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IoT-Heart Attack Detection and Heart Monitor with Automatic Ambulance Alert System

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Abstract: ***In recent years, the application of Internet of Things (IoT) technology in the healthcare sector has significantlyenhanced the monitoring and management of chronic illnesses and emergency health situations. This projectaims todevelopareal-timeIoT-basedsystemforheartattackdetectionandcontinuousheartratemonitoring.Thesystemcontinuously tracks the user's heart rate and other vital parameters to identify early signs of a heart attack. Using sensorssuch as ECG (Electrocardiogram) and PPG (Photoplethysmography), it collects comprehensive heart activity data, which isprocessed and analyzed by a microcontroller integrated with a Wi-Fi module (ESP8266 or ESP32). The collected data istransmitted to a cloud server, where machine learning algorithms analyze it to detect irregular patterns and potential cardiacrisks. In the event of an abnormality, the system promptly alerts the user, caregivers, and healthcare professionals through amobileapplication,enablingtimelymedicalresponse.Thisapproachnotonlystrengthenspreventivehealthcareandemergencyrespons e but alsosupports remote patient monitoring, offeringascalable and efficient solution toreducecardiac-related fatalities.***

Keywords: Internet of Things (IoT), Heart attack detection, Smart health monitoring, Wearable sensors, ECG monitoring,Real-timehealth data, Biomedical signal processing, Automatic alert system, Cloud computing, Remote patient monitoring, Machinelearning in healthcare, Edge computing, Heart rate variability (HRV), Healthcare IoT architecture, Emergency response system,IoT-enabled healthcare, Patient safety and monitoring, Wireless sensor networks (WSN), Mobile health (mHealth), Smartwearabledevices.

I. INTRODUCTION

Heart disease remains one of the most critical global health concerns, accounting for millions of deaths each year and affectingindividuals across all age groups and demographics. Among the various cardiovascular disorders, heart attacks (myocardialinfarctions) are particularly fatal when not detected and treated promptly. Early warning signs often go unnoticed due to the lack ofcontinuousmonitoring,especiallyamonghigh-riskpatients whodo notreceiveregularmedicalsupervision.

Traditional methods of heart rate and ECG monitoring generally require patients to visit healthcare facilities or use bulky medicalequipment. This limits the practicality and accessibility of real-time, continuous heart monitoring. However, the advent of the Internetof Things (IoT) has revolutionized the healthcare sector, providing innovative solutions for remote health monitoring and emergencydetection.

IoT technology enables the creation of interconnected devices that can collect, process, and transmit data in real-time. This capabilitysupports the development of wearable devices that continuously track a person's heart activity outside of clinical environments. SuchIoT-driven systems have the potential to greatly enhance the detection and management of cardiac issues by empowering individualsto monitor theirhearthealthanytime and anywhere.

This project aims to design and implement an IoT-based system for heart attack detection and heart rate monitoring, integratingsensors, microcontrollers, and wireless communication technologies to ensure continuous real-time observation. By incorporatingECG (Electrocardiogram) and PPG (Photoplethysmography) sensors, the system gathers detailed data on heart rate variability, bloodcirculation, and the electrical activity of the heart. The microcontroller processes the collected data locally and transmits it to a cloudserver using a Wi-Fi module such as ESP8266 or ESP32. The cloud server then applies machine learning algorithms to analyze thedataand detectirregular heartpatternsthatmayindicate apotentialheartattackorothercardiacabnormalities.

AverageHeartRateAcrossAgeGroups

Age	Heart Rate
Newbornbaby	140
7year	85–90

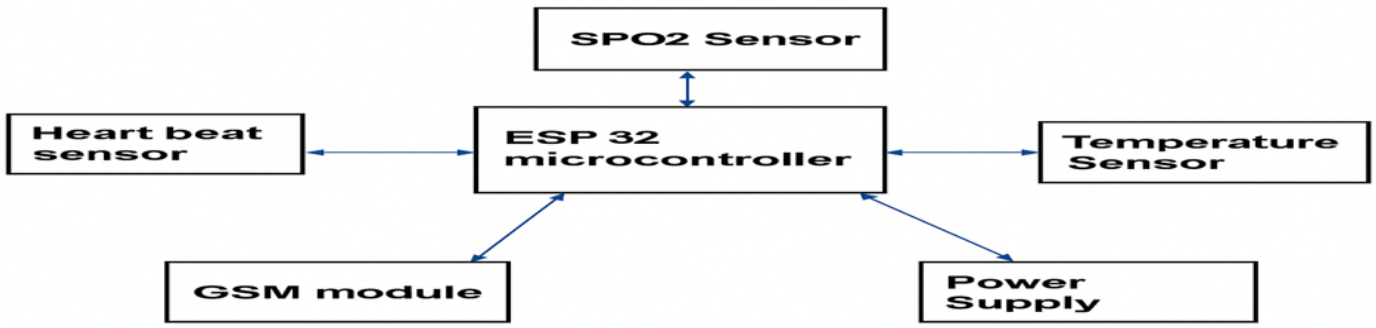
14year	80–85
Adult	70–80
Athletes	60–100

Heart rate averages vary across age groups due to differences in metabolic and cardiac efficiency. Newborns exhibit the highest heartrates, typically ranging from 100 to 160 beats per minute (bpm). Toddlers generally have rates between 80 and 120 bpm, whileschool-agedchildrenaveragebetween70 and 100bpm. Adultsusuallymaintainanormalheartratebetween60 and 100bpm.
Athletes tend to have lower heart rates, a sign of superior cardiovascular fitness. In older adults, heart rates may increase slightly dueto age-related changes in cardiac function. Understanding and monitoring these ranges are essential for the early detection of anyabnormalitiesthatmayindicatepotentialheartcomplications.

II. METHODOLOGY

1) *DataAcquisition:* Heart rate and ECG signals are continuously collected using sensors (e.g., ECG sensor, pulse sensor) connected to a microcontroller(likeArduinoor ESP32).
2) *SignalProcessing*: The collected data is filtered and analyzed to detect irregularities such as abnormal heart rate or ECG patterns indicating a possibleheartattack.
3) *DataTransmission:* Processeddataissenttothecloudoramobileappvia Wi-Fior GSM module forremotemonitoring.
4) *Detection&DecisionMaking:* Athreshold-basedormachinelearningalgorithmidentifiesheartattacksymptomsinrealtime.
5) *AlertGeneration:* If a heart attack is detected, the system automatically sends alerts (SMS/notification) to the registered contacts, doctors, and nearbyambulanceserviceswithGPSlocation.
6) *DataLogging:* Patienthealthdataisstoredonthecloudfor medicalanalysisandfuturereference.

III. PROPOSED SYSTEM



IV. LITERATURE SURVEY

The future of IoT-based health monitoring is very promising. Ongoing advancements in artificial intelligence (AI) anddeeplearningare improvingthe accuracyof heartattackdetection algorithms.

1) To monitor parameters like blood pressure, heart rate, and ECG, Dhapodkar et al. (2025) created an integratedwirelesssystemthat combineswearablesensors,cloud-baseddataprocessing,andartificial intelligence.
2) To predict Sudden Cardiac Death (SCD), Rehman et al. (2024) created an Internet of Things (IoT)-basedemergency cardiac death risk rescue alarm system that suggested real-time ECG signal monitoring and cloud-basedtransmission.
3) Umeretal.presentedaprototypeforahealthmonitoring system thatusesartificialintelligenceandtheInternetof Things to track the health of people with serious heart failure.Patients with chronic illnesses now have a betterchance of surviving thanks to the planned healthcare system, which also provides accessible, affordable, andtrustworthymonitoring, particularlyfor cardiacpatients.
4) Abdulmalek et al (2022) proposed detailed review on the IoT based Healthcare-Monitoring System towardsImprovingQualityof Life.

V. FUTURE SCOPE

In the future, the IoT-based Heart Attack Detection and Monitoring System can be enhanced using AI and machine learning for more accurate and predictive analysis of heart conditions. Cloud connectivity will allow real-time data sharing with hospitals for faster response. Integration with wearable devices, 5G networks, and smart city infrastructure can improve efficiency and coverage. Further developments may focus on low-power sensors, advanced data security, and expanding accessibility to rural areas, making the system more reliable, intelligent, and life-saving.

VI. CONCLUSION

The IoT-based Heart Attack Detection and Heart Monitoring System with Automatic Ambulance Alert is an innovative solution designed to save lives by enabling real-time health monitoring and instant emergency response. By continuously tracking vital signs and detecting abnormalities, the system can alert medical personnel and dispatch an ambulance automatically, reducing response time during critical situations. This project demonstrates how IoT and smart healthcare technologies can work together to provide timely assistance, improve patient safety, and pave the way for more advanced, connected healthcare systems in the future.

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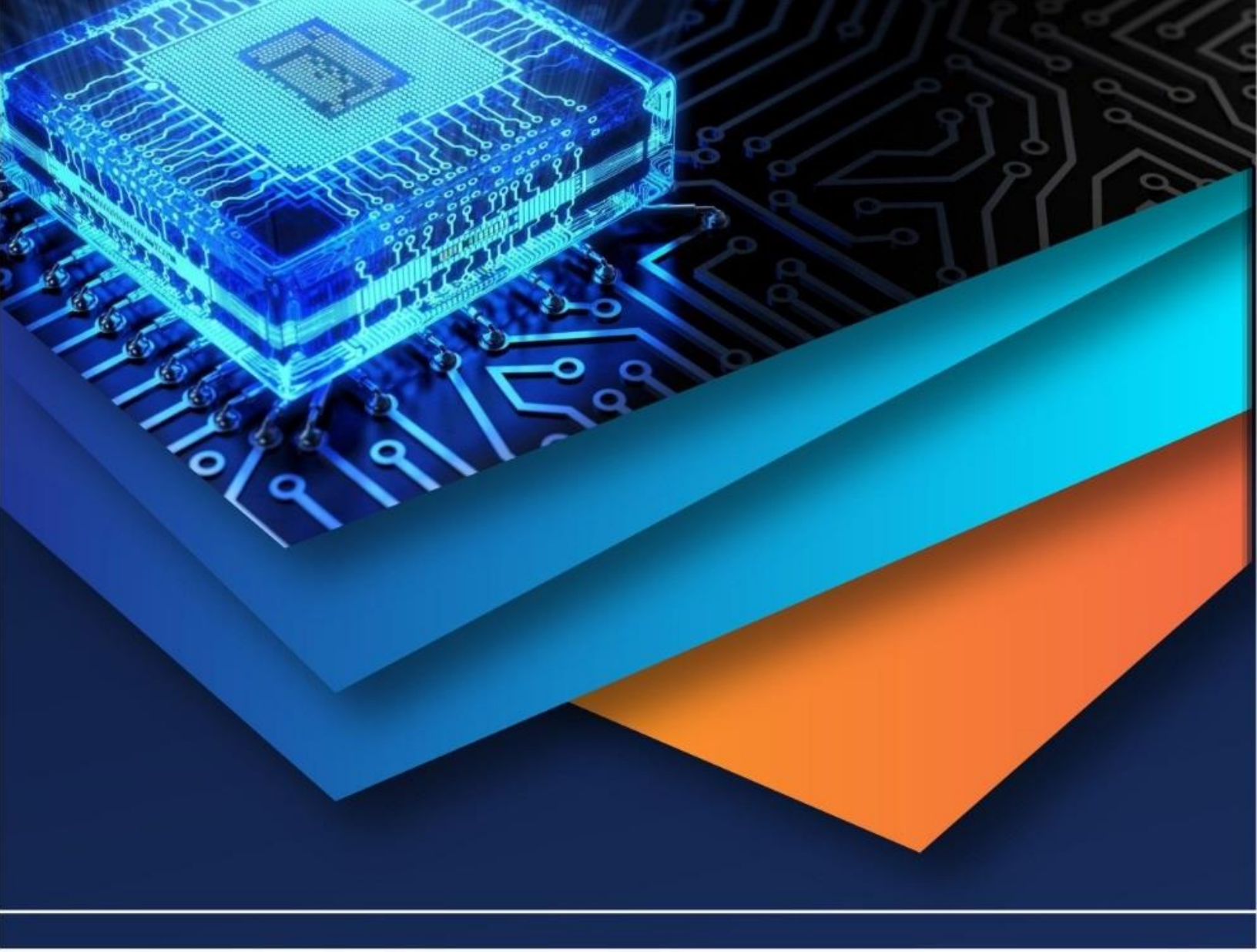

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