

ABSTRAK

Perkembangan otomasi industri menuntut sistem kontrol yang andal, fleksibel, dan aman, khususnya pada sistem transportasi vertikal seperti *lift* barang. Pada implementasi sebelumnya, sistem *lift* barang masih menggunakan *smart relay* yang memiliki keterbatasan dalam fleksibilitas pemrograman, kapasitas *input-output*, serta pengembangan logika kontrol dan sistem keselamatan. Oleh karena itu, tugas akhir ini bertujuan untuk merancang dan mengimplementasikan sistem kontrol *lift* barang enam lantai berbasis *Programmable Logic Controller (PLC)* sebagai pengganti *smart relay*. Sistem dirancang menggunakan *PLC Omron CPM1A* sebagai pengendali utama dan *PLC Mitsubishi FX1S* sebagai pendukung sistem notifikasi, dengan pemrograman *ladder diagram*. Sistem dilengkapi dengan sensor *limit switch* sebagai pendeteksi posisi, kontaktor sebagai penggerak motor, indikator *seven segment*, *buzzer*, serta sistem pengaman berupa *door lock* dan *emergency stop*. Metode penelitian meliputi perancangan perangkat keras, perancangan perangkat lunak, implementasi panel kontrol, serta pengujian fungsional sistem. Hasil pengujian menunjukkan bahwa sistem mampu beroperasi dengan baik, memiliki waktu respon yang cepat, akurasi pemberhentian *lift* yang tepat, serta sistem keselamatan yang berfungsi optimal. Selain itu, hasil perbandingan menunjukkan bahwa sistem berbasis *PLC* memiliki fleksibilitas, keandalan, dan kemudahan pengembangan yang lebih baik dibandingkan *smart relay*. Dengan demikian, sistem kontrol *lift* barang berbasis *PLC* ini dinilai layak dan efektif untuk diterapkan pada lingkungan industri serta mendukung kebutuhan otomasi di era Revolusi Industri 4.0.

Kata kunci: *Lift* barang, *PLC*, *Smart relay*, Sistem kontrol, Otomasi industri

ABSTRACT

The development of industrial automation requires control systems that are reliable, flexible, and safe, particularly in vertical transportation systems such as freight elevators. In previous implementations, freight elevator systems commonly utilized smart relays, which have limitations in programming flexibility, input-output capacity, and the development of advanced control logic and safety systems. Therefore, this final project aims to design and implement a six-floor freight elevator control system based on a Programmable Logic Controller (PLC) as a replacement for smart relays. The system is designed using an Omron CPM1A PLC as the main controller and a Mitsubishi FX1S PLC as a supporting notification system, programmed using ladder diagrams. The system is equipped with limit switch sensors for position detection, contactors for motor control, seven-segment indicators, buzzers, and safety systems including lifts and emergency stop functions. The research methodology includes hardware design, software design, control panel implementation, and functional system testing. The test results show that the system operates properly, has a fast response time, accurate floor stopping performance, and an optimally functioning safety system. Furthermore, comparative analysis indicates that PLC-based systems provide better flexibility, reliability, and ease of development compared to smart relay-based systems. Therefore, the proposed PLC-based freight elevator control system is considered suitable and effective for industrial applications and supports automation requirements in the era of Industry 4.0.

Keywords: Freight elevator, PLC, Smart relay, Control system, Industrial automation