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Smart Health Watch For Stroke Detection

Rajeshwari Kisan [1] Apoorva K[2], Ashwini B[3], Vinayak C[4], Komal R[5]

[1]Assistant Professor, S G Balekundri Institute of Technology, Belagavi, Karnataka, India
[2]Student, S G Balekundri Institute of Technology, Belagavi, Karnataka, India
[3]Student, S G Balekundri Institute of Technology, Belagavi, Karnataka, India
[4]Student, S G Balekundri Institute of Technology, Belagavi, Karnataka, India
[5]Student, S G Balekundri Institute of Technology, Belagavi, Karnataka, India

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Abstract - Stroke and cardiac emergencies are often preceded by a sudden and unnoticed rise in blood pressure. Early identification of abnormal BP levels can help prevent severe health complications. This project proposes an IoT-based Stroke Detection System using an ESP8266 microcontroller and a digital blood pressure (BP) module. The system measures systolic, diastolic, and pulse values and displays them locally on an LCD module. Based on BP threshold classification, the ESP8266 sends email notifications to the doctor using the Blynk IoT platform. An alert message is shared to help healthcare providers take timely action. The system therefore, supports early stroke risk detection through automatic monitoring and notification. The system continuously measures systolic, diastolic, and pulse values and displays them locally on an LCD module for immediate visibility. Based on BP threshold classification, the ESP8266 automatically sends email notifications to the concerned doctor using the Blynk IoT platform whenever abnormal conditions are detected. This real-time alert mechanism assists healthcare providers in taking timely preventive or emergency actions. The proposed system supports early stroke risk detection through continuous monitoring, automatic classification, and instant notification. Stroke and cardiovascular emergencies remain one of the leading causes of death and long-term disability across the world. A major contributing factor to stroke is prolonged hypertension or sudden abnormal changes in blood pressure that often go unnoticed. Continuous monitoring of blood pressure plays a crucial role in early diagnosis and prevention of severe complications. This project presents a Smart Health Watch for Stroke Detection based on Internet of Things (IoT) technology using an ESP8266 microcontroller and a digital blood pressure monitoring module. The system continuously measures systolic pressure, diastolic pressure, and pulse rate, and displays the values locally on an LCD screen for immediate awareness. The collected data is analyzed using predefined medical thresholds to detect abnormal BP conditions. When an abnormal condition is detected, the system automatically sends an email alert to the concerned doctor through the Blynk IoT platform. This proactive alert mechanism enables early medical intervention, reduces emergency response time, and enhances patient safety. The proposed system offers a low-cost, reliable, and scalable solution for real-time stroke risk monitoring in both home-based and clinical environments.

Keywords: Abnormal, Pulse value, Blynk IOT, email notification, Stroke detection.

1. INTRODUCTION

Strokes often occur due to uncontrolled or rising blood pressure. Most patients do not monitor their BP throughout the day, which makes early detection difficult. Regular hospital-based monitoring is inconvenient, and manual measurement cannot capture sudden fluctuations. To address this, the proposed project uses IoT-assisted automatic alerting. A digital BP module records the patient's BP at the wrist and sends the values to the ESP8266. The readings are displayed on an LCD screen for local monitoring. If the systolic value falls outside the normal range, the system categorizes the condition and instantly sends an email alert to the doctor through the Blynk platform. This timely notification helps identify a possible stroke risk in advance. To address these challenges, the proposed project introduces a Smart Health Watch for Stroke Detection using IoT-assisted automatic monitoring and alerting. A digital BP module worn on the wrist records the patient's blood pressure parameters and transmits them to the ESP8266 microcontroller. The measured values are displayed on an LCD screen for local monitoring. When the systolic BP falls outside predefined safe limits, the system categorizes the condition and instantly sends an email alert to the doctor through the Blynk IoT platform. This timely notification enables early medical intervention and significantly reduces the risk of stroke-related complications. Traditional BP monitoring methods are largely manual and hospital-centric, requiring frequent visits to healthcare centers. These methods are inconvenient for elderly patients, individuals with mobility issues, and people living in rural areas. Moreover, manual measurements do not provide real-time alerts during critical situations. With advancements in IoT and wearable technology, it is now possible to design smart healthcare systems that continuously monitor vital parameters and provide instant alerts. The Smart Health Watch for Stroke Detection aims to bridge this gap by providing an automated, wearable, and IoT-enabled solution for continuous BP monitoring. By integrating a digital BP

module with the ESP8266 microcontroller, the system ensures real-time data acquisition, processing, and remote communication. The use of cloud-based IoT platforms allows healthcare professionals to receive timely alerts, enabling preventive care and reducing stroke-related mortality. Research Objectives

1.1 RESEARCH OBJECTIVES

The main objective of this project is to design and develop an IoT-based wearable system for continuous blood pressure monitoring. The system measures systolic, diastolic, and pulse rate values using a digital BP sensor and classifies the readings based on standard medical threshold guidelines. The measured values are displayed in real time on an LCD module, providing users with instant local feedback. By continuously monitoring BP patterns, the system enables early detection of abnormal conditions that may indicate stroke risk. The system incorporates an automated alert mechanism using IoT technology to send email notifications to doctors through the Blynk platform whenever abnormal BP levels are detected. This supports remote health monitoring, minimizes delays in medical response during hypertensive emergencies, and reduces dependence on manual BP measurements and frequent hospital visits. The overall goal is to develop a cost-effective, user-friendly wearable health monitoring solution suitable for both home and clinical environments.

1.2 OPERATIONAL MODES

The blood pressure monitoring system works in different modes to ensure patient safety. In Normal and Continuous Monitoring Mode, the system continuously measures blood pressure and pulse rate and displays the readings on the LCD without generating any alerts as long as the values remain within the normal range. When the readings begin to approach abnormal limits, the system enters Warning Mode, where it identifies conditions such as pre-hypertension or hypotension and prepares the alert mechanism while continuing monitoring. If the systolic BP goes beyond the defined thresholds, the system switches to Alert Mode, categorizes the condition as low, pre-high, or high BP, and immediately sends an email notification to the healthcare provider through the Blynk platform. In cases of critically high BP, the system activates Emergency Mode, prioritizing rapid alert transmission to enable immediate medical intervention.

2. METHODOLOGY

The methodology of the IoT-Based Stroke Detection System involves continuous monitoring of a patient's blood pressure using a digital BP module connected to an ESP8266 Wi-Fi microcontroller. The BP sensor automatically measures systolic, diastolic, and pulse values when powered through a 5V adaptor. These readings are then sent to the ESP8266, which processes the data and compares it with predefined threshold ranges to determine whether the BP level is normal, low, pre-high, or high. The processed values are displayed locally on a 16×2 I2C LCD screen so that the patient can see their BP instantly. If the systolic value goes outside the normal range, the ESP8266 sends an automatic email alert to the doctor through the Blynk IoT platform. This timely alert helps in early detection of abnormal BP variations that may indicate stroke risk. The methodology ensures real-time monitoring, immediate classification, and quick notification to the healthcare professionals. The microcontroller compares the acquired BP values with predefined threshold ranges to classify the patient's condition into normal, low, pre-high, or high BP categories. The processed readings are displayed in real time on a 16×2 I2C LCD screen, allowing patients and caregivers to instantly observe their BP status. If the systolic BP value exceeds or drops below the normal range, the ESP8266 triggers an automatic email alert to the doctor via the Blynk IoT platform. This methodology ensures real time monitoring, accurate classification, and prompt notification for early stroke risk identification. The measured values are transmitted to the ESP8266, which acts as the central processing unit. The microcontroller executes a threshold-based algorithm to analyze the BP values and determine the patient's health condition. The system categorizes the BP readings into normal, hypotensive, pre-hypertensive, and hypertensive states. All readings are displayed in real time on a 16×2 I2C LCD module for local monitoring. When abnormal BP values are detected, the ESP8266 establishes a Wi-Fi connection and communicates with the Blynk IoT platform. An automatic email alert containing the patient's BP status is sent to the doctor or healthcare provider. This methodology ensures uninterrupted monitoring, immediate classification, and rapid alert delivery.

2.1 WORKFLOW DIAGRAM

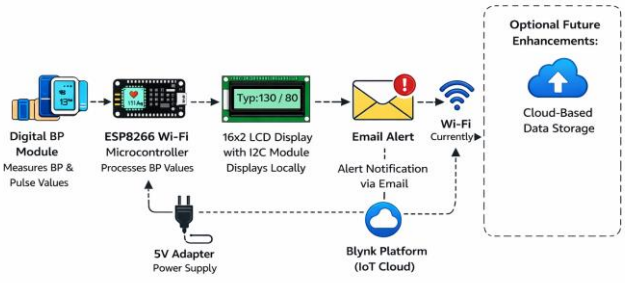

Figure 1: **IOT Based Stroke Detection System**

3. RESULTS AND DISCUSSION

The results of the implementation showed that the system successfully measured and displayed BP values on the LCD screen and accurately classified the readings using the

threshold model. Whenever the systolic BP crossed the defined limits, the ESP8266 immediately triggered an email alert through the Blynk platform, notifying the doctor about the abnormal condition. This demonstrated that the IoT-based alert mechanism worked efficiently and without delay. The discussion reveals that the system is very useful for the early detection of stroke symptoms, as rising BP is often a prime indicator. It also reduces the need for manual BP checking and ensures continuous monitoring, especially for elderly or high-risk patients. However, the system's performance depends on stable Wi-Fi availability, and the BP readings may vary if the sensor is not properly positioned. Even with these limitations, the system provides a valuable and cost-effective solution for early medical intervention. The discussion highlights that the system is particularly beneficial for elderly patients, individuals with hypertension, and patients with a history of stroke. It minimizes the need for manual BP monitoring and supports continuous, remote health supervision. However, system performance depends on stable Wi-Fi connectivity, and improper placement of the BP sensor may affect accuracy. Despite these limitations, the system offers a practical and affordable solution for early stroke risk detection. Experimental results indicate that the Smart Health Watch accurately measures blood pressure and pulse rate under normal operating conditions. The threshold-based classification algorithm successfully identifies abnormal BP variations and triggers alerts without noticeable delay. The LCD display provides clear and real-time visualization of patient data. The discussion highlights the practical benefits of the system, particularly for elderly patients, individuals with chronic hypertension, and post-stroke patients requiring constant supervision. The system reduces reliance on hospital visits and manual monitoring. However, factors such as Wi-Fi stability, sensor placement, and user compliance may affect accuracy. Despite these limitations, the system demonstrates strong potential for real-world healthcare applications.

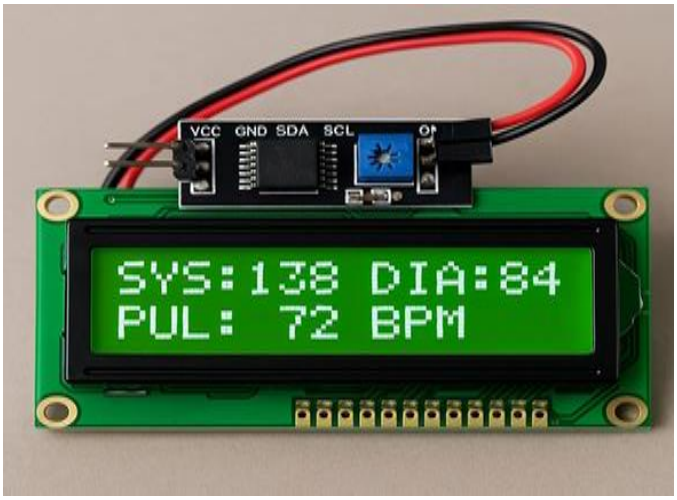

Figure 2 : LCD Display Provides the BP Readings

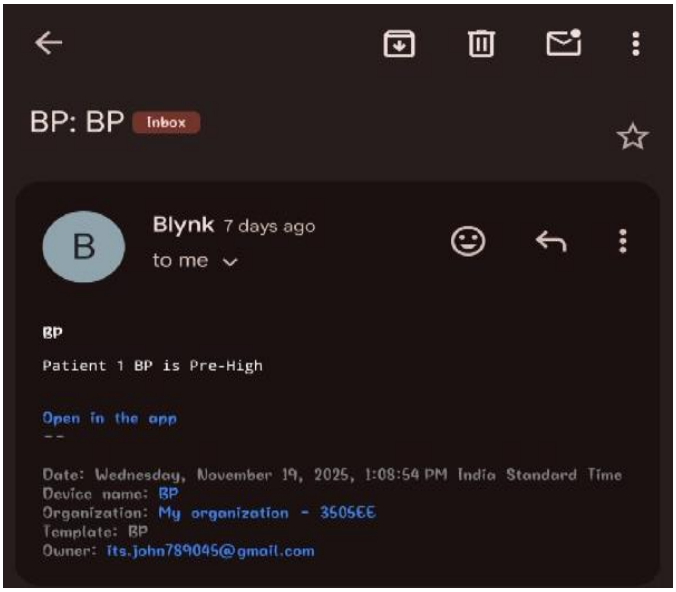

Figure 3: Email notification received to the hospital

4. CONCLUSION

The IoT-Based Stroke Detection System offers a reliable solution for continuous blood pressure monitoring and early identification of stroke risk. Using a digital BP sensor, ESP8266 microcontroller, and Blynk-based alert system, it ensures accurate BP classification and timely notifications to healthcare providers, reducing delays in medical response. The system is cost-effective, user-friendly, and suitable for use in homes, hospitals, rural clinics, and elderly care facilities. With future enhancements such as mobile application integration, cloud data storage, and additional biosensors, the system can evolve into a more comprehensive smart health monitoring solution.

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BIOGRAPHIES

Apoorva K is a final-year Computer Science and Engineering student. She is currently pursuing her degree at SG Balekundri Institute of Technology.

Ashwini B is a final-year Computer Science and Engineering student. She is currently pursuing her degree at SG Balekundri Institute of Technology.

Vinayak C is a final-year Computer Science and Engineering student. He is currently pursuing his degree at SG Balekundri Institute of Technology.

Komal M is a final-year Computer Science and Engineering student. He is currently pursuing her degree at SG Balekundri Institute of Technology.