gives an alert when abnormal health readings are detected.

C. Software Design

- The software is developed using the Arduino IDE. The Arduino reads data from the MAX30102 and LM35 sensors, processes the readings, and displays the results on the I^2C LCD. If any value exceeds the normal limit, the buzzer is activated to alert the user.

IV. Working Principle

The Arduino Uno collects data from the MAX30102 and LM35 sensors and processes the readings. The measured heart rate, SpO_2, and body temperature are displayed on the I^2C LCD in real time. If any parameter exceeds the normal limit, the buzzer generates an alert, providing continuous and reliable health monitoring. appliance.



V. RESULTS AND DISCUSSION

The proposed BioPulse Health Monitoring System was successfully tested and provided accurate real-time measurement of heart rate, SpO_2, and body temperature. The readings were displayed clearly on the I^2C LCD, and the buzzer responded immediately when abnormal values were detected. The results show that the system is reliable, low-cost, portable, and suitable for home healthcare applications.

VI. CONCLUSION AND FUTURE SCOPE

Conclusion

The proposed BioPulse Health Monitoring System successfully measures heart rate, SpO_2, and body temperature in real time using the Arduino Uno and biomedical sensors. The system is low-cost, portable, reliable, and easy to use, making it suitable for home healthcare and personal health monitoring.

Future Scope

In the future, the system can be upgraded with IoT technology for remote patient monitoring. Additional sensors such as ECG, blood pressure, and respiratory rate sensors can also be integrated to provide more comprehensive health monitoring.

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