

Wireless Biomedical Sensor Network-Based Patient Real-Time Monitoring In Smart Healthcare Systems

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Abstract: *The rapid advancement of wireless technology and the growing demand for continuous patient health monitoring have led to the emergence of Wireless Biomedical Sensor Networks (WBSNs) as a transformative solution in smart healthcare systems. This paper presents a comprehensive design and implementation of a real-time patient monitoring system based on WBSNs, leveraging various biomedical sensors such as heartbeat, ECG (AD8232), body temperature (MLX90614), and blood oxygen level (MAX30100), all integrated with the ESP32 microcontroller for data acquisition and wireless transmission. The system continuously collects vital physiological parameters and transmits the processed data via Wi-Fi or Bluetooth to cloud platforms or mobile applications, enabling remote healthcare monitoring. The design adopts a modular approach using functional partitioning, which separates data acquisition, processing, transmission, user interface, data storage, and alert systems into independent components for enhanced scalability, maintainability, and reliability. A matrix keypad and LCD display interface are incorporated for local user interaction, allowing real-time viewing and control. This low-cost, portable, and efficient monitoring solution enhances early detection of critical health conditions and improves patient outcomes through timely medical intervention. The proposed system holds significant potential in remote healthcare, fitness tracking, elderly care, and emergency response, thereby advancing the vision of a connected and intelligent healthcare infrastructure.*

Keywords: Wireless Biomedical Sensor Network, Real-Time Monitoring, Smart Healthcare, ESP32 Microcontroller, Biomedical Sensors

