I I O T: A TOOL TO INCREASE PRODUCTIVITY AND REDUCE COSTS IN THE PACKAGING INDUSTRY

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The study focuses on the use of the Industrial Internet of Things (IIoT) concept to optimize the operation of packaging machines. The study examines the potential of IIoT to collect, process, and analyze data on the operation of individual components of packaging machines, such as solenoid valves. Using sensors and electronic systems, data on temperature, vibration, pressure, and other valve parameters can be obtained. Analyzing this data allows us to assess the health of the valves, identify potential problems, and optimize their performance. The results of the study show that the use of IIoT can significantly improve the efficiency and reliability of packaging machines, as well as reduce maintenance and repair costs. The study, which aims to develop a formalized approach to IIoT-based modeling in the structure of packaging machines, allows us to analyze the impact of intelligent control systems on productivity, flexibility, reliability, and product quality.

To achieve this goal, a detailed analysis of the key components of the ICS, such as sensors, actuators, data collection and analysis platforms, and decision-making algorithms, was conducted.

The research object was the process of dosing liquid products in a packaging machine. A mathematical model was developed that describes the dynamics of the dosing process, taking into account the characteristics of a proportional pressure regulator. The results of modeling and experimental studies have shown that the proposed module of the intelligent control system is able to effectively stabilize lifting and lowering operations within the specified accuracy and speed limits. The results confirmed that with a stepwise change in the output absolute pressure setpoint signal from 0.5 to 6.5 bar at an absolute supply pressure of 8 bar and a regulator throughput of 1500 Nl/min for small volumes of the outlet cavity (no more than 0.01 l), the process proceeds quickly (t = 0.12 c) and practically without fluctuations. With an increase in the volume of the initial cavity, the duration of the transient process increases and at a volume of V = 4 l reaches approximately 1 s (t = 0.3 c). At the same time, the overshoot of 0...7 % and the oscillation slightly increase, remaining within the permissible limits. For all values of the receiver volume, the steady-state error does not exceed 2000 Pa, which is 0.25% of the supply pressure. As a result of the experimental studies, it was found that the duration and nature of the transient processes of pressure control at the output of the PRE, as a compensator for dynamic loads, depend on the volume of the receiver connected to its output, the throughput of the inlet and outlet ports of the pressure regulator, and the supply pressure.

Keywords: *Industrial Internet of Things (IIoT), packaging machines, optimization, sensors*

References

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