

## ABSTRAK

### RANCANG BANGUN ALAT KESEHATAN UNTUK PENGUKURAN KADAR GULA DARAH, DENYUT JANTUNG DAN SPO<sub>2</sub> SECARA *NON-INVASIVE* BERBASIS *INTERNET OF THINGS*

(2025: xii + 59 halaman + 31 gambar + 6 tabel)

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Pemantauan kondisi kesehatan secara mandiri menjadi semakin penting, terutama bagi penderita penyakit kronis seperti diabetes dan gangguan kardiovaskular. Penelitian ini merancang dan membangun alat kesehatan non-invasif berbasis *Internet of Things* (IoT) yang mampu mengukur kadar gula darah, denyut jantung, dan kadar oksigen dalam darah (SpO<sub>2</sub>) secara *real-time*. Sistem menggunakan sensor GY-MAX30102 dengan metode *photoplethysmograph* (PPG) dan mikrokontroler ESP32 untuk pemrosesan serta pengiriman data melalui konektivitas Wi-Fi dengan protokol MQTT. Hasil pengukuran ditampilkan pada LCD dan dikirim ke server untuk pemantauan jarak jauh. Berdasarkan proses kalibrasi terhadap alat medis konvensional, alat ini memiliki tingkat akurasi sebesar 95,82% untuk kadar gula darah, 95,83% untuk denyut jantung, dan 99,29% untuk kadar oksigen (SpO<sub>2</sub>). Akurasi dipengaruhi oleh faktor eksternal seperti posisi jari, warna dan ketebalan kulit, serta kelembapan. Dengan pengembangan lebih lanjut, alat ini berpotensi menjadi solusi praktis dan nyaman untuk pemantauan kesehatan harian secara non-invasif dan terintegrasi.

Kata kunci: Non-invasif, kadar gula darah, denyut jantung, SpO<sub>2</sub>, *Internet of Things*, MAX30102, ESP32.

## **ABSTRACT**

### ***DESIGN AND CONSTRUCTION OF A MEDICAL DEVICE FOR NON-INVASIVE MEASUREMENT OF BLOOD SUGAR LEVELS, HEART RATE AND SPO2 BASED ON THE INTERNET OF THINGS***

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*Self-monitoring of health conditions is becoming increasingly important, especially for people with chronic diseases such as diabetes and cardiovascular disorders. This research designed and built a non-invasive Internet of Things (IoT)-based health device capable of measuring blood sugar, heart rate, and blood oxygen (SpO<sub>2</sub>) levels in real time. The system uses a GY-MAX30102 sensor with a photoplethysmograph (PPG) method and an ESP32 microcontroller to process and transmit data via Wi-Fi connectivity with the MQTT protocol. Measurement results are displayed on an LCD and sent to a server for remote monitoring. Based on a calibration process with conventional medical devices, this device has an accuracy rate of 95.82% for blood sugar levels, 95.83% for heart rate, and 99.29% for oxygen (SpO<sub>2</sub>) levels. Accuracy is affected by external factors such as finger position, skin color and thickness, and humidity. With further development, this device has the potential to become a practical and convenient solution for non-invasive and integrated daily health monitoring.*

*Keywords: Non-invasive, blood sugar level, heart rate, SpO<sub>2</sub>, Internet of Things, MAX30102, ESP32*