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Design and Implementation of a Pellet Mill Operation Panel Based on PLC and SCADA
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ABSTRACT

This research presents design and implementation of pellet mill operation panel based on PLC and SCADA to overcome the limitations of conventional pellet mill operation systems, which generally lack centralized monitoring, automated protection, and real-time operational data acquisition. The developed prototype employs a Lollete LU48-MR PLC programmed using the Ladder Diagram method in GX Developer to execute sequential motor control with 5-second delays between the pellet mill, conditioner, and feeder motors. The control system also incorporates an interlock mechanism and a fail-safe protection scheme using an Over Current Relay (OCR) and an Emergency Stop (E-Stop). Process variables are acquired through a proximity sensor connected to the PLC High Speed Counter (HSC) for rotational speed measurement and a Type-K thermocouple with a 4-20 mA transmitter for temperature monitoring. The PLC communicates with the Haiwell Cloud SCADA platform via the Modbus RTU protocol over an RS-485 communication network.

Experimental results demonstrated that all control, monitoring, and protection functions operated according to the design specifications. The sequential control successfully executed motor startup with the programmed 5-second intervals, while the protection system responded correctly to overload and emergency conditions. The measured overload response times were 36.17 s for the conditioner section and 25.92 s for the pellet mill section. The SCADA interface provided stable real-time visualization of motor status, rotational speed, temperature, and alarm conditions throughout system operation. Comparison of RPM measurements between the panel indicator and the SCADA system showed a deviation of only 1-10 RPM, indicating consistent monitoring performance. Furthermore, the historical data logging function successfully recorded operational data at 10-second intervals, while PLC-SCADA communication remained stable with an average response delay of approximately 1 s, without communication loss or data loss during continuous operation. These results demonstrate that the proposed PLC and SCADA based Pellet Mill Operation Panel provides reliable control, effective real-time monitoring, improved operational safety, and efficient historical data management, making it suitable as an industrial automation solution for pellet mill operations.

Keywords: Pellet Mill Operation Panel, Industrial Automation, PLC, SCADA, Real-Time Monitoring