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IoT Based Advanced Cardiac Arrest Detection System

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Abstract: Internet of Things (IoT) based Advanced cardiac Arrest Detection system have an expansive potential of becoming an integral part of the future medical system. In particular, these systems can play life-saving roles for monitoring of patients with critical health issues. Any health care monitoring system must be free from incorrect data, which may arise because of instrument failure or communication errors. In this project, to detect reliability and accuracy of data obtained by the IoT-based remote health monitoring. This project makes a use of MAX30100 (heartbeat & oxygen), ESP8266 Wi-Fi module and Arduino nano. The main controlling device of the project is Arduino nano microcontroller. Arduino will continuously read the heartbeat and spo2 value through MAX30100 sensor and will be sent to the blynk mobile application through esp8266 Wi-Fi module. User can access this device using smart mobile from anywhere in the world. To achieve this task microcontroller loaded program written in embedded C language.

Keywords: Cardiac arrest detection, IoT (internet of things), Wearable health sensors, Real-time monitoring, Heart rate variability

I. INTRODUCTION

The main aim of this project is to develop a cohesive methodology for heart rate monitoring and heart attack notification system for any heart patients, especially the elderly and at risk. In this proposed system, a pulse sensor is used to measure a person's heart rate and post it on hardware as well as uploading it to blynk APP through the implementation of IoT. Mobility and compactness were also considered for this system, with a strap-on container for most of the components was also designed. Based on the heart rate data, the system also sends notification on mobile about an emergency based on very high or low heart rate. This project makes use of an onboard computer, which is commonly termed as micro controller. It acts as heart of the project. This onboard computer can efficiently communicate with the output and input modules which are being used. The controller is provided with some internal memory to hold the code. This memory is used to dump some set of assembly instructions into the controller. And the functioning of the controller is dependent on these assembly instructions. The action of these instructions is already loaded into the Microcontroller using Embedded C programming. The controlling device of the whole system is a Microcontroller. Max30100 heartrate sensor, ESP8266 Wi-Fi module, LCD and Buzzer are interfaced to the Microcontroller. When the user switches ON the device, it will continuously be monitoring the heart rate on LCD and upload them into the BLYNK APP also sending blynk notification to the user mobile and activate the buzzer in abnormal conditions through esp8266 Wi-Fi module. The action of these instructions is already loaded into the Microcontroller using Embedded C programming.

Block Diagram

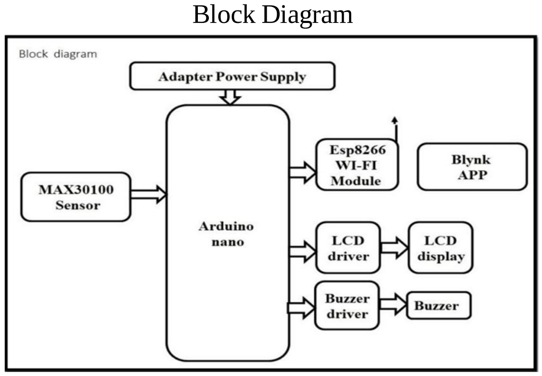
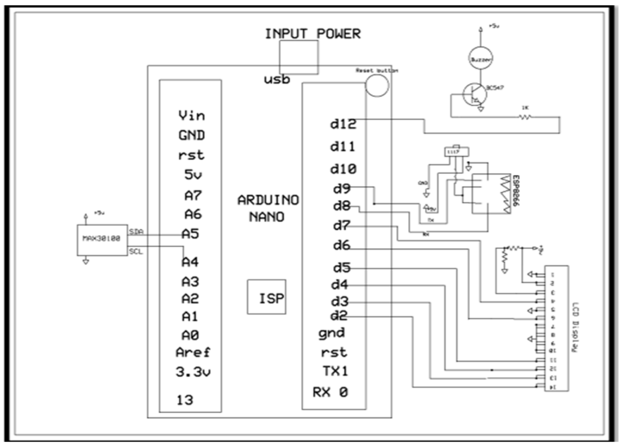


Fig1.blockdiagram

II. IMPLEMENTATION

The IoT-based Advanced Cardiac Arrest Detection System using the ESP8266 and Blynk app can be designed to measure heart rate and SpO2 (oxygen saturation) in real-time. Wearable sensors, like a pulse oxi-meter, are used to capture heart rate and SpO2 data from the patient. The ESP8266 microcontroller, known for its Wi-Fi capabilities, transmits this data to the cloud via the Blynk app, providing a user-friendly interface for remote monitoring on smart phones. When the system detects abnormal readings, such as an irregular heart rate or low oxygen levels, it sends instant alerts to caregivers and healthcare providers through the app, enabling rapid intervention and response to prevent cardiac arrest. This setup offers an efficient and portable solution for continuous cardiac monitoring.

Circuit Diagram

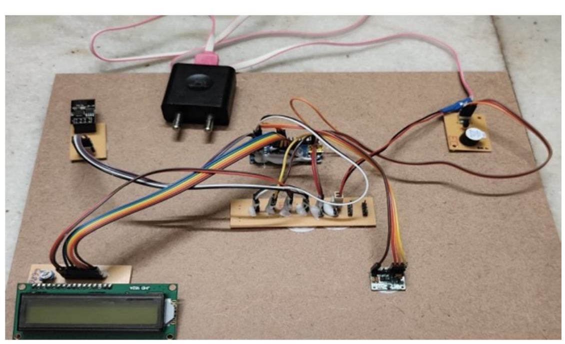


In the IoT-based Advanced Cardiac Arrest Detection System using ESP8266, the circuit primarily consists of an ESP8266 microcontroller, a pulse oxi-meter sensor (e.g., MAX30100) to measure heart rate and SpO2, and a power source (like a battery or USB power). The pulse oxi-meter sensor is connected to the ESP8266 through its I2C communication pins. Specifically, the SCL (clock) and SDA (data) pins of the sensor are connected to the GPIO5 (D1) and GPIO4 (D2) pins of the ESP8266, respectively, to enable data exchange. The sensor is powered by the 3.3V and GND pins of the ESP8266.

The ESP8266 communicates wirelessly with the internet via Wi-Fi and sends the data to the Blynk cloud using its integrated Wi-Fi module. The device is powered either via the Vin pin from a 5V source (such as a USB) or through a battery connected to the microcontroller. Once the heart rate and SpO2 data is collected, the ESP8266 transmits it to the Blynk app using Wi-Fi, where the user can view it in real-time. In case abnormal readings are detected, such as irregular heartbeats or low oxygen levels, the system triggers alerts through the Blynk app. The overall circuit is compact and designed for low power consumption, making it ideal for continuous monitoring.

III. RESULT

The project "IOT Based advanced cardiac arrest detection system" was designed continuous heart rate monitoring and early cardiac attack detection also notification system. The action of these instructions is already loaded into the Microcontroller using Embedded C programming.



Real time implementation of iot detection kit

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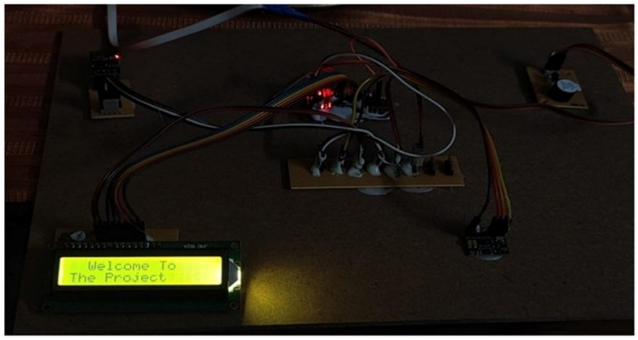
This figure shows the complete setup of the IoT-based cardiac arrest detection system in its real-time implementation. The kit is designed to continuously monitor cardiac parameters and SpO2 levels.



Hardware kit when it is in ON state

This figure illustrates the kit when it is powered ON, showcasing the operational
Status of the device and its ready for data collection.

A. Cases Based On Different Ranges Such As

1) Case1: normal stage 60 to 100bpm & 95 to 100 SPO2

LCD Displaying normal range of heart rate and SPO2

- Heart Rate: 60 to 100 bpm
- SpO2: 95 to 100%

In this case, the system detects heart rates and SpO2 levels within the normal ranges,
Indicating stable cardiac and respiratory health

2) Case2: low heart rate 30 to 60bpm & below 95 SPO2

LCD Displaying low range of heart rate and SPO2 and display on blynk app of abnormality

- Heart Rate: 30 to 60 bpm
- SpO2: Below 95%

This scenario highlights instances of bradycardia (low heart rate) and potentially low SpO2 levels, which may require further investigation or medical attention.

3) *Case3: high heart rate 100 to 180 & 100 to more*

LCD Displaying high range of heart rate and SPO2 and display on blynk app of abnormality

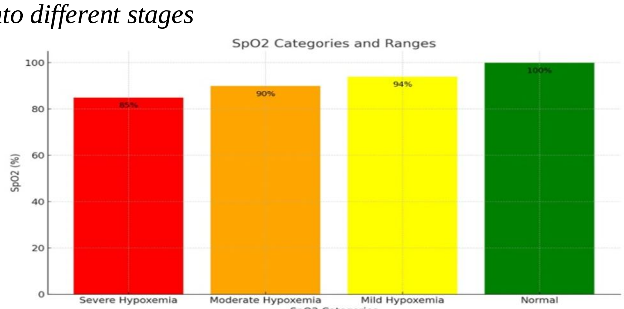
- Heart Rate: 100 to 180 bpm
- SpO2: 100% or more

This case demonstrates tachycardia (high heart rate) and normal or elevated SpO2
Levels, suggesting an active or stressed cardiovascular state.

It is a bar graph representation of the SpO2 ranges:
- Severe Hypoxemia: Less than 85%
- Moderate Hypoxemia: 86% to 90%
- Mild Hypoxemia: 91% to 94%
- Normal: 95% to 100%

These visual aids in understanding the different SpO2 categories and their respective Ranges.

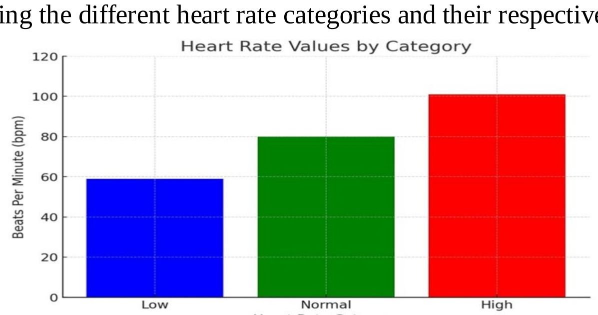
B. Ranges of spo2 is categorized into different stages



Graphical representation of different SPO2 ranges

This is a graphical representation of the low, normal, and high heart rate ranges
- Low (Bradycardia): 30 to 60 bpm
- Normal: 60 to 100 bpm
- High (Tachycardia): 100 to 180 bpm

This visualization helps in understanding the different heart rate categories and their respective ranges.



Graphical representation of different Heart rate ranges

IV. CONCLUSION AND FUTURE SCOPE

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

A. Future Scope

1) We can add some other health sensors.
2) We can add GSM, GPS to track the location and alert message to the pre-defined mobile number

REFERENCES

[1] Yosuf ElSaadany, AKM Jahangir A. Majumder, Donald R. Ucci. "A Wireless Early Prediction System of Cardiac Arrest through IoT" (2017) IEEE 41st annual computer software and applications conference (COMPSAC) organization={IEEE}, 2017:vol.2 pp690-695

[2] Liu, Ji-Han and Chang, Hsiao-Ko and Wu, Cheng-Tse and Lim, Wee Shin and Wang, Hui-Chih and Jang, Jyh-Shing Roger." Machine learning based early detection system of cardiac arrest" (2019) 2019 International Conference on Technologies and Applications of Artificial Intelligence (TAAI) organization={IEEE},2019 pp1-6

[3] Jang, Dong-Hyun and Kim, Joonghee and Jo, You Hwan and Lee, Jae Hyuk and Hwang." Developing neural network models for early detection of cardiac arrest in emergency department". (2020) The American journal of emergency medicine publisher={Elsevier},2020 Vol:38 pp43-49

[4] Kwon, Joon-myoung and Kim, Kyung-Hee and Jeon, Ki-Hyun and Lee." Artificial intelligence algorithm for predicting cardiac arrest using electrocardiography"(2020) Scandinavian journal of trauma, resuscitation and emergency medicine.2020 Vol:28 pp1-10

[5] Beach, Christopher and Krachunov, Sammy and Pope, James and Fafoutis." An ultra low power personalizable wrist worn ECG monitor integrated with IoT infrastructure".(2018) publisher={IEEE}2018 Vol6, pp4400-44021

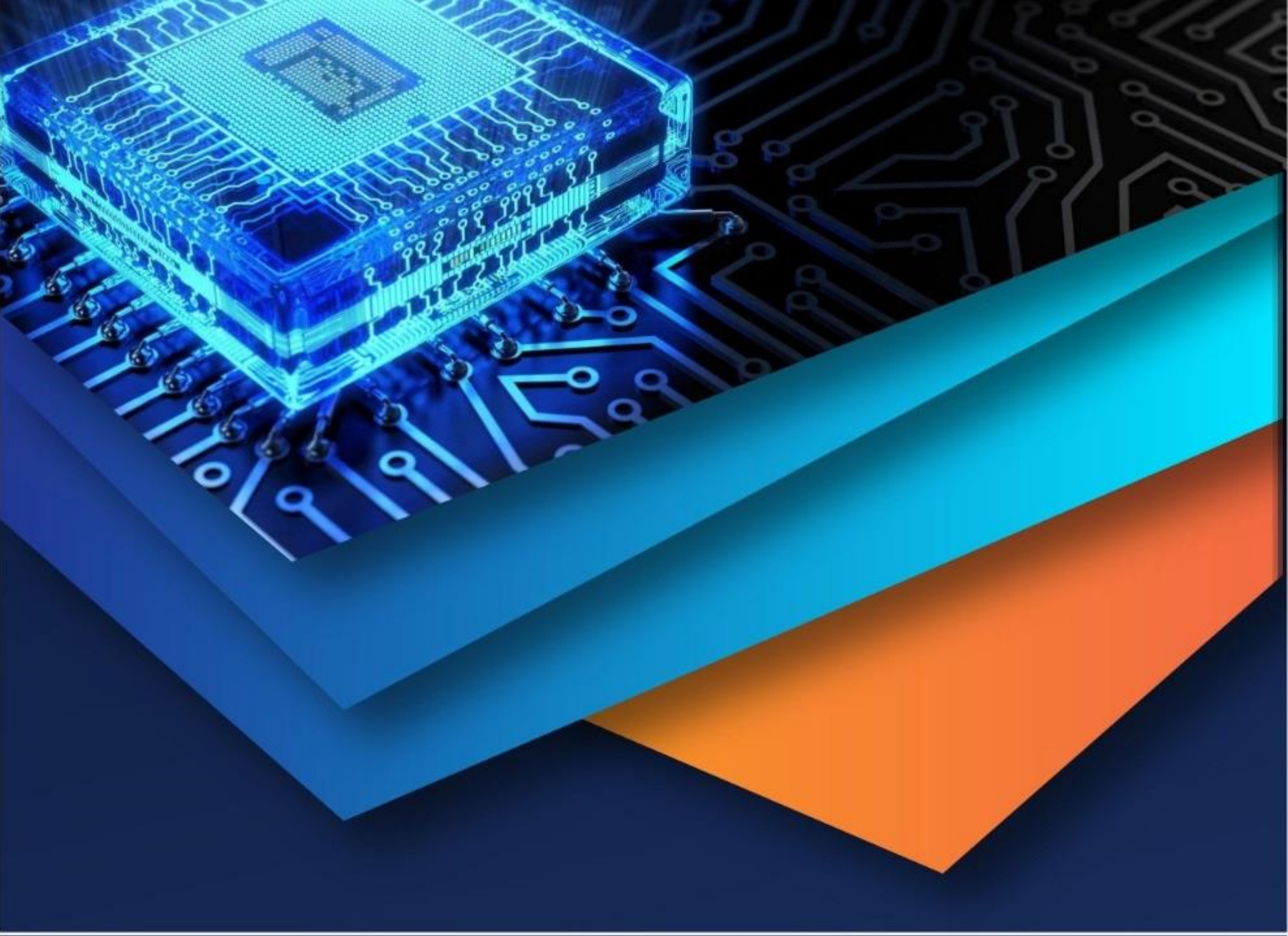
[6] Abba, S., & Garba, A. M. (2019). An IoT-Based Smart Framework for a Human Heartbeat Rate Monitoring and Control System. Proceedings

[7] Abbasi-Kesbi, R., Valipour, A., & Imani, K. (2018). Developed wearable miniature sensor to diagnose initial perturbations of cardio respiratory system. Healthcare Technology Letters, 5(6), 231-235.

[8] Abdulla, R., Eldebani, A. A., Selvaperumal, S. K., & Abbas, M. K. (2020). IoT based Pet Feeder. Test Engineering & Management, 83(March-April 2020), 269– 279. http://www.testmagzine.biz/index.php/testmagzine/article/view/3584

[9] Al-Gumaei, W., Selvaperumal, S. K., Abdulla, R., & Nataraj, C. (2018). Smart Tree Care System with Internet of Things. Research Journal of Applied Sciences, Engineering and Technology, 15(9), 328–336. https://doi.org/10.19026/rjaset.15.5923

[10] Beach, C., Krachunov, S., Pope, J., Fafoutis, X., Piechocki, R. J., Craddock, I., & Casson, A. J. (2018). An Ultra Low Power Personalizable Wrist Worn ECG Monitor Integrated With IoT Infrastructure. IEEE Access, 6, 44010–44021. https://doi.org/10.1109/ACCESS.2018.286.



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