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IOT Based Self Operated CPR Belt

Muthamilselvi N[1],Akash. R[2],Karunamoorthy. S[3], Abdul Basit[4], Dinesh. D[5]

[1]*Assistant Professor, Dept.Of Biomedical Engineering, Dhanalakshmi Srinivasan Engineering College, Perambalur, Tamil Nadu, India.*

[2,3,4,5]*Student,Dept.Of Biomedical Engineering, Dhanalakshmi Srinivasan Engineering College, Perambalur, Tamil Nadu, India*

ABSTRACT

This project presents a wearable, automated system designed to deliver real-time cardiopulmonary resuscitation (CPR) in emergency situations. The smart CPR belt is equipped with sensors like a respiration sensor, ECG sensor, and temperature sensor to constantly monitor a patient’s vital signs. If the system detects a critical condition, it can automatically perform chest compressions according to standard CPR guidelines. At the core of the system is the ESP32 microcontroller, which collects and processes sensor data and sends it to healthcare providers using IoT technology. The ECG sensor checks heart activity and triggers CPR if the pulse is abnormal or absent. The respiration sensor ensures proper breathing is maintained, while the temperature sensor helps monitor for other health concerns. Real-time data transmission allows medical professionals to track the patient's status remotely and take action if needed. This system reduces the dependency on bystanders to perform CPR, increasing survival chances—especially in remote areas with limited access to medical help. The integration of smart sensors and IoT makes this device a potential game-changer for emergency medical care.

Keywords: IoT, CPR, ECG, Healthcare, Cardiac Arrest

1. INTRODUCTION

Cardiopulmonary resuscitation (CPR) is essential in saving lives during cardiac arrest or respiratory failure. However, performing CPR effectively requires quick action and proper technique, which not everyone is trained to do. Delays or mistakes in giving CPR can greatly reduce a person's chance of survival, especially in remote areas where medical help may take time to arrive. To solve this, our project introduces an intelligent wearable device that automates CPR. It uses a respiration sensor, ECG sensor, and temperature sensor to monitor a patient’s vital signs in real time. If a dangerous condition is detected—such as a stopped heartbeat—the device automatically begins chest compressions using a servo motor. The ESP32 controller manages all data from the sensors and sends it to doctors or emergency responders using an IoT connection. This allows professionals to monitor and respond quickly, even from a distance.

2. EXISTING SYSTEM

Cardiac arrest is a leading cause of death, and quick CPR can mean the difference between life and death. However, manual CPR often has problems: people get tired, compressions may be uneven, and not everyone knows how to perform CPR correctly. Patients with pacemakers are at risk of further complications if CPR is not done properly. In remote areas, the delay in getting help makes the situation worse.

2.1 DISADVANTAGES

Manual CPR depends on a person being nearby and knowing what to do. Many bystanders may hesitate to help because they’re not trained or are afraid of causing harm. In out-of-hospital cases, delays before professionals arrive can greatly lower survival chances if no one is able to start CPR right away.

3. PROPOSED SYSTEM

The proposed CPR Belt solves these problems by automatically performing chest compressions and monitoring vital signs using smart sensors. It uses a temperature sensor to track body heat and breathing rate, and an ECG sensor to monitor heart activity. A built-in servo motor performs chest compressions with the right depth and speed. All this data is processed by the ESP32 controller and sent to healthcare providers using an IoT platform. This setup ensures fast action and remote monitoring by medical teams.

4. SYSTEM IMPLEMENTATION

4.1 BLOCK DIAGRAM

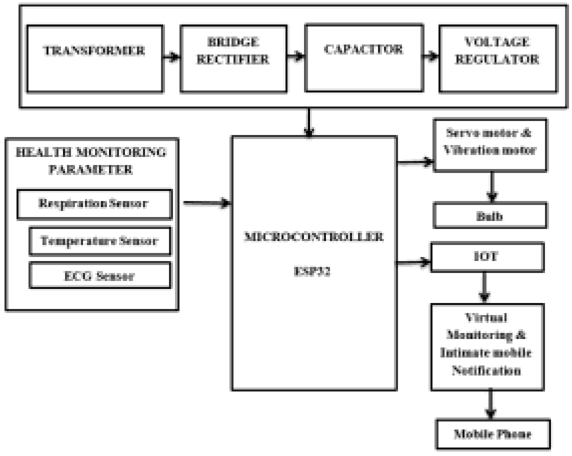

Fig-1 Block Diagram

5. SYSTEM REQUIREMENTS

5.1.POWER SUPPLY

A power supply provides electricity to the device. There are two main types:

Linear power supply: Simple design, but bulky and less efficient.

Switching power supply: More efficient and compact but more complex..

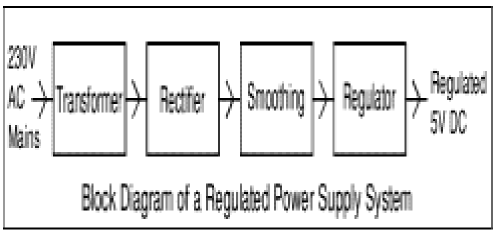

Fig 2 Power supply

5.2 LINEAR POWER SUPPLY

This type takes in AC from a wall outlet, uses a transformer to reduce the voltage, then converts it to DC with a rectifier. A capacitor smooths out the current, and a voltage regulator ensures steady output. Transformers adjust voltage through magnetic fields between coils.

Step-down transformer lowers voltage.

Turns ratio determines output voltage:

\text{Turns ratio} = \frac{V_p}{V_s} = \frac{N_p}{N_s}

Power in = Power out:

V_p \times I_p = V_s \times I_s

5.3 TRANSFORMER

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.

The input coil is called the primary and the output coil is called the secondary.

There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

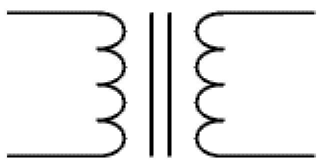

Fig 3 Transformer

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

5.4 RECTIFIER

A rectifier changes AC to DC using diodes.

Bridge rectifier: Converts full AC wave to DC.

Half-wave rectifier: Uses just one half of the wave.

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The resulting DC may still fluctuate and needs a smoothing capacitor for use in electronics.

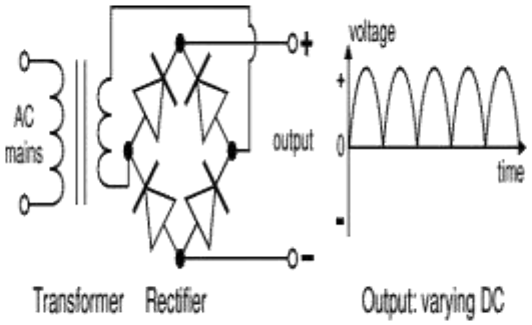

Fig 4 Rectifier setup

5.5 REGULATOR

Voltage regulators keep output steady, such as +5V or +12V.

Common type: LM78XX series, e.g., 7805 gives +5V.

Protects against too much current or heat.

Used in logic circuits, instruments, and consumer electronics

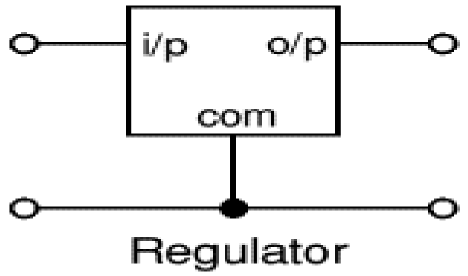

Fig 5 Regulator

6. CONCLUSION

The represents a significant advancement in the field of emergency medical response, particularly for cardiac arrest situations. By integrating state-of-the-art sensor technology and IoT capabilities, this innovative system provides a solution that overcomes the limitations of traditional CPR methods. The reliance on human intervention has long posed challenges in delivering timely and effective CPR, often resulting in suboptimal outcomes for patients experiencing cardiac emergencies. The proposed system automates the process of administering chest compressions, ensuring that patients receive the correct depth and rate of compressions consistently. With its ability to continuously monitor vital signs through pulse, MEMS, and temperature sensors, the belt not only provides immediate care but also enables proactive health management. The ESP32 controller facilitates real-time data transmission to medical professionals, enhancing communication and response times in critical situations. By reducing dependence on bystanders and providing an easy-to-use, portable solution, the IoT Based Self-Operated CPR Belt empowers individuals to take immediate action during emergencies. Its user-friendly design allows for deployment in various environments, ensuring accessibility and functionality for users regardless of their training level. In summary, this project highlights the potential of technology to transform emergency care, ultimately improving survival rates for patients in cardiac arrest. It stands as a promising solution, bridging the gap between emergency response and the increasing need for immediate medical intervention in our increasingly busy and unpredictable world. Future advancements and iterations of this system could further enhance its capabilities, paving the way for a new standard in life-saving technologies.

7. RESULT & DISCUSSION

The development and testing of the **IoT Based Self-Operated CPR Belt**were aimed at evaluating its functionality, effectiveness, and reliability in simulating real-world cardiac emergencies. The system was subjected to a series of tests to assess its performance in delivering automated CPR, monitoring vital signs, and transmitting data in real-time. The belt was designed to deliver chest compressions at a rate of 100 to 120 compressions per minute, adhering to current CPR guidelines. Observations indicated that the device maintained high compression quality over extended periods, with minimal variations in depth and rate, which is a significant improvement over manual CPR performance.
The ESP32 controller demonstrated robust performance in transmitting vital sign data and alerts to the designated IoT platform. Test scenarios involved simulating cardiac arrest situations where the system successfully sent real-time notifications to healthcare professionals. This rapid response capability is crucial for timely medical intervention. The integration of IoT capabilities allows for real-time monitoring and communication, facilitating faster emergency responses and ensuring that healthcare providers can make informed decisions based on live data. the results of the testing phases affirm the feasibility and effectiveness of the **IoT Based Self-Operated CPR Belt** as an innovative solution in the realm of emergency medical care. Continued refinement of the design, along with comprehensive clinical trials, will be essential in bringing this technology to market and ensuring its impact on improving survival rates in cardiac emergencies.

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