

RINGKASAN

PERANCANGAN SISTEM KENDALI DAN KESELAMATAN PADA *PRODUCTION SEPARATOR* BERBASIS PLC DAN HMI

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Industri minyak dan gas memerlukan sistem kendali yang andal untuk menjamin efisiensi dan keselamatan, terutama pada unit seperti *Production Separator* yang mengatur tekanan, level, dan aliran. Namun, seringkali ditemukan tantangan dalam memastikan integrasi yang optimal antara perangkat keras, logika kontrol, dan antarmuka pengguna. Permasalahan ini mencakup bagaimana merancang sistem kendali yang mampu merespons perubahan variabel proses secara real-time, bagaimana mendesain antarmuka HMI yang intuitif bagi operator, serta bagaimana memastikan sistem keselamatan berjalan sesuai spesifikasi dalam berbagai kondisi operasional. Penelitian ini merancang sistem kendali berbasis PLC dan HMI menggunakan EcoStruxure Machine Expert dan Vijeo Designer, dengan pengembangan logika kontrol, desain antarmuka HMI real-time, serta integrasi sensor dan aktuator. Sistem HMI berhasil menampilkan parameter tekanan dan level secara akurat, serta mengimplementasikan sistem keselamatan yang mengacu pada *safe chart*, termasuk alarm HH, H, L, LL dan shutdown otomatis melalui ESD, PSD, USD-1. *Shutdown hierarchy* berhasil diterapkan, di mana PSD memiliki prioritas lebih tinggi. Mode auto pada valve LCV-104 menghasilkan bukaan yang sesuai perhitungan manual, sementara mode manual memungkinkan pengaturan langsung oleh operator. Grafik tren bukaan valve juga tampil akurat dalam kedua mode. Selain itu, fitur *Maintenance Override Switch* (MOS) berhasil diimplementasikan untuk sensor tekanan dan level guna memungkinkan pemeliharaan tanpa memicu *shutdown*. Validasi dilakukan melalui simulasi berbagai skenario, dengan tingkat keberhasilan sistem mencapai 100%, menunjukkan sistem berjalan sesuai desain dan mampu meningkatkan keselamatan operasional secara signifikan.

Kata kunci : *Production Separator*, PLC, HMI, EcoStruxure Machine Expert, Vijeo Designer

SUMMARY

DESIGN OF CONTROL SYSTEM AND SAFETY SYSTEM IN PRODUCTION SEPARATOR BASED ON PLC AND HMI

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The oil and gas industry requires reliable control systems to ensure efficiency and safety, especially in units such as Production Separators that regulate pressure, level, and flow. However, there are often challenges in ensuring optimal integration between hardware, control logic and user interface. These issues include how to design a control system capable of responding to changes in process variables in real-time, how to design an HMI interface that is intuitive for operators, and how to ensure safety systems perform to specification under various operational conditions. This research designed a PLC and HMI-based control system using EcoStruxure Machine Expert and Vijeo Designer, with control logic development, real-time HMI interface design, and sensor and actuator integration. The HMI system successfully displays pressure and level parameters accurately, and implements a safety system that refers to the safe chart, including HH, H, L, LL alarms and automatic shutdown via ESD, PSD, USD-1. Shutdown hierarchy was successfully implemented, where PSD has higher priority. The auto mode of the LCV-104 valve produces manually calculated openings, while the manual mode allows direct setting by the operator. The valve opening trend graph also appears accurate in both modes. In addition, a Maintenance Override Switch (MOS) feature was successfully implemented for the pressure and level sensors to allow maintenance without triggering a shutdown. Validation was conducted through simulation of various scenarios, ensuring the system performed as designed and was able to improve operational safety.

Keywords : Production Separator, HMI, EcoStruxure Machine Expert, Vijeo Designer