International Journal of Computer Technology and Science

E-ISSN .: 3048-1961
P-ISSN .: 3048-1899

Research Article

Review of the Control System of the Tokiwa W500 Packing Machine at PT. Indofood CBP Sukses Makmur, Semarang Noodle Division

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Abstract. The selection of this research topic is based on the important role of packing machines in the noodle production process. As consumer demand continues to increase and industrial competition becomes more intense, optimizing production efficiency is a critical requirement for manufacturing companies. This study focuses on the Tokiwa W500 Packing Machine used at PT. Indofood CBP Sukses Makmur, Noodle Division, Semarang. The research method involves a comprehensive review of the machine control system to evaluate its operational performance. Data collection was conducted through direct observation, structured interviews with machine operators, and relevant literature review. The review emphasizes system performance, operational efficiency, and the level of automation, while identifying potential areas for improvement. The results indicate that the Tokiwa W500 Packing Machine operates in a stable and consistent manner during the noodle packaging process. However, opportunities were identified to enhance the automation system in order to improve production efficiency and reduce the risk of human error. This study is expected to contribute to the development of more effective and optimized control systems for industrial packing machines.

Keywords: Automation, Control System, ICBP, Packing Machine, Tokiwa.

Received: December 11, 2025
Revised: December 31, 2025
Accepted: January 12, 2026
Published: January 16, 2026
Curr. Ver.: January 16, 2026

1. Introduction

In the dynamic food manufacturing industry (Tan et al., 2025), machine efficiency and reliability play a key role in ensuring the smooth production of consumer goods (Yang et al., 2024), one of the critical components in the instant noodle production chain is the Tokiwa W500 Packing Machine (Xiangdong, 2018). This study focuses on the evaluation of the control system of this machine, which has a central position in the packaging process at PT. Indofood

CPB Sukses Makmur Semarang Noodle Division (Puspita Sari et al., 2018). The selection of this research topic stems from the importance of the Packing Machine in the context of noodle production. As consumer demands grow and competition intensifies, the need to optimize the production process becomes crucial (Purnomo et al., 2025). The Tokiwa W500 Packing Machine, as a key element in the final stage of noodle manufacturing, requires careful inspection to ensure its efficiency, reliability, and potential for improvement (Mahbubah et al., 2021).

The urgency of the evaluation is emphasized by the critical role of this machine in the overall production chain. Any inefficiency or deficiency in its operation can have a cascading impact on the entire manufacturing process, affecting productivity and potentially compromising the quality of the final product. Therefore, a thorough review of the control system is not only timely but also essential to maintain and improve the company's competitiveness in the market (Mahbubah et al., 2021);(Alcon, F., de-Miguel, M. D., & Burton, 2024)

The study (Formentini et al., 2021) is Food Quality Evaluation with Electronic Nose and Machine Learning. Food quality evaluation using electronic nose and machine learning is the main focus. Key findings include the integration of electronic nose and machine learning as a fast and economical food quality assessment tool. The focus is on various food categories and the effectiveness of integration on diverse food products. The second reference (Purba et al., 2024) is Food Packaging Innovation for Food Efficiency and Safety. Innovation in food packaging is highlighted to improve factory process efficiency, productivity, quality, and food safety. Key findings indicate the need for automation integration and improvement of robust, flexible, and efficient packaging machines. The study emphasizes more on packaging material trends, especially smart packaging. The third reference (Hwa & Chuan, 2024) is Robotics Implementation in Agriculture and Food Industry. Robotics is implemented in agriculture and food industry to improve safety, quality, and profitability. The findings highlight the potential for replacing human tasks, especially in the dairy and food industry. Robotics applications cover a wide range of aspects, such as food product grading, packaging, meat processing, and general production.

Previous research has considered a deeper integration between quality evaluation using electronic nose technology and recent developments in packaging automation. This potential gap suggests that increased integration could yield more holistic solutions to improve food efficiency and quality across the production chain. The uniqueness of this research lies in its approach, which combines these two critical aspects, opening up opportunities for a more comprehensive and integrated understanding of the factors influencing food efficiency and quality.

This research is not only a technical evaluation, but also a practical contribution to the broader field of food manufacturing, where advances in machinery directly impact operational

efficiency and product quality. The following sections will discuss a detailed analysis of the Tokiwa W500 Packing Machine control system, presenting findings and implications that can guide strategic decision-making for PT. Indofood CPB Sukses Makmur.

2. Proposed Method

The research methodology involves a diverse approach, combining direct observation, interviews with machine operators, and an in-depth literature review, focusing on key aspects such as reliability, efficiency, and automation, this study aims to provide valuable insights into the current condition of the Tokiwa W500 Packing Machine, in addition, the identification of potential improvements will contribute to the formulation of more effective maintenance strategies and improved operational performance (Tannady et al., 2019); (Friederich & Lazarova-Molnar, 2024)

The study adopted an evaluative design to evaluate the control system of the Tokiwa W500 Packing Machine used at PT. Indofood CPB Sukses Makmur, Semarang Noodle Division. The main focus of this study is on the reliability, efficiency, and automation of the packing machine (Prasasti, Susila, & Priambodo, 2021) (Sun & Li, 2010). The study population consisted of Tokiwa W500 Packing Machines in the division, and the sample was selected using a purposive sampling method to ensure the representativeness of the evaluation results. Data collection was carried out through direct observation of machine operations, in-depth interviews with operators, and a literature review to understand industry standards and current technologies. Data analysis involved a quantitative approach with a focus on machine reliability, operational efficiency, level of automation, and identification of potential improvements. The research findings are expected to provide insights into the performance of the Tokiwa W500 Packing Machine, including its high reliability in the instant noodle packaging process. In addition, the evaluation results will highlight opportunities for improvement, particularly in increasing automation to achieve better efficiency. The practical implications of these findings will be outlined along with recommendations that can support PT. Indofood CPB Sukses Makmur in improving and enhancing the control system of the Tokiwa W500 Packing Machine. This overall methodology is aimed at contributing to more effective maintenance and increased productivity in the company's Noodle Division (Luo, 2022); (Friederich & Lazarova-Molnar, 2024). The following is a block diagram of the research, shown in Figure 1.

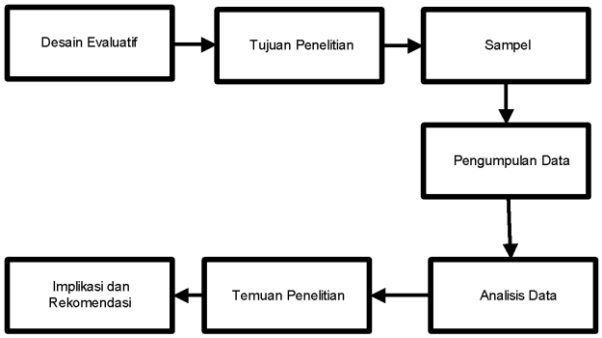

Figure 1. Block Diagram.

Figure 1. explains the research planning and implementation process, where the first stage is evaluative design, the second stage is research objectives, the third stage is sample, the fourth stage is data analysis, the fifth stage is research findings, and the final stage is implications and recommendations.

3. Results and Discussion

Electrical Parts of the Tokiwa W 500 Packing Machine

Tokiwa W500 Packing Machine (Minh et al., 2023); (Yunzhang & Liang, 2016) is a machine specifically designed to carry out the packaging process in the food industry, especially for products such as instant noodles and their components such as spices, soy sauce, sauce, oil, and other additives such as onions and crackers. This machine has a horizontal packing system to accommodate a variety of materials that need to be packaged together. The advantage of this machine lies in its sophisticated electronic system, with a maximum speed of around 100 packs of instant noodles per minute. Equipped with a Bag Length Speed (RPM) sensor and the length of the label cut in millimeters, as well as a counter to count the number of instant noodles that have been packaged and temperature control.

This temperature control system (STANKOV et al., 2017) is particularly important for regulating the heater temperature in the sealing process. High RPM speeds require proportional heater temperature adjustments to ensure optimal sealing results, if the RPM is high with a low heater temperature, the sealing results can be easily torn or even not adhered, if the RPM is low with a high heater temperature, it can cause label melting and leakage, so the product must be rejected and repackaged, therefore, the heater temperature adjustment must be in accordance with the speed of the machine to ensure good packaging quality and avoid product waste. The image of the Tokiwa W 500 Packing Machine is shown in Figure 2.

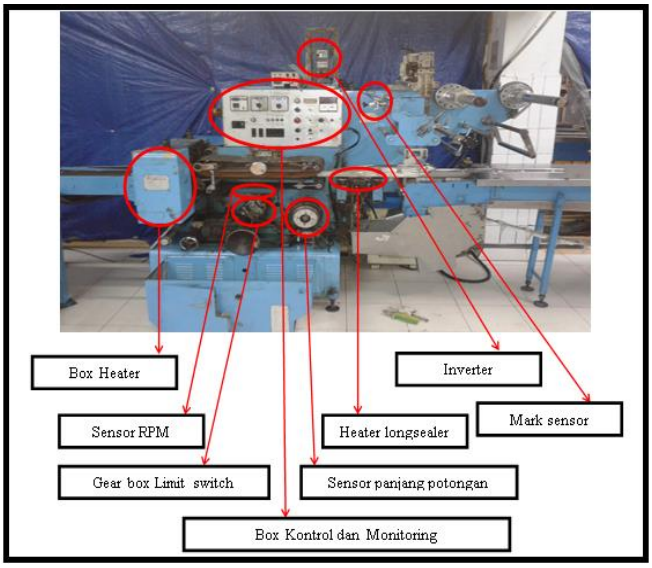

Figure 2. Tokiwa W 500 Packing Machine.

Figure 2. it is shown that the Tokiwa W 500 Packing Machine consists of a Hester Box, RPM Sensor, Gear Box Limit Switch, Inverter, Mark Sensor, Heater Long Sealer, Cut Length Sensor, Control Box, and Monitoring.

Procedure for Using the Tokiwa W500 Packing Machine

The Tokiwa W500 packing machine, as a key element in modern production lines, promises the potential to transform and improve the packing process (Mahbubah et al., 2021). A picture of the procedure for using the Tokiwa W500 Packing Machine is shown in Figure 3.

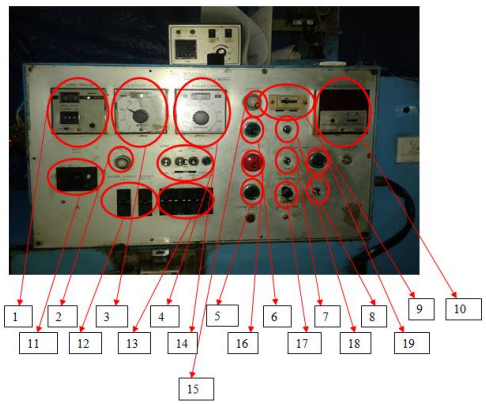

Figure 3. Procedures for Using Packing Machines.

Figure 3.We enter the core of the Tokiwa W500 Packing Machine with the Control and Monitoring Box, which reveals sophisticated controls and systematic monitoring. Each element in this box has a specific role in regulating and ensuring the performance of the packing machine. The following is a detailed description of the function of each component listed in Figure 3, explained in Table 1.

Table 1 Function of Each Component.

No	Component	Function
1	Temperature Control Heater Longsealer	Maintaining optimal temperature in the Longsealer section to ensure precise packaging sealing.
2	Main Power Pilot Lamp	Provides a visual indicator of main power, ensuring engine operation at adequate power levels.
3	Temperature Control Heater Endsealer Upper	Responsible for temperature control in the Upper Endsealer section for consistent finishes.
4	Pilot Light Heater Longsealer and Heater Endsealer	Provides visual information regarding the status and performance of the heater on the Longsealer and Endsealer.
5	Inching Button	Step-by-step control of machine movements for detailed adjustments and settings.
6	Tombol Follow Up Manual	Enable manual control mode to follow and adjust the packing process more precisely.
7	Switch Endsealer Manual	Switch selection to manual control for Endsealer.
8	Switch Register Kontrol	Control the packaging material registration process for accuracy and positioning precision.
9	Counter	Calculate the number of packaging units that have been produced during machine operation.
10	Display BagLength Speed	Displays information regarding the package length and current processing speed.
11	Main Power MCB	Controls the main power current of the machine for safety and stable performance.
12	Main Motor NFB and 100 VAC Voltage System NFB	Manipulates temporary disturbances by disconnecting power to the main motor and the 100 VAC system.
13	NFB Heater Longsealer dan Heater Endsealer	Protects the machine from voltage anomalies by cutting off power to the Longsealer and Endsealer heaters.
14	Temperature Control Heater Endsealer Lower	Control the temperature at the Lower Endsealer to achieve optimal sealing results.
15	Pilot Light for Follow Up Motorcycle	Displays Follow Up motor status and performance.
16	Emergency Stop Button	Instantly disables the engine in emergency situations, providing an additional layer of security.

17	Potensiometer Speed Control	Adjust the operational speed of the machine according to production needs.
18	Switch Temperatur Kontrol ON/OFF	Enable or disable temperature control according to operational needs.

Table 1.The function of each component on the Tokiwa W500 Packing Machine is explained, including temperature control, power control, and visual monitoring to ensure operation.

Bag Length and Speed Network System

The Bag Length and Speed circuit system is the core of measuring and monitoring the speed and length of the label pieces on the machine, in this system, the RPM sensor uses proximity sensor technology to detect movement and distance on the gear, producing pulses represented in the form of numbers on the display (Shaik & Peddakrishna, 2025). The image of the Bag Length and Speed circuit system is shown in Figure 4.

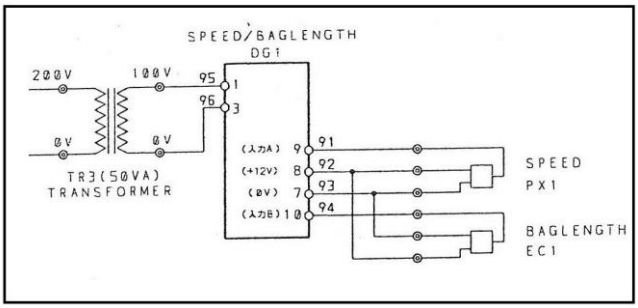

Figure 4. Bag Length and Speed network system.

Figure 4.provides a detailed overview of connecting the RPM and Baglength sensor outputs to the display. The RPM sensor output is connected to pin 9 on the display, while the Baglength sensor output is connected to pin 10 on the display. This display serves as a visual interface for the machine operator, displaying digital numbers that provide information about the speed and length of the label cut according to predetermined standards.

The RPM sensor uses a proximity sensor, and the Baglength sensor uses a rotary encoder. Proximity sensors operate based on the distance and number of teeth on the gear. When the proximity sensor detects a high gear, it outputs a voltage (24 VDC); conversely, when it does not detect a high gear, the sensor outputs no voltage (0 V). Pulses occur according to the number of teeth on the gear, which then pulses the proximity sensor.

Rotary encoders essentially generate pulses based on rotation. The number of pulses depends on the type of rotary encoder used; for example, the NB-600ZC rotary encoder generates 600 pulses per rotation. The pulses from the proximity sensor and rotary encoder are converted and processed to be displayed numerically using a seven-segment display.

Overall, the system utilizes information from both sensors to provide the operator with accurate, measurable information. The output from the proximity sensor and rotary encoder

is electronically processed and displayed clearly on a display, allowing the operator to precisely monitor the speed and length of the label cut.

Heater Endsealer and Longsealer network system

The heater end sealer and long sealer circuit system on the packaging machine is responsible for controlling the heater temperature. This involves heaters on the end sealer (top and bottom) and the long sealer, which are regulated by temperature control with the help of temperature sensors. Pilot lights provide a visual indication of heater performance (Kondakci & Zhou, 2017). This system ensures accurate and efficient sealing at the end and length of the package, maintaining optimal production quality (Kondakci & Zhou, 2017). The heater end sealer and long sealer circuit system is shown in Figure 5.

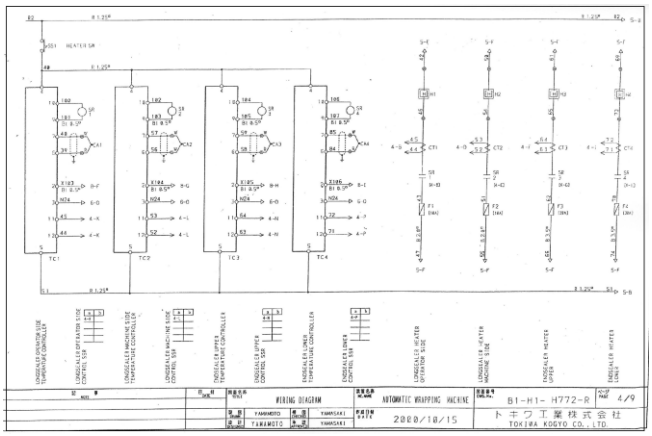

Figure 5. Endsealer and Longsealer Heater Network System.

Figure 5. it can be explained that the heater is controlled by a solid state relay at a control temperature based on a temperature sensor that uses a thermocouple. This thermocouple is placed in the Heater Endsealer (50 VAC) and Heater Longsealer (50 VAC), from there the heat source for the thermocouple, which when the temperature rises there is a potential difference on the legs, from there the temperature of the heater endselaer and longsealer is controlled according to the demand temperature at the control temperature. When the temperature has reached the demand temperature, the solid state relay will be OFF or the switch will open so that the heater is OFF, after the heater temperature drops to a certain temperature degree, approximately 10 degrees lower than the demand temperature, the heater will be ON again until the demand temperature is reached and will be OFF again and so on will be like that repeatedly so that the sealing process continues to get good results.

Phase 380 VAC Prime Drive Motor

The 3-phase 380 VAC prime mover motor is an electric motor that works with three phases and an electric voltage of 380 Volt Alternating Current (VAC). This motor has the advantage of providing stable and efficient power to drive the packing machine at a higher voltage level, by using a 3-phase system, the 3-phase 380 VAC prime mover motor can provide more consistent power and provide better efficiency in its operation, making it a vital

key component in the packing machine (Anggrainy et al., 2025). The wiring diagram of the 3-phase 380 VAC prime mover motor is shown in Figure 6.

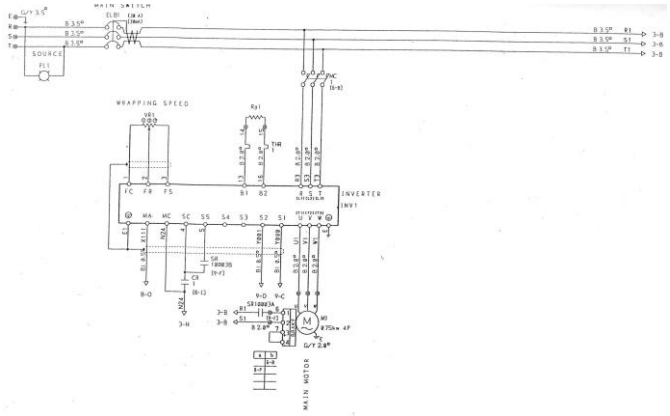

Figure 6. Wiring Diagram of 3 Phase 380 VAC Prime Drive Motor.

Figure 6. It can be explained that the 3-phase motor circuit system starts with a 3-phase No Fuse Breaker (NFB) as the main breaker. This NFB is connected in series with a 3-phase Miniature Circuit Breaker (MCB), which is responsible for breaking the electric current flow in the 3-phase Inverter. The output of this Inverter is then connected to the 3-phase main drive motor on the packing machine. This motor uses a magnetic braking system where the inductor is given a direct current (DC) to ensure that when the machine stops, the label remains in the correct position. When the motor is turned off, the MOSFET relay is active so that the inductor receives a 24 Volt DC direct current, creating a strong magnetic force that affects the position of the label. When the motor is turned on, the MOSFET relay is inactive, avoiding the formation of magnetic forces, so that the motor can rotate without the influence of the inductor breaker.

Follow Up Motor 3 Fase 200 VAC

Follow Up Motor 3 Phase 200 VAC is a 3 Phase Motor that can run, if it gets a 3 Phase 200 VAC voltage source (Japan Industrial Standard) (Rizki & Eka, n.d.) Wiring Diagram Follow Up Motor 3 Phase 200 VAC is shown in Figure 7.

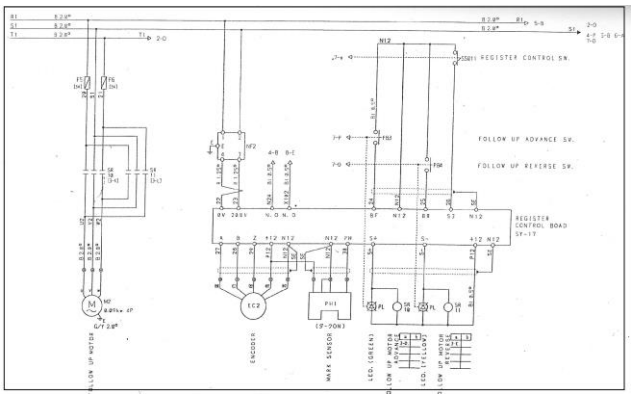

Figure 7. Wiring Diagram Follow Up Motor 3 Fase 200 VAC.

Figure 7. shows a follow-up motor circuit system designed to have the ability to rotate back and forth or forward and backward. The follow-up motor is able to rotate in both directions based on the pulse comparison between the 12 VDC photoelectric switch sensor

and the 12 VDC encoder. This pulse comparison is regulated by a register control board consisting of various types of digital ICs. This board has a Home Position, which reflects the initial or reference condition. In conditions where the pulse in the digital system is logic 1, the follow-up motor is turned off, if the sensor logic is logic low (0) and the encoder is logic high (1), the follow-up motor is activated to rotate forward, pushing the label so that the Endsealer piece matches the black line on the label. When the sensor logic is logic high (1) and the encoder is logic low (0), the follow-up motor is activated to rotate backward, pushing the label backward so that the Endsealer piece remains in line with the black line on the label.

4. Conclusions

This study evaluates the control system of the Tokiwa W500 Packing Machine at PT. Indofood CPB Sukses Makmur Noodle Division, providing an in-depth overview of the Machine's reliability in the instant noodle packaging process, although the Machine proved to be very reliable, the study identified opportunities for increased automation to further improve efficiency and reduce the potential for human error. Practical suggestions for management include developing an optimal maintenance strategy, which can not only improve the Machine's operational efficiency but also support the company's focus on safety and maintenance. These findings are expected to be the foundation for the company in designing appropriate improvement measures, creating a more efficient control system, and thus, increasing the overall productivity of the Noodle Division in the future.

Acknowledgments:We would like to express our sincere appreciation to all those who supported this research. Thank you for your financial contributions, facilities, materials, and valuable advice. Thanks to their support, this research was successfully carried out.

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