

ABSTRAK

Khoirul Mahfud. 2026. Skripsi. Pengembangan Sistem Proteksi *Overcurrent* dan *Overvoltage* dengan *Human Machine Interface* (HMI) berbasis *Liquid Crystal Display* (LCD) *Thin Film Transistor* (TFT) 2.4 Inch. Program Studi Pendidikan Teknik Elektro, Universitas PGRI Madiun. Pembimbing (I) Ihtiari Prastyaningrum, M.Si. Pembimbing (II) Ir. Sulistyaning Kartikawati, M.Pd.

Penelitian ini bertujuan merancang, menguji validitas, serta mengetahui respon pengguna terhadap *prototype* sistem proteksi *overcurrent* dan *overvoltage* dengan *Human Machine Interface* (HMI) berbasis *Liquid Crystal Display* (LCD) *Thin Film Transistor* (TFT) 2.4 inch. Metode yang digunakan adalah *Research and Development* (R&D) dengan model ADDIE. *Prototype* mengintegrasikan Arduino Uno sebagai pengendali, sensor PZEM-004T sebagai pembaca parameter listrik, *relay* dan *buzzer* sebagai aktuator proteksi, serta LCD TFT *touch screen* sebagai *interface*. Hasil pengujian menunjukkan sensor PZEM-004T memiliki akurasi tinggi dengan rata-rata *error* tegangan 0,41% dan arus 4,36%, serta sistem mampu mendeteksi *overcurrent* dan *overvoltage* serta memutus aliran listrik otomatis. Validasi 5 ahli memperoleh 90,4% (Sangat Layak), respon 5 masyarakat pemilik bengkel 90,8% (Sangat Layak), dan respon 21 mahasiswa 89,2% (Baik). *Prototype* dinyatakan layak digunakan sebagai sistem proteksi kelistrikan sekaligus media pembelajaran interaktif yang mendukung pembelajaran kontekstual.

Kata Kunci : Sistem proteksi, arus lebih, tegangan lebih, Human Machine Interface, pembelajaran kontekstual.

ABSTRACT

Khoirul Mahfud. 2026. Thesis. Development of an Overcurrent and Overvoltage Protection System with a Human Machine Interface (HMI) Based on a 2.4Inch Thin Film Transistor (TFT) Liquid Crystal Display (LCD). Electrical Engineering Education Program, PGRI University of Madiun. Advisor (I) Ihtiari Prastyaningrum, M.Si. Advisor (II) Ir. Sulistyaning Kartikawati, M.Pd.

This study aims to design, test the validity of, and determine user response to a prototype overcurrent and overvoltage protection system with a Human Machine Interface (HMI) based on a 2.4-inch Thin Film Transistor (TFT) Liquid Crystal Display (LCD). The method used was Research and Development (R&D) based on the ADDIE model. The prototype integrates an Arduino Uno as the controller, a PZEM-004T sensor as the electrical parameter reader, a relay and buzzer as protection actuators, and a TFT LCD touchscreen as the interface. Test results show that the PZEM-004T sensor has high accuracy, with an average voltage error of 0.41% and a current error of 4.36%, and that the system is capable of detecting overcurrent and overvoltage and automatically cutting off the power supply. Validation by 5 experts yielded a score of 90.4% (Highly Acceptable), feedback from 5 auto shop owners scored 90.8% (Highly Acceptable), and feedback from 21 students scored 89.2% (Good). The prototype was deemed suitable for use as both an electrical protection system and an interactive learning tool that supports contextual learning.

Keywords: Protection System, Overcurrent, Overvoltage, Human Machine Interface, Contextual Learning.