ABSTRAK

Metode resistivitas dalam geofisika menggunakan *resistivity meter* untuk mengukur nilai resistivitas bawah permukaan melalui injeksi arus dan pengukuran tegangan. Proses akuisisi data konvensional masih menggunakan perpindahan elektroda manual yang membutuhkan waktu lama dan rentan terhadap kesalahan operator. Penelitian ini bertujuan merancang *smart resistivity meter* multi-channel berbasis *Internet of Things* (IoT) yang dapat mengefisienkan proses akuisisi data dengan sistem *switching* elektroda otomatis untuk konfigurasi Schlumberger, Wenner, dan *Dipole-dipole*. Penelitian menggunakan metode eksperimental dengan merancang sensor arus berbasis shunt resistor dan sensor tegangan menggunakan rangkaian pembagi tegangan. Sistem terintegrasi dengan mikrokontroler ESP32 dan Arduino Uno untuk mengontrol 8 elektroda melalui relay *switching*. Data tersimpan otomatis pada *cloud storage* dan dapat dikontrol melalui aplikasi *mobile* berbasis MIT App Inventor. Hasil pengujian menunjukkan sistem dapat beroperasi dengan *error* pembacaan tegangan 3% dan arus 2%, presisi tegangan 92% dan arus 96%, dengan *range* pengukuran 0-100V dan 0-100mA. Sistem berhasil melakukan *switching* elektroda otomatis sesuai konfigurasi yang dipilih dan mengunggah data *real-time* ke *cloud storage*. Konsumsi daya sistem sebesar 4,23 watt dengan kemampuan multi-channel 8 elektroda. Kesimpulan penelitian menunjukkan *smart resistivity meter* multi-channel berhasil meningkatkan efisiensi akuisisi data geolistrik dengan fitur *switching* otomatis, penyimpanan *cloud*, dan kontrol aplikasi *mobile* yang *user-friendly* untuk tiga konfigurasi utama survei resistivitas.

Kata kunci: *Smart resistivity meter*, IoT, *switching* elektroda, *cloud storage*, geolistrik.

ABSTRACT

The resistivity method in geophysics utilizes a resistivity meter to measure subsurface resistivity values through current injection and voltage measurement. Conventional data acquisition processes still rely on manual electrode displacement, which is time-consuming and prone to operator errors. This research aims to design an Internet of Things (IoT)-based smart multi-channel resistivity meter that can enhance data acquisition efficiency through automatic electrode switching systems for Schlumberger, Wenner, and Dipole-dipole configurations. The research employed an experimental method by designing a current sensor based on shunt resistor and a voltage sensor using voltage divider circuits. The system is integrated with ESP32 and Arduino Uno microcontrollers to control 8 electrodes through relay switching. Data is automatically stored in cloud storage and can be controlled through a mobile application based on MIT App Inventor. Test results demonstrate that the system can operate with voltage reading error of 3% and current error of 2%, voltage precision of 92% and current precision of 96%, with measurement ranges of 0-100V and 0-100mA. The system successfully performs automatic electrode switching according to the selected configuration and uploads real-time data to cloud storage. System power consumption is 4.23 watts with 8-electrode multi-channel capability. The research conclusion indicates that the smart multi-channel resistivity meter successfully improves geoelectric data acquisition efficiency with automatic switching features, cloud storage, and user-friendly mobile application control for three main resistivity survey configurations.

Keywords: *Smart resistivity meter, IoT, electrode switching, cloud storage, geoelectric*