ABSTRACT

Patients with special needs require intensive health care and monitoring, particularly regarding their heart rate and location. Delays in medical treatment can occur if the patient's condition is not monitored in real time, especially when they are outside the supervision of medical personnel or family. The main problem in this research is the lack of a wearable device capable of monitoring the patient's heart rate and location in real time via a local monitoring website without relying on a cloud server.

This research designed and built a Wi-Fi-based wearable device system equipped with a planar microstrip antenna operating at a frequency of 2.4 GHz. The system consists of a Pulse Heart Rate sensor to detect heart rate, a Neo-6M GPS module to determine the patient's position, and an ESP32 microcontroller as the central processing and data transmission center to a local website server integrated with Google Maps. The website monitoring is designed to run without using the cloud, allowing for independent access locally. The advantages of this system include real-time data stored directly on the local server, greater security because it does not rely on third-party services, and more efficient operational costs.

Test results show that the Pulse Heart Rate sensor is capable of detecting heart rate in real time with 97% accuracy, and the GPS module can automatically transmit the patient's position to the monitoring website. The proposed microstrip antenna performed better than the ESP32's built-in antenna, with a Return Loss of -19.806 dB, a VSWR of 1.2277, a gain of 4.83 dBi, and a transmission range of up to 90 meters LoS, compared to the existing antenna's range of only 54 meters. This system has proven effective as a solution for real-time monitoring of patients with special needs without cloud dependence, with advantages in transmission speed, wider range, and local data security.

Keywords: Microstrip antenna, ESP32, GPS Neo-6M, Pulse sensor, Wearable device