

ABSTRACT

The significant increase in hemodialysis patients in Indonesia from 2017 to 2020 demonstrates the need for more effective health monitoring systems. Hemodialysis patients frequently experience complications such as anemia and hypertension that constitute the primary causes of their mortality. Continuous monitoring becomes critically important considering that hemodialysis patient mortality increases up to 30% during the interdialytic period and cardiovascular complication risks increase 5-7 fold. This research aims to design an Internet of Things (IoT)-based health monitoring system to monitor the health conditions of hemodialysis patients in real-time during the 48-72 hour interdialytic period.

The developed system integrates dual photoplethysmography (PPG) sensors for blood pressure measurement, optical sensors for hemoglobin levels, and MobileNetV2 algorithm for edema detection through image processing. The collected data is processed using ESP32 microcontroller and stored in Firebase as a real-time database. An Android application was developed using Android Studio platform with a four-level urgency classification feature based on measured vital parameters. System testing was conducted on normal subjects and 5 hemodialysis patients over 4 days.

Test results showed accuracy with mean difference of -0.89 mmHg for systolic and -2.56 mmHg for diastolic, along with very high correlations of 0.987 and 0.975, edema detection using MobileNetV2 achieved 96.67% accuracy, and bluetooth data transmission integrity of 97-100%. The hemoglobin monitoring system showed systematic bias of -0.4 g/dL with standard deviation of 1.59 g/dL. User Acceptance Test demonstrated 100% success rate among 4 patients and 1 medical staff. This system successfully provides continuous monitoring with urgency classification based on measured vital parameters.

Keywords: *Anemia, Decision Support System, Edema, Health Monitoring, Hemodialysis, Hypertension, Internet of Things, Machine Learning, MobileNetV2, Photoplethysmography, Real-time Monitoring.*