IOT ENABLED CARDIAC HEALTH MONITORING AND EMERGENCY ALERT SYSTEM

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ABSTRACT

This IoT-enabled cardiac monitoring system uses a Pulse Sensor and ESP8266 to track heart rate and vital signs, sending real-time data to a React web app for visualization and alerts via buzzer, LED, and Twilio SMS. It supports additional sensors for temperature and oxygen, stores data for analysis, and plans future upgrades like AI-based anomaly detection, wearable integration, and emergency alerts for enhanced remote monitoring. Cardiovascular diseases (CVDs) are a leading cause of mortality worldwide, necessitating continuous health monitoring and timely intervention. This paper presents an IoT-enabled cardiac health monitoring device and emergency alert system, designed to track real-time heart health metrics and provide immediate alerts in case of anomalies. The system integrates wearable sensors, cloud-based data processing, and artificial intelligence to monitor parameters such as heart rate, ECG, and blood pressure. Using wireless connectivity, the collected data is transmitted to a cloud platform for analysis and storage. In case of abnormalities, the system automatically notifies healthcare providers and emergency contacts via SMS, mobile applications, or email. This proactive approach enhances patient safety, reduces response time in emergencies, and enables remote health monitoring, making it particularly beneficial for elderly and high-risk individuals. The proposed solution aims to bridge the gap between real-time health monitoring and timely medical intervention, ultimately improving cardiac health outcomes.

KEYWORDS

IoT, Sensors, ESP8266, LED, Cloud fare, Alerting mechanism, BPM, Temperature, Heartrate algorithm.

INTRODUCTION

Heart health is a serious issue, and in order to avoid complications or death, prompt action is necessary. Patients are exposed to unrecognised changes in their vital signs or heart rate because traditional monitoring techniques frequently lack real-time response. This gadget is required to close that gap by providing constant, real-time monitoring and prompt warnings, guaranteeing that irregularities are found early and that action is taken right away. Through the use of IoT technology, cardiac health may be approached in a proactive, data-driven manner, improving patient outcomes.

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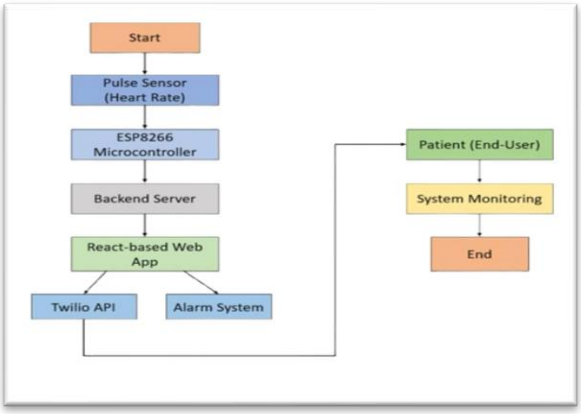
Using sensors and the ESP8266 microcontroller, this Internet of Things-based cardiac monitoring system monitors vital indicators and heart rate. A React web application receives real-time data, which sets off alarms via SMS, LEDs, and a buzzer. It improves emergency response and preventive cardiac health monitoring through wearable integration, data analysis, and AI potential.

LITERATURE SURVEY

Writer: Rajan Kumar Book: "IoT and Healthcare Systems: Innovations and Applications" Publication Year:2018
In this book, Kumar examines how IoT technologies are starting to play a crucial role in contemporary healthcare systems, with an emphasis on heart health in particular. He talks on how the constant monitoring of vital signs by wearable IoT devices, including fitness trackers and smartwatches, has revolutionized the early diagnosis of heart attack symptoms. The book emphasizes how abnormal patterns like arrhythmias, which may be heart attack precursors, can be identified by real-time data analysis. IoT-based diagnostic tools, according to Kumar, shorten the interval between the start of symptoms and treatment, increasing the likelihood that patients will survive.
Subhas Chandra Mukhopadhyay wrote this. Book: "Smart Sensors for Real-Time Diagnosis of Heart Diseases" Publication Year: 2017
The creation of smart sensors for use in Internet of Things systems for the real-time diagnosis of cardiac illness especially heart attacks, is the main topic of Mukhopadhyay's book. He talks about different sensor systems that monitor blood pressure, oxygen saturation level.

PROPOSAL DIAGRAM



Technical Specifications

- **Output Voltage:** 10 mV/°C
- **Temperature Range:** -55°C to +150°C
- **Accuracy:** ±0.5°C (typical) at room temperature (25°C)
- **Supply Voltage:** 4V to 30V
- **Current Consumption:** 60 µA (typical)

a. Temperature sensor (DS18B20)

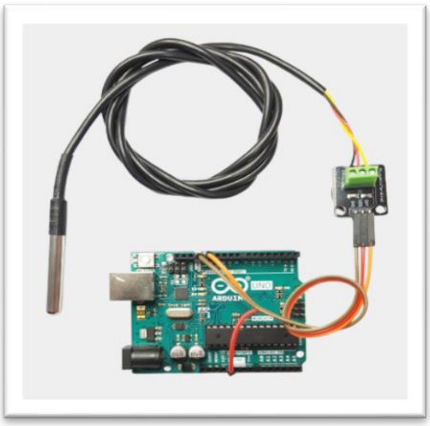


Fig1.temperature sensor db18b20

Body temperature monitoring to detect fever or abnormal conditions.
Compensating ECG readings, as temperature affects blood flow and sensor accuracy.
Early warning system for hypothermia or fever-related cardiac

risks.

Specification:

- Temperature measurement range
- Accuracy
- Stability, which includes the sensor's optimum operating environments, durability, and life expectancy
- Probe type, which describes the unit that houses the temperature sensor
- Operating voltage
- Output resolution
- Conversion time
- Operating current
- Humidity range (if applicable)
- Resolution
- Unique 64-bit address (if applicable)

b. Pulse Sensor

Fig2. Pulse Sensor

One kind of heart rate sensor that uses photoplethysmography (PPG) is called a pulse sensor. By applying light—typically infrared or green—to the skin and measuring the amount of light reflected back, it is able to determine the heart rate. The sensor can detect the pulse because the reflected light fluctuates with each
beating due to variations in blood volume.

Technical specifications

- Power supply ranges from 3.3V to 5V (compatible with most Arduino boards).
- Current Consumption: ~4mA (low power consumption, suitable for continuous monitoring).
- Output Signal: An analog signal that varies with heartbeat.
- Photoplethysmography (PPG) identifies pulses by monitoring variations in light absorption in the skin.
- Mounting: Use a Velcro strap or sticky pad to attach to a fingertip, earlobe, or wrist.

c. ECGMAX30102

Fig 3. ECG SENSOR MAX30102

The MAX30102 is an integrated pulse oximetry and heart-rate monitor 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. The MAX30102 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface. The module can be shut down through software with zero standby current, allowing the power rails to remain powered at all times.

d. USB CABLE

Fig4. USB CABLE

Universal Serial Bus (USB) is an industry standard that establishes specifications for connectors, cables, and protocols for communication, connection, and power supply between personal computers and their peripheral devices.

e. ESP8266

Fig5.ESP8266

ESP8266 is a well-liked option for embedded systems due to its low power consumption and affordable cost. ESP-01, which is small and has few GPIOs, and ESP-12E/F, which has more GPIOs and flash memory, are common modules.

Technical Specifications

- Size:27mm x 40.5mm x 4.5mm
- Weight: 10g
- Operating Temperature: -20°C to 85°C

f. LED

Fig6. LED

Small indicator LEDs, typically in 3mm or 5mm sizes, operate at forward voltages from around 1.8V (red) to 3.3V (blue/white) with currents of 10–20mA, offering brightness levels from roughly 100 to 500 mcd and viewing angles between 20° and 60°. They require a current-limiting resistor to prevent overcurrent and are designed to perform reliably across a broad temperature range, often from -40°C to 85°C.

Specification:

1.Voltage: 1.8V – 3.3V (depends on color)
2. Current: 10mA – 20mA (recommended: 10mA for long life)
3.Forward Voltage (Vf) per Color: Red: 1.8V – 2.2V,Green: 2.0V – 3.0V, Yellow/Orange: 2.0V – 2.2V .
4.Viewing Angle: 20° – 60°
5.Power Dissipation: ~60mW
6.Operating Temperature: -40°C to 85°C.

FUTURE SCOPE

- Healthcare sector
- Emergency services
- Sports medicine

RESULT

The table presents biometric observations of individuals, including ECG, body temperature, and BPM (beats per minute). It lists user names alongside their recorded BPM and temperature values.

Consistent Temperature Range :The recorded temperatures range between 97.9°F and 98.7°F, showing minimal variation.

Accuracy in Readings: BPM values are closely grouped (168.53 – 169.49), indicating precise measurements.
Reliable ECG Data: All individuals have similar BPM trends, suggesting stable ECG readings.
Minimal Fluctuation :Both BPM and temperature readings remain within a narrow range, ensuring consistency.

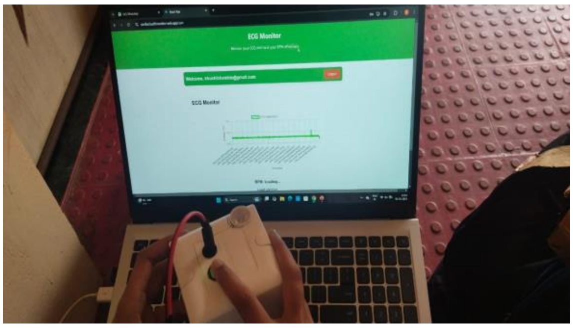
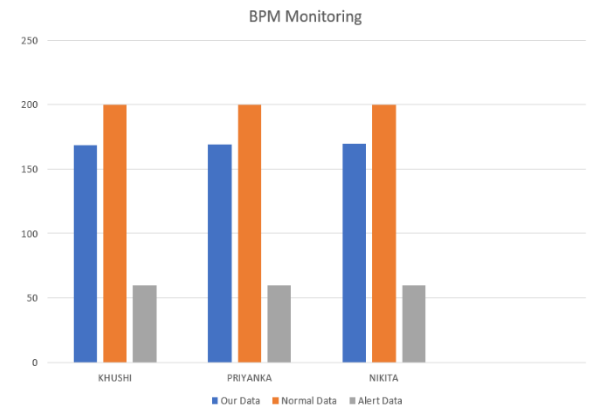


Fig7.Interface with device

S. No	User Name	Parameter	Observation
1	Priyanka Dhapodkar	✓ ECG ✓ Temperature ✓ BPM	 *BPM 169.32* *TEMPERATURE 98.6*
2	Khushi Bhomble	✓ ECG ✓ Temperature ✓ BPM	 *BPM 168.53* *TEMPERATURE 97.9*
3	Nikita Thool	✓ ECG ✓ Temperature ✓ BPM	 *BPM 169.49* *TEMPERATURE 98.7*

Fig8.Data Collected



The bar chart titled "BPM Monitoring" presents a comparison of three types of heart rate (beats per minute) data—Our Data, Normal Data, and Alert Data—for three individuals: Khushi, Priyanka, and Nikita.

- Our Data (Blue Bars): Represents the recorded BPM values from a monitoring system.
- Normal Data (Orange Bars): Shows the expected or standard BPM values.
- Alert Data (Gray Bars): Indicates abnormal BPM values that may require attention.

Observations:

- The normal BPM values (orange bars) remain consistently around 200 BPM for all three individuals.
- The recorded BPM values (blue bars) are lower than the normal values, hovering around 160–170 BPM.
- The alert BPM values (gray bars) are significantly lower, around 60 BPM, indicating potential issues that may need further investigation.

This data suggests that the monitoring system detects variations in heart rate and identifies potential health risks by categorizing them as alert data

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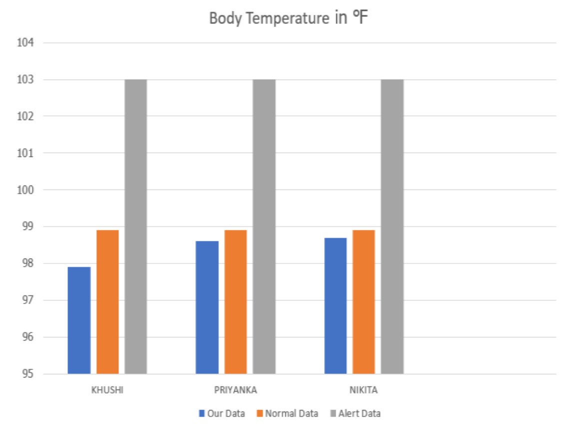

The bar chart titled "Body Temperature in °F" presents a comparison of three types of body temperature readings—Our Data, Normal Data, and Alert Data—for three individuals: Khushi, Priyanka, and Nikita.

Data Breakdown:

- Our Data (Blue Bars): Represents the measured body temperature using a monitoring system.
- Normal Data (Orange Bars): Indicates the expected or standard body temperature.
- Alert Data (Gray Bars): Represents abnormal body temperatures that may signal a health concern.

Observations:

- Khushi's temperature: The recorded value (~98°F) is slightly lower than the normal (~99°F), but the alert value is significantly higher (~103°F).
- Priyanka's temperature: The recorded and normal temperatures are nearly identical (~98.5–99°F), while the alert data is much higher (~103°F).
- Nikita's temperature: Follows a similar pattern, with recorded and normal temperatures around 99°F, but the alert temperature reaching ~103°F.

This chart highlights the system's ability to distinguish normal temperature ranges from fever conditions, helping in early detection of health issues.

S.No.	Age Group	Temperature(°C)	BPM	ECG(mv)
1	Preschool (3-5 years)	36.5 - 37.5	80 - 140	0.5 - 1.5
2	Child (6-12 years)	36.5 - 37.5	70 - 120	0.5 - 1.5
3	Teen (13-19 years)	36.1 - 37.2	60 - 100	1.0 - 2.0
4	Adult (20-60 years)	36.1 - 37.2	60 - 100	1.0 - 2.0
5	Senior (60+ years)	35.8 - 36.8	60 - 100	0.5 - 1.5

CONCLUSION

In conclusion, This Internet of Things (IoT)-based cardiac monitoring device uses an ESP8266 microcontroller and sophisticated sensors to detect vital signs and heart rate in real time. It guarantees smooth data visualisation, prompt alarms via buzzers, LEDs, and SMS messages, and proactive health management by integrating with a React web application. Predictive diagnosis and emergency response are further improved by the system's potential for wearable device integration and AI-driven analysis. This invention lowers the risk of cardiac emergencies by enabling continuous, remote monitoring for both patients and healthcare professionals. Future developments have the potential to transform individualised healthcare by improving cardiac monitoring's effectiveness, accessibility, and lifesaving potential.

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