

DEVELOPING AN AUTOMATIC BOTTLE FILLING AND CAPPING SYSTEM BASED ON PLC THROUGH THE INTEGRATION OF A FLOW SENSOR AND A ROTARY TABLE MECHANISM

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ABSTRACT

Manual bottle packaging often results in inconsistent liquid volumes and inaccurate bottle positioning, which negatively affects production quality and efficiency. This research aims to design and develop an automatic bottle filling and capping system based on a PLC to address these issues. The system integrates a flow sensor for liquid volume measurement, a stepper motor to drive the rotary table, and pneumatic actuators for the capping process. Additionally, an infrared proximity sensor is used to detect bottle presence, and a passive bottle cap holder is designed to keep the cap stable before closure. The system is programmed using the Omron CP2E PLC and features an HMI interface via Haiwell B7H to facilitate parameter configuration and real-time process monitoring. Tests were conducted on key components, including the flow sensor's measurement accuracy, the infrared sensor's sensitivity, rotary table rotation precision based on input pulses, the cap holder's effectiveness, and the system's overall performance. Test results showed an average measurement error of 0.465% for liquid volume, 100% accuracy in rotary table positioning, responsive bottle detection by the infrared sensor, and stable cap holding during the capping process. The average time for a complete filling and capping cycle was recorded at 43.55 seconds. This system has proven effective in enhancing efficiency, reducing manual intervention, and ensuring consistent packaging quality. Thus, the designed automation system significantly contributes to the development of liquid packaging technology, particularly for small and medium-scale industries.

Keywords: *Filling and Capping System, Omron CP2E PLC, Flow Sensor, Rotary Table, Automation System.*