ABSTRACT

The increasing demand for scalable, continuous healthcare monitoring has fueled the development of IoT-enabled solutions that can provide real-time physiological data. This paper describes the implementation of a Health Monitoring System (HMS) to monitor vital signs like heart rate, oxygen saturation (SpO_2), and body temperature. The device uses the MAX30102 optical sensor to monitor heart rate and SpO_2 levels, and the DFRobot MCP9808 for precise temperature measurements. These sensors are integrated with an ESP32 Supermini S3 microcontroller, allowing for secure and efficient data transmission to a cloud database via REST API. The HMS provides real-time access to physiological parameters via a web interface, allowing caregivers and healthcare providers to monitor patients remotely. The hardware design included a physical constraint in the shape of a finger slot enclosure to reduce motion artifacts and increase measurement consistency, similar to the mechanical design of commercial fingertip pulse oximeters. Extensive experimental evaluations validate the system's ability to provide precise and steady measurements. Peripheral temperature measurements are constantly between 35 and 36.5°C, and resting heart rate rates are within normal ranges for healthy persons. Furthermore, comparative analysis against a generic digital fingertip pulse oximeter demonstrates a high degree of correlation in BPM and SpO_2 measurements, reinforcing the system's validity. HMS provides a dependable and accessible solution for remote patient monitoring because to its low latency data pipeline and modular design. By combining IoT with cloud computing, it promotes preventative healthcare practices and enables rapid interventions, resulting in more efficient and data-driven care delivery.

Keywords: ***Cloud computing, health monitoring, Internet of Things (IoT), MAX30102, MCP9808, remote monitoring***