Engineering and Technology Journal e-ISSN: 2456-3358
Volume 10 Issue 08 August-2025, Page No.- 6391-6396
DOI: 10.47191/etj/v10i08.33, I.F. – 8.482

Automatic Product Packaging System Design Labview-Based

Sarifudin[1], Syafriyadi Nor[2*], Sunu Hasta Wibowo[3], Bambang Suriansyah[4]
[1,2,3,4] Electro Engineering, Banjarmasin State Polytechnic

ABSTRACT: This research aims to develop an innovative automated product packaging system, integrate the LabVIEW platform as an instrumentation visualization, and utilize conveyors and goods counters as a vital part of the packaging mechanism. The control of this system will be connected to hardware in the form of LED buttons and Arduino, providing convenience and flexibility in controlling its operations. This system will include a LabVIEW program that functions to control processes in the plant, consisting of upper and lower conveyors and equipped with proximity sensors as object detection and boxes to accommodate the inserted product. The panel will display a counter to monitor the number of objects and boxes that have been packed. In addition, the Arduino microcontroller will process input from push buttons to control the STOP and START functions in running plants in LabVIEW. The input data will be sent via serial communication between LabVIEW and Arduino, ensuring efficient connectivity between them.

KEYWORDS: Instrumentation, LabVIEW, Automation, Conveyor, packaging mechanism

I. INTRODUCTION

Industrial automation has become a critical aspect of improving efficiency and productivity in various industrial sectors. Industrial plant automation processes play an important role in automating various tasks and operations that were previously done manually [1]. One popular technology used in industrial automation control and visualization is LabVIEW, a software platform developed by National Instruments [2]. LabVIEW allows users to easily build control, data acquisition, and visualization systems through a graphical interface.

In this context, this study aims to help students understand the process of industrial automation plants by utilizing LabVIEW instrumentation. The focus of this research will be put on virtual simulations of automated packaging systems involving conveyors, item counters, and hardware controls such as push buttons, LEDs, and Arduino. This automated packaging system will be designed in a structured and systematic manner to achieve efficiency and reliability goals in the product packaging industry.

The background of this research stems from the rapid growth of industrial automation technology and the need for skilled human resources in operating and developing automation systems. Students in a variety of related courses (e.g., Electrical Engineering, Mechanical Engineering, or Computer Engineering) require an in-depth understanding of how to design, implement, and integrate automation systems in an industrial environment. In this case, this study aims to provide a clear and real picture of how LabVIEW can be used in automating the product packaging process.

The research will also discuss the integration between hardware and software in automated packaging systems. Researchers will identify challenges and obstacles that often arise in the development of industrial automation systems, as well as find the best solutions and approaches to overcome these problems. Thus, this research will contribute to advancing science and technology in the field of industrial automation.

Furthermore, the research will include an in-depth analysis of the need for an efficient automated packaging system. Factors such as conveyor speed, item counter accuracy, and LabVIEW interface will be carefully observed to achieve optimal performance in the system. This research will also consider safety and reliability aspects in the development of this industrial automation system.

The results of this research are expected to be used as learning materials in various higher education institutions or industrial automation training. In addition, this research will be a reference for students, lecturers, or industrial automation practitioners who want to understand the concepts and applications of LabVIEW in the context of automated packaging.

II. PREVIOUS RESEARCH

To design an automated product packaging system based on LabVIEW, a literature review was conducted to collect information about relevant previous studies. Several previous studies have explored the use of LabVIEW in the automation industry, including hardware control and process visualization. [3] implemented LabVIEW as a monitoring interface for turbidity, water PH, and temperature monitoring systems. Using Web Publishing Tools to be able to be accessed remotely via the web. Their results show the use of the system is more economical and reliable for water monitoring systems.

Related to water level monitoring, research by [4] uses LabVIEW to monitor the water level in the tank. The LabVIEW program sends data to the Arduino and through the Arduino, the pump is turned on if the water level in the upper tank is low and the pump is turned off if the water level is filled in the upper tank. Water level measurement using ultrasonic sensors. In addition, the same thing was done by [5] for the control of sluices.

In addition, research by [6] involves integration between LabVIEW and hardware such as Arduino, and PLC (Programmable Logic Controller) in industrial automation process control. They developed 3 different system models. That is the traffic light control system of 2 intersections. The second model is the control of the water level in the tank. The third model is a multi-lift control system integrated with the LabVIEW interface, allowing users to control process parameters in each simulator.

The use of LabVIEW is also applied to monitoring and plotting the characteristics of solar panels. [7] integrates Arduino as a sensor data reader and sends it to LabVIEW using LIFA (LabVIEW Interface For Arduino). The measured characteristics are I-V (current-voltage) and P-V (voltage-power) for solar panels.

Monitoring of other parameters is carried out by [8] creating a data logger tool to monitor air temperature and humidity in real time. Monitoring results are displayed via the Labview interface, Arduino Uno &; DHT sensor. The measurement parameters are recorded automatically into data logging in the form of MS Excel format. In addition, there is a study [9] that tested data transfer rates using LM35 sensors for Arduino data acquisition to LabVIEW.

Previous research has also used LabVIEW for DC motor position control systems. [10] implements PID control in LabVIEW that sends control signals to real-time DC motors via Arduino. In addition, LabVIEW was developed to demonstrate the output response of the motor position to time to observe system performance.

From this literature review, it can be concluded that the use of LabVIEW as a platform for controlling and visualizing automated packaging systems has proven efficient and reliable in several previous studies. However, there is no proposed instrument system related to the product packaging system. Therefore, this research aims to overcome these challenges and develop a structured and systematic automated packaging system by utilizing the advantages of LabVIEW as a control and visualization tool for the automation industry.

III.SYSTEM DESIGN

In this study, the structure of the control system was constructed as illustrated in the block diagram in Figure 1. From the picture, it can be seen that there are push button inputs and LEDs connected to the Arduino board [11]. The push button press action will be sent and processed using LabVIEW using the UART (Universal Asynchronous Receiver-Transmitter) protocol.

In the system design stage, an automated packaging system design is carried out involving conveyors, item counters, LabVIEW interfaces, and integration with hardware such as LED buttons and Arduino. The system design includes the mechanical design of conveyors and goods counters, as well as the LabVIEW interface that will be used as a visualization and control tool for the system. In addition, the design includes the layout and relationships between all components of the system to achieve efficient integration

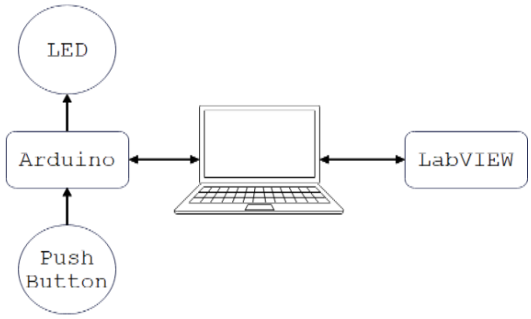


Figure 1. 1Diagram Blok on the Ssystem

A. Control Design

The design of these controls aims to achieve operations that suit the specific needs of the application. Figure 2 the use of Ladder Logic in control systems is commonly used in PLC (Programmable Logic Controller) devices, providing many advantages because it can facilitate the understanding and implementation of industrial control. Ladder Logic has become a commonly used programming language in industry due to its intuitive representation and is similar to electrical circuit diagrams [12]. However, the application of this study focuses only on drive control, while functions such as TIMER and COUNTER are made their functions in LabVIEW.

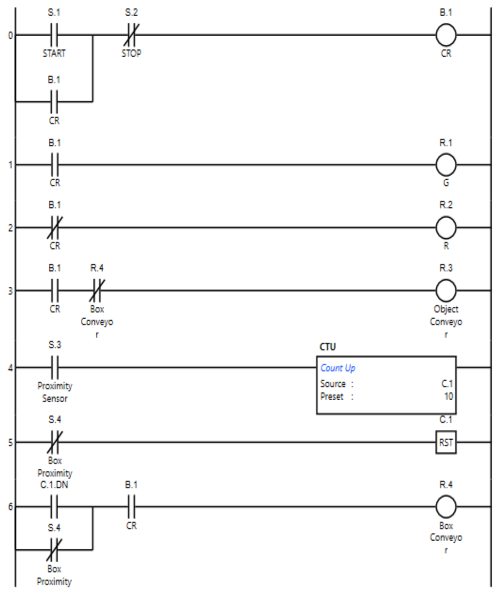


Figure 2. Ladder diagram

B. LabVIEW Implementation

At this stage, the implementation of the LabVIEW interface as the main controller of the automatic packaging system is carried out. The LabVIEW used in this research is the 2017 version. In addition, the use of additional modules DSC (Datalogging and Supervisory Control) provides various industrial devices such as sensors, actuators, and other equipment to design applications LabVIEW automates various industrial processes [13]. In the DSC module, there is a component called Image Navigator. This image library is very useful for creating attractive user interfaces in LabVIEW. It integrates all system components and allows users to monitor and control the packaging process in real time.

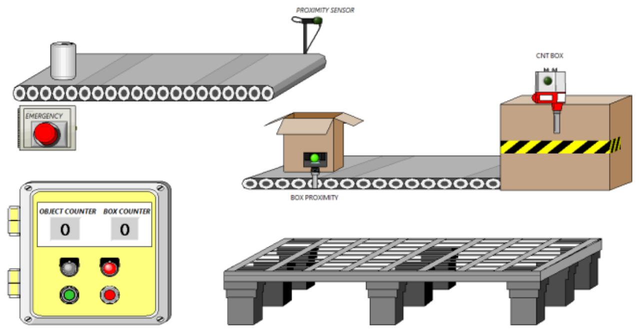


Figure 3. System design on LabVIEW front panel2

In Figure 3 there are conveyors, sensors, panels, and pallets. The first conveyor to move objects. At the end of the conveyor, there is a proximity sensor to detect the presence of the object and count the object. If the counter has reached the set point, then the second conveyor will move toward the packaging station. After going through the station, the proximity sensor will detect the presence of the box. Then the number of boxes is calculated and the process resets back to the beginning.

C. System Integration

The system integration stage is the process of uniting all components into a well-integrated system. Conveyors and object counters with proximity sensors are connected to the LabVIEW interface and control hardware such as LED buttons and Arduino. The entire automated packaging process must proceed according to plan and coordinate with each other to achieve the main goals of the system.

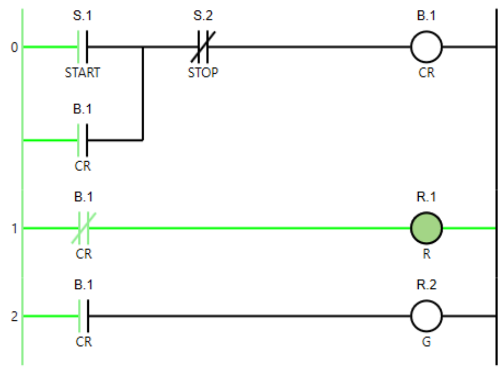
In addition, automated packaging systems that have been designed and implemented will be tested to test their functionality, accuracy, and performance. Tests include simulating product packaging operations using conveyors and item counters, as well as control testing via LabVIEW and hardware interfaces. The data obtained during the test will be analyzed to evaluate the performance of the system and ensure that the system achieves the predetermined goals.

IV. RESULTS AND DISCUSSION

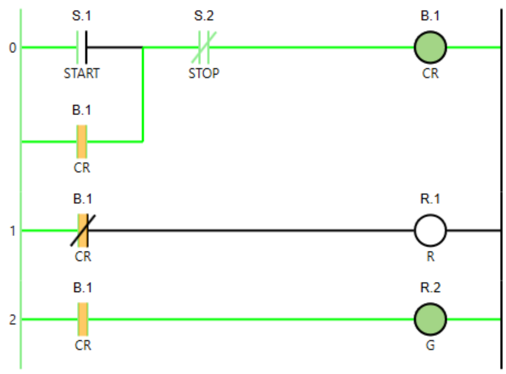
The instrumentation system built is a conveyor system for packing goods that aims to count the number of goods that pass through the conveyor and pack them into boxes. The system consists of a conveyor, proximity sensors to detect objects, a LabVIEW interface, and Arduino controls to control virtual instruments in LabVIEW.

To control the plant instrument on LabVIEW, the Arduino will read the push button condition, the red led status indicates idle or OFF condition if the STOP button is pressed, and if the START button is pressed, the green led lights up which indicates the ON condition.

Figure 4 shows when it is idle (a), where the red LED (R) will light up. When the START push button is pressed (b), the Control Relay (CR) will be active and the condition will remain active when the STRAT push button is removed, the active CR condition will make the green led (G) light up. When the STOP push button is pressed, it will return to idle. Output on the CR will be sent via UART (Universal Asynchronous Receiver-Transmitter) protocol from Arduino to LabVIEW.



(a)



(b)

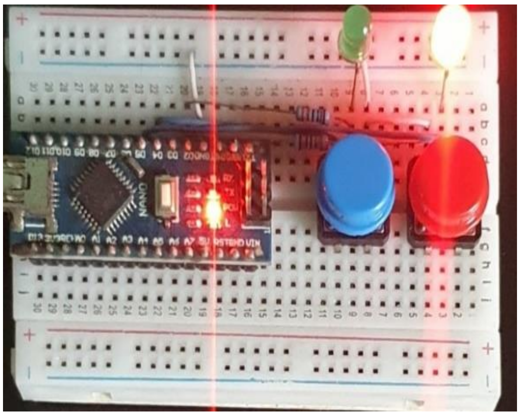
Figure 4. Simulation results on the ladder diagram3

```
// INPUT
START = !digitalRead(PB_START);
STOP = !digitalRead(PB_STOP);

// PROCESS
CR = (START || CR) && !STOP;
R = !CR;
G = CR;

// OUTPUT
digitalWrite(LAMP_G, G);
digitalWrite(LAMP_R, R);
Serial.println(CR);
```

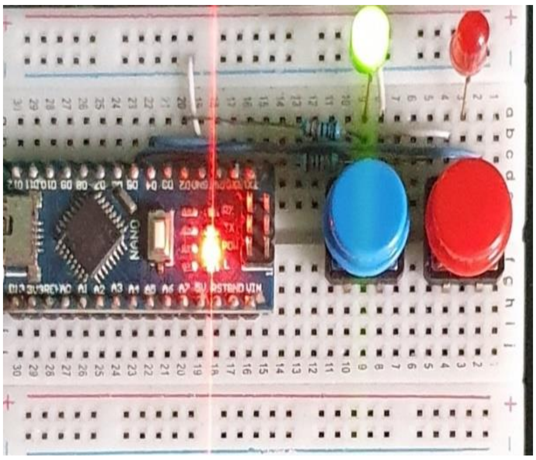
Figure 5. convert Ladder logic to Arduino program

Figure 5 is the result of converting ladder logic into programming in Arduino. The output of the CR variables is 0 and 1. The results on the hardware are shown in Figure 6.

Part (a) indicates an idle condition or the STOP button is pressed. While section (b) indicates the condition ON. Programming on hardware is following the ladder logic designed. Next, create a block diagram in LabVIEW which also follows the logic of the ladder logic.



(a)



(b)

Figure 6. Hardware Test Results

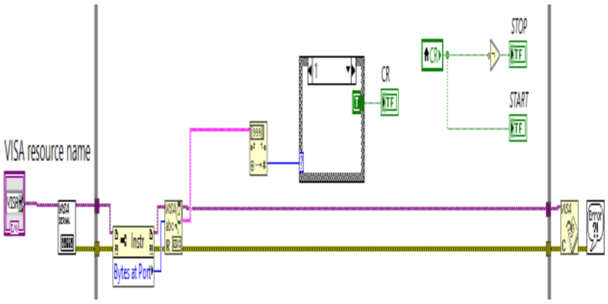


Figure 7. The control system on the LabVIEW block diagram

The diagram block in Figure 7 reads data from serial communication. In LabVIEW, communication uses VISA (Virtual Instrument Software Architecture) as a serial communication interface with Arduino [14]. The data sent by Arduino will be the same as what VISA reads, which is 0 and 1. The character '0' will be declared false, and the character '1' as true. Local variable CR will store data for led indicators in the front panel of LabVIEW and run the entire system on the plant.

Some control functions designed such as counters and motors on the conveyor are made based on functions in LabVIEW, so to make it easier for students to understand the flow of the program, the function is made with sub vi. The application of block diagrams to the designed system is shown in Figure 8.

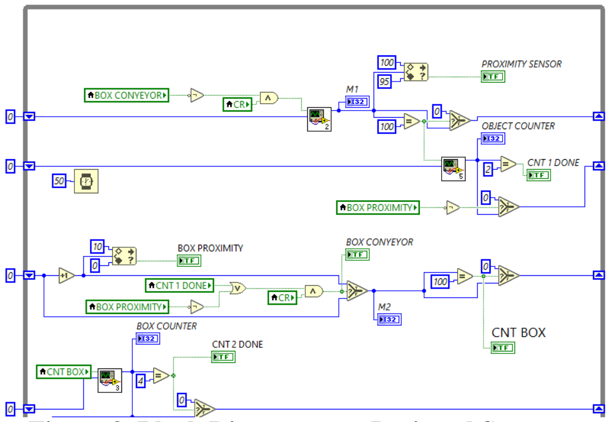


Figure 8. Block Diagram on a Designed System

The overall view of the system designed in Figure 8 will give the results of the flapping instrument of the object (can) calculated based on the amount specified using the proximity sensor, the detected object will be calculated each time the sensor detects the object. The object will fall into a box at the bottom end of the first conveyor if the number of objects calculated has reached the set point, the upper conveyor will stop, and the lower conveyor will be active when the proximity sensor on the lower conveyor does not detect the presence of the box after the concession runs, the object counter will be reset to 0, and when the box passes through the end of the station, Calculated box 1 when detected proximity sensor (CNT BOX). Boxes that have passed the packing stage will be arranged on pallets according to the pre-arranged production amount. The entire system on the LabVIEW is shown in Figure 9.

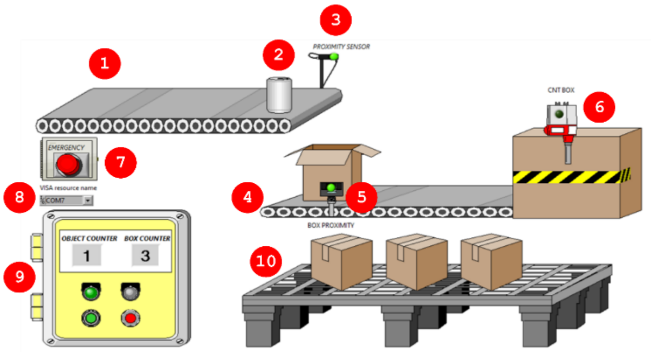


Figure 9. Overall system on the front panel

1. Top conveyor
2. Objects or objects
3. Proximity sensor for counting objects or objects
4. Bottom conveyor
5. Proximity sensor to detect the presence of a box
6. Packing station and box count counter
7. Emergency button
8. Serial port
9. Control panel
10. Pallet

System testing is carried out through test scenarios covering a variety of different quantities of goods, namely 5, 10, and 15 objects or objects, with a constant conveyor speed. The test results show that the instrumentation system can accurately calculate the number of items and pack them into boxes with the right amount. All simulation results correspond to the expected results, demonstrating the reliability of the system in performing its tasks.

Although the system has worked very well, there is an opportunity to improve the system further. Further development can be done to add additional features, such as integration with real systems or the use of additional sensors to optimize the packing process. An adjustable speed setting for conveyors.

Overall, this research makes a valuable contribution to supporting students' understanding of industrial automation plant processes using LabVIEW instrumentation. The successfully developed automated packaging system can be used as an example and inspiration for research and implementation of other automation systems. The results of this study also provide valuable insights for the industry in utilizing LabVIEW as an effective tool for automating processes and improving production efficiency.

V. CONCLUSION

This research has successfully developed a well-integrated automated packaging system using the LabVIEW platform as a user interface and control. The system involves conveyors and item counters as part of the packaging mechanism, as well as control of hardware such as LED buttons and Arduino. System functionality and reliability testing show that this LabVIEW-based automated packaging system can perform well in product packaging operations. LabVIEW interfaces have proven effective in controlling automated packaging systems and providing clear visualizations of the packaging process. In addition, integration with hardware such as LED buttons and Arduino also runs smoothly, allowing for more intuitive and efficient control of the system.

Thus, this research makes an important contribution to supporting students' understanding of industrial automation plant processes by utilizing LabVIEW instrumentation. The automated packaging system successfully developed in this research can be a real example for students and industry practitioners in implementing automation using LabVIEW. The research also provides insight into the application of the LabVIEW interface and integration with hardware to build reliable and efficient industrial automation systems.

REFERENCES

1. H. Jebelli, M. Habibnezhad, S. Shayesteh, S. Asadi, and S. H. Lee, Automation and Robotics in the Architecture, Engineering, and Construction Industry. Springer International Publishing, 2022. [Online]. Available: https://books.google.co.id/books?id=ZptXEAAAQBAJ
2. C. Elliott, V. Vijayakumar, W. Zink, and R. Hansen, "National Instruments LabVIEW: A Programming Environment for Laboratory Automation and Measurement," *J. Lab. Autom.*, vol. 12, no. 1, pp. 17–24, 2007, doi: 10.1016/j.jala.2006.07.012.
3. 3. Yogesh K. Taru and Anil Karwankar, "Water Monitoring System Using Arduino with LabVIEW," in Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication (ICCMC), 2017, pp. 416–419. Accessed: Feb. 13, 2023. [Online]Available: https://ieeexplore.ieee.org/document/8282722/
4. R. M. Shrenika, S. S. Chikmath, A. V. Ravi Kumar, Y. V. Divyashree, and R. K. Swamy, "Non-contact Water Level Monitoring System Implemented Using LabVIEW and Arduino," in Proceedings - 2017 International Conference on Recent Advances in Electronics and Communication Technology, *ICRAECT 2017*, Oct. 2017, pp. 306–309. doi: 10.1109/ICRAECT.2017.51.
5. A. Abdurahman, "Automatic Water Gate Monitoring and Control System Model Based on Arduino and LabView" (*Model Sistem Monitoring Dan Kendali Pintu Air Otomatis Berbasis Arduino*

dan LabView) Epic J. Electr. Power, Instrum. Control, vol. 1, no. 1, pp. 1–7, 2018, doi: 10.32493/epic.v1i1.1038.
6. M. Aria, J. Utama, F. Fauzia, M. Rizal, M. Fahmi, and M. Yudha, "Virtual Simulation System with Various Examples and Analysis Tools for Programmable Logic Controller Training," in *IOP Conference Series: Materials Science and Engineering*, Aug. 2020, vol. 879, no. 1. doi: 10.1088/1757-899X/879/1/012108.
7. A. El Hammoumi, S. Motahhir, A. Chalh, A. El Ghzizal, and A. Derouich, "Real-time virtual instrumentation of Arduino and LabVIEW based PV panel characteristics," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 161, no. 1, 2018, doi: 10.1088/1755-1315/161/1/012019.
8. A. Solikin and Karman, "Air Temperature and Humidity Data Loggers Equipped With Labview and Arduino-Based Warning Systems," *BEST J. Appl. Electr. Sci. Technol.*, vol. 4, no. 2, pp. 51–56, 2022, doi: 10.36456/best.vol4.no2.6169.
9. D. N. Bagenda and P. S. Rudati, "Akuisisi Data Menggunakan Labview Dengan Arduino Sebagai Perangkat Keras Berbiaya Rendah," *Gema Teknol.*, vol. 20, no. 4, pp. 105–112, 2020, doi: 10.14710/gt.v20i4.26233.
10. M. Saad, A. H. Amhedb, and M. Al Sharqawi, "Real time DC motor position control using PID controller in LabVIEW," *J. Robot. Control*, vol. 2, no. 5, pp. 342–348, 2021, doi: 10.18196/jrc.25104.
11. "Arduino Docs Arduino Documentation." Accessed: Jul. 27, 2023. [Online]. Available: https://docs.arduino.cc/
12. K. L. S. Sharma, "9 - Data Acquisition and Control Unit: Software," K. L. S. B. T.-O. of I. P. A. (Second E. Sharma, Ed. Elsevier, 2017, pp. 125–149. doi: https://doi.org/10.1016/B978-0-12-805354-6.00009-8.
13. National Instruments, "Getting Started with the LabVIEW Datalogging and Supervisory Control Module," *Ni.Com*, pp. 2–8, 2023, [Online]. Available: https://www.ni.com/docs/en-
14. US/bundle/labview-datalogging-and-supervisory-control-module-getting-started/resource/372946d.pdf
15. V. Instrumentation, "VISA R / W NI-VISA Read : basic exercises."