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Design and Implementation of an Energy-Efficient Automatic Conveyor Control System Using Counter-Based Logic

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Abstract: Automatic conveyor systems are essential for material handling in modern manufacturing, yet conventional implementations commonly run continuously under timer control or single-sensor triggering. Such operation wastes electrical energy and accelerates mechanical wear whenever the conveyor line is unloaded. This paper presents the design and implementation of an Arduino Uno–based automatic conveyor control system that employs a counter-based logic strategy. Two NPN photoelectric sensors are installed at the entry and exit of the conveyor to count incoming and outgoing objects in real time; the drive motor is energized only while the number of objects that have entered exceeds the number that have exited, and it stops automatically once the line is empty. A relay module electrically isolates the 12 V DC motor from the microcontroller, and a hard-wired emergency stop provides an independent safety layer. The belt speed was analyzed to guarantee that each object dwells within the sensing zone longer than the sensor response time, ensuring reliable detection. Experimental testing shows that the sensors detect objects accurately within their effective range and that the counter logic regulates motor operation strictly according to load presence. The proposed system improves operational efficiency, reduces unnecessary energy consumption, and mitigates no-load mechanical wear, thereby supporting a more intelligent industrial automation process.

Keywords: Automatic Conveyor System; Arduino Uno; Counter Logic; Photoelectric Sensor; Industrial Automation; Material Handling; Energy Efficiency.

INTRODUCTION

In the modern industrial era, the implementation of automated systems has become increasingly widespread to support production processes with greater consistency, efficiency, and accuracy. Automation has been proven to enhance productivity, improve workplace safety, and reduce operational costs in industrial activities (Hendri *et al.,*). One of the most common applications of automation is the conveyor system, which functions as a continuous material-handling mechanism. Conveyors are extensively utilized in manufacturing plants, warehouses, and production systems because they accelerate material handling and improve operational efficiency compared with manual methods (Manullang *et al.,*).

In production environments, conveyor systems require effective control mechanisms to ensure smooth material flow and prevent congestion along the production line. Uncontrolled movement of goods can disrupt material distribution and reduce the overall efficiency of the production system. A conveyor monitoring and control system is therefore required to maintain a continuous material flow and support optimal production performance (Riesa Syariful Akbar *et al.,*). Furthermore, the control system must be capable of accurately detecting the presence of objects so that the conveyor can operate in accordance with actual field conditions (Harsito *et al.,*).

A common issue encountered in conveyor systems is continuous operation even when no objects are present on the conveyor line. This condition results in unnecessary electrical energy consumption, accelerates mechanical component wear, and shortens equipment lifespan (Riesa Syariful Akbar *et al.,*). Operating an unloaded conveyor reflects an inefficient system because energy is consumed when it is not required (Harsito *et al.,*). Consequently, a system capable of autonomously controlling conveyor operation based on the presence of objects is highly desirable.

One approach to addressing this issue is an automatic detection system capable of identifying the presence of objects on the conveyor. With such a mechanism, the conveyor can operate when objects are present and stop automatically when the line becomes empty. This approach has the potential to improve energy efficiency, reduce mechanical stress on components, and establish a more organized material-flow process (Harsito *et al.,*). In addition, automated control can enhance production stability by ensuring that conveyor operation corresponds directly to system requirements (Hendri *et al.,*).

Based on these considerations, this study focuses on the design and implementation of an automatic conveyor control system capable of detecting the

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presence of objects on the conveyor line. The proposed system activates the conveyor when objects are detected and automatically stops when no objects remain. The main contribution of this work is a counter-based control strategy that, unlike timer-based or single-sensor schemes, synchronizes motor operation with the real-time difference between the number of objects entering and leaving the line. The developed system is expected to improve operational efficiency, reduce component wear, minimize energy consumption, and support smoother and more organized production processes (Hendri *et al.,*).

LITERATURE REVIEW

Numerous studies have investigated conveyor-system automation using various methods and approaches. Reviewing previous research is essential to understand the current state of the art and to identify the research gap that the proposed system aims to address.

Hendri *et al.,* (Hendri *et al.,*) developed an automatic miniature conveyor system using a microcontroller for object transportation. The system employed a single infrared sensor for object detection and a timer-based control algorithm to determine the motor operating duration. However, this approach is limited by timing accuracy: variations in object weight may affect conveyor speed, so the motor can stop before an object reaches the end of the conveyor.

Akbar *et al.,* developed an automatic conveyor sorting prototype integrated with Internet of Things (IoT) technology (Riesa Syariful Akbar *et al.,*). The system used sensors to identify object types and transmitted monitoring data through an online platform. Although the monitoring capability was advanced, the conveyor operated continuously whenever the system was active, indicating that energy efficiency was not a primary concern.

Ramadhan *et al.,* (Ramadhan *et al.,*) designed an automatic conveyor system using an ultrasonic sensor and an Arduino Uno to detect object presence based on distance measurement. Ultrasonic sensors, however, have limitations in detecting small objects and are susceptible to measurement errors caused by wave-reflection interference. Wijaya *et al.,* (Wijaya *et al.,*) developed an automatic conveyor using infrared sensors and a DC motor for small-scale material transport, but relied on a time-delay method, making stopping accuracy highly dependent on the characteristics and movement of the transported objects. Fauzi *et al.,* (Fauzi *et al.,*) proposed an IoT-based conveyor monitoring system offering remote supervision through a mobile application; the study focused mainly on data communication and remote access rather than optimizing motor operation and energy efficiency.

Beyond these representative works, related approaches have addressed conveyor automation from complementary angles: load-cell and flow-sensor feedback for waste-handling conveyors (Riesa Syariful Akbar *et al.,*), (Harsito *et al.,*), programmable logic controller (PLC)-based sorting (Prasetyo *et al.,*), proximity-sensor triggering (Saputra *et al.,*), hybrid photodiode–ultrasonic tracking (Putri *et al.,*), ultrasonic-based automatic object sorters (Restuasih *et al.,*), general microcontroller-based conveyor design (Wulandari), and robotic-arm object handling on conveyors (Imran *et al.,*). Collectively, these studies confirm the maturity of sensor-driven conveyor control but also reveal a recurring limitation.

Based on the reviewed literature, most automatic conveyor systems still rely on a single sensor, timer-based control, continuous operation, or condition-based control that does not consider real-time synchronization between incoming and outgoing objects. This study therefore proposes a different approach by implementing counter logic with two NPN photoelectric sensors to compare, in real time, the number of objects entering and leaving the conveyor. This approach is expected to improve operational efficiency, reduce unnecessary energy consumption, and extend the lifespan of mechanical components by preventing motor operation under no-load conditions.

RESEARCH METHODOLOGY

System Design

The automatic conveyor control system was designed using a closed-loop architecture consisting of three main subsystems: an input subsystem, a processing subsystem, and an output subsystem. The input subsystem uses two NPN photoelectric sensors as object-presence detectors; these sensors were selected for their fast response time, immunity to ambient-light variation, and ability to detect objects accurately without physical contact. The processing subsystem employs an Arduino Uno microcontroller as the central controller, chosen for its low cost, ease of programming, and sufficient number of digital

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input/output pins. The output subsystem consists of a relay module that controls a 12 V DC motor driving the conveyor; the relay electrically isolates the motor load from the microcontroller, protecting the Arduino Uno from high current and the back electromotive force (back-EMF) generated by the motor. The overall system architecture is illustrated in Fig. 1.

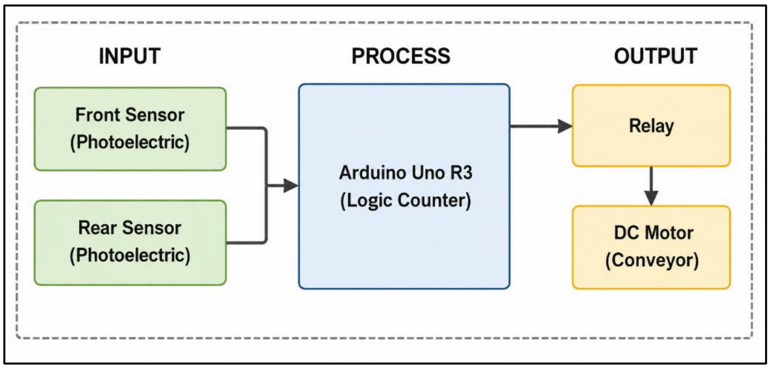

Fig. 1. Block diagram of the automatic conveyor control system.

Hardware Design

The hardware was developed with functionality, safety, and ease of maintenance in mind. The two NPN photoelectric sensors were positioned strategically along the conveyor line: the first (input) sensor was installed at the beginning of the conveyor to count incoming objects, while the second (output) sensor was placed at the end to count outgoing objects. The distance between the two sensors was set according to the conveyor length (approximately 40 cm) to ensure accurate counter calculation.

A 12 V DC motor serves as the primary actuator driving the conveyor belt. To avoid overloading the Arduino I/O pins, the motor is controlled through a 5 V relay module. The system is further equipped with a hard-wired emergency-stop switch that directly disconnects the motor power supply in an emergency. The specifications of the main components are listed in Table I.

Table I. Specifications of the Main System Components

No.	Component	Specification	Quantity
1	Microcontroller	Arduino Uno R3	1
2	Photoelectric Sensor	NPN type, detection range 5–30 cm	2
3	DC Motor	12 V, 60 RPM	1
4	Relay Module	5 V, 10 A, 1 channel	1
5	Object Sensor	E18-D80NK infrared proximity	1
6	Power Supply	12 V, 5 A	1
7	Step-Down Converter	12 V to 5 V DC converter	1

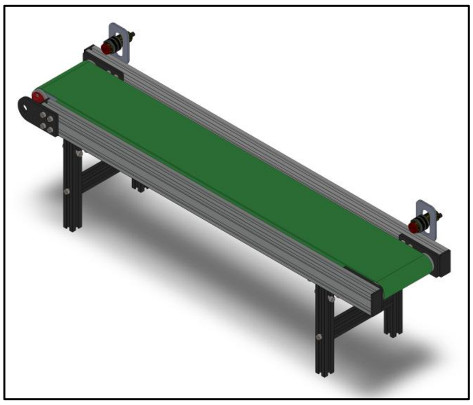

Fig. 2. Physical realization of the automatic conveyor prototype.

Conveyor Speed Calculation

To ensure reliable object detection during operation, the linear speed of the conveyor belt must be determined. Belt speed is a critical parameter because it directly influences the ability of the photoelectric sensors to detect passing

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objects within their response time. If the conveyor moves too fast, an object may pass through the sensing area before the sensor produces a stable output, causing detection failures or missed counts.

The linear velocity of the belt is governed by the rotational speed of the drive pulley and its diameter. Assuming the belt moves without slipping on the pulley surface, the belt speed can be derived from the circumferential distance traveled in one revolution. The circumference of the drive pulley is

$$C = \pi D$$

(Hendri *et al.*,)

where C is the pulley circumference (m) and D is the pulley diameter (m). If the motor rotates at N revolutions per minute (RPM), the linear belt speed is

$$V = \pi DN / 60$$

(Manullang *et al.*,)

where V is the belt speed (m/s), $\pi = 3.1416$, D is the pulley diameter (m), and N is the motor rotational speed (RPM). The calculated speed is then used to estimate the object travel time along a conveyor of total length L:

$$t = L / V$$

(Riesa Syariful Akbar *et al.*,)

To guarantee reliable detection, the dwell time of an object within the sensing zone must exceed the sensor response time:

$$t\_response < t\_detection$$

(Riesa Syariful Akbar *et al.*,)

where t_response is the response time of the photoelectric sensor (s) and t_detection is the time during which the object remains within the sensing area (s). Satisfying this condition keeps each object within the effective sensing range long enough for the sensor to generate a stable output, minimizing missed counts, false detections, and counting errors. Accurate detection also allows the Arduino Uno to update the counter_in and counter_out values in real time, so the control algorithm always operates on the latest system state.

Applying these relationships to the developed prototype, the drive motor operates at N = 60 RPM and the total conveying length is L = 0.4 m. Taking a representative drive-pulley diameter of D = 0.03 m, the belt circumference is $C = \pi D \approx 0.094$ m, and the linear belt speed obtained from Eq. (2) is $V = \pi DN/60 \approx 0.094$ m/s. The corresponding object travel time from Eq. (3) is $t = L/V \approx 0.4/0.094 \approx 4.25$ s. Because the response time of the selected NPN photoelectric sensors is on the order of a few milliseconds, whereas the object dwell time within the sensing zone at this belt speed is several hundred milliseconds, the detection-reliability condition of Eq. (4) is satisfied by a wide margin. This confirms that the chosen operating speed supports accurate and uninterrupted counting.

Electronic Circuit Architecture

An electronic circuit schematic was developed to ensure proper power distribution, reliable signal transmission, and stable system operation. The architecture integrates the Arduino Uno microcontroller, two NPN photoelectric sensors, a relay module, a 12 V DC motor, a step-down converter, and a regulated power supply into a unified control system. Each component is interconnected according to its functional role, allowing sensor signals, control commands, and electrical power to be exchanged efficiently. The configuration was designed to provide high operational reliability while simplifying installation, maintenance, and future expansion.

The power-distribution architecture uses a 12 V DC supply as the primary energy source. Because the Arduino Uno and the photoelectric sensors require a regulated 5 V supply, a step-down converter reduces the voltage from 12 V to 5 V. This regulation ensures that each component operates within its specified electrical ratings, improving stability and preventing malfunction caused by voltage fluctuation. Proper grounding is also implemented to minimize electrical noise and maintain signal integrity.

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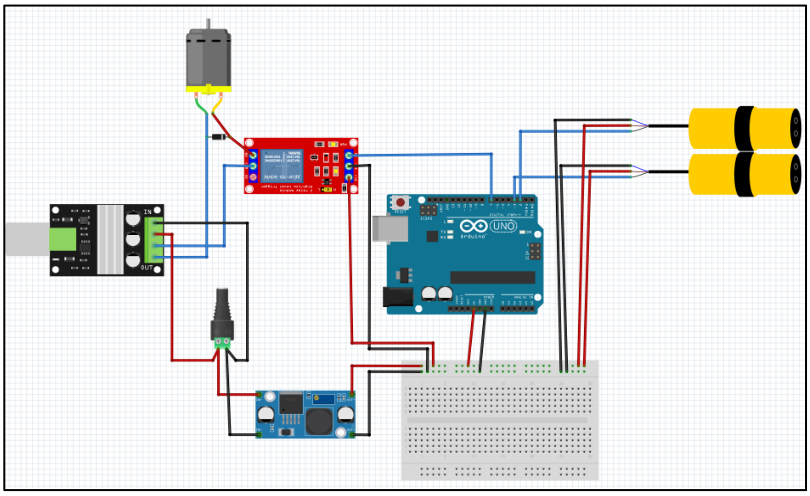

Fig. 3. Electronic circuit schematic of the conveyor control system.

As shown in Fig. 3, the motor current is not supplied directly through the Arduino Uno. Instead, the microcontroller provides only a low-current control signal to the relay module, which acts as an electrically isolated switch for the motor power circuit. This prevents excessive current from flowing through the Arduino I/O pins and protects the microcontroller from overload and from the back-EMF generated by the DC motor during switching. The two NPN photoelectric sensors are connected to the digital input pins and serve as the primary sensing devices. The Arduino continuously processes their outputs using the counter-based algorithm to determine conveyor occupancy; based on the comparison between counter_in and counter_out, it activates or deactivates the relay and thus the motor. Overall, the circuit provides a robust, safe, and energy-efficient hardware platform for the proposed system.

Control Algorithm and Program Logic

The system operates on a counter-based control algorithm that continuously monitors the number of objects entering and leaving the conveyor. At program start, the Arduino Uno initializes all variables, with counter_in and counter_out set to zero. The microcontroller then continuously reads the front (input) sensor to detect incoming objects; when the sensor value exceeds the predefined threshold, the system registers an object and increments counter_in by one. A short debounce delay prevents multiple counts of the same object while it remains within the sensing area. The program similarly monitors the rear (output) sensor and increments counter_out whenever an object is detected leaving the conveyor. Using two independent sensing points minimizes counting errors and provides a reliable representation of the actual number of objects on the line.

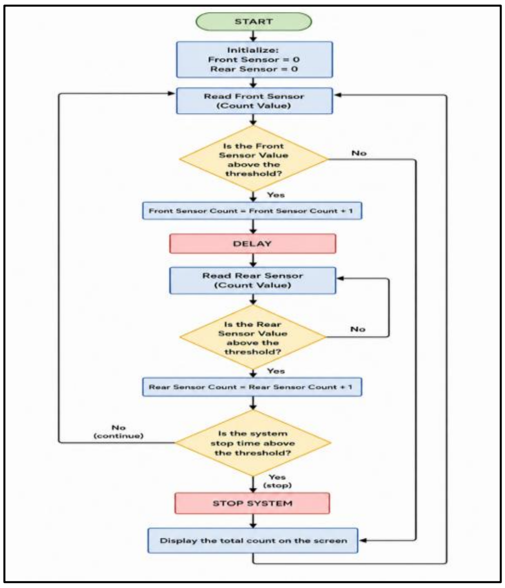

Fig. 4. Flowchart of the counter-based control algorithm.

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As shown in Fig. 4, the algorithm continuously compares counter_in and counter_out to determine the motor state. When the number of incoming objects exceeds the number of outgoing objects (counter_in > counter_out), the conveyor is considered occupied and the relay is activated to keep the motor running, indicating that one or more objects are still being transported. Conversely, when counter_in equals counter_out, the system concludes that no objects remain and automatically deactivates the motor to prevent unnecessary operation. The control loop repeatedly performs object detection, counting, and motor-status evaluation until the stopping condition is satisfied, after which the final counting results are displayed for monitoring. This structure enables real-time object tracking, accurate counting, and automatic conveyor operation while improving energy efficiency and reducing no-load mechanical wear.

RESULTS AND DISCUSSION

The outcome of this study is an Arduino Uno–based automatic conveyor control system that employs counter logic and two NPN photoelectric sensors for object detection. The system was designed so that the motor operates only when objects are present and stops automatically when the line is empty. The first sensor functions as the input sensor, detecting objects entering the conveyor, and the second serves as the output sensor, detecting objects reaching the end of the line. Data from both sensors are processed by the Arduino Uno using the counter-based algorithm to determine the motor operating condition. The system was evaluated through three complementary tests, described below.

Photoelectric Sensor Detection Test

The photoelectric sensor was tested to evaluate its ability to detect the presence of objects at various object-to-sensor distances. The results are summarized in Table II.

Table II. Photoelectric Sensor Detection Test Results

No.	Object Distance (cm)	Sensor Condition	Detection Status
1	0	Active	Detected
2	10	Active	Detected
3	20	Active	Detected
4	29	Active	Detected
5	30	Inactive	Not detected

As shown in Table II, the sensor reliably detected objects from 0 cm up to 29 cm but failed to register an object at 30 cm. This behavior defines an effective sensing range whose upper boundary lies at approximately 30 cm, consistent with the manufacturer's specified range of 5–30 cm. As the object moved closer to the sensor's detection zone, the response became more stable and accurate; beyond the boundary, sensitivity dropped sharply and detection became unreliable. From a design standpoint, this result indicates that objects must be routed within the effective sensing window and that the sensor mounting distance should be kept comfortably below the 30 cm limit to preserve a stable detection margin and avoid missed counts.

Counter Logic Test

The counter logic was evaluated to verify the system's ability to count incoming and outgoing objects in real time. Several objects were passed through the conveyor sequentially while the corresponding counter values and motor status were recorded, as shown in Table III.

Table III. Counter Logic Test Results

No.	Incoming Objects (counter_in)	Outgoing Objects (counter_out)	Motor Status
1	1	1	Inactive
2	2	1	Active
3	5	3	Active
4	5	5	Inactive
5	3	3	Inactive

The results in Table III confirm that the counter-based logic correctly compared the numbers of incoming and outgoing objects. In cases 2 and 3, counter_in exceeded counter_out (a difference of one and two objects, respectively), indicating that objects were still present on the line; the motor remained active accordingly. In cases 1, 4, and 5, counter_in equaled counter_out, meaning the line

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was empty, and the motor was correctly deactivated. Notably, case 5 shows that the logic depends on the equality of the two counters rather than their absolute magnitude: even after three objects had been processed, the motor stopped as soon as the counts balanced. These observations verify that the motor state is driven by the instantaneous occupancy of the conveyor, which is the core requirement of the proposed strategy.

Overall Conveyor System Test

Finally, the integrated system was tested to evaluate its overall behavior while automatically transporting objects along the line. The observed responses are presented in Table IV.

Table IV. Overall Conveyor System Test Results

No.	Test Condition	System Response	Description
1	No object present	Inactive	Conveyor stopped
2	Object enters the conveyor	Motor active	Conveyor running
3	Object on the conveyor line	Motor active	Conveyor running
4	Object exits the conveyor	Active for 1 s	Conveyor running
5	Conveyor line empty	Inactive	Conveyor stopped

Table IV demonstrates that the integrated system behaved exactly as specified by the control logic. The conveyor started automatically when an object entered and continued running while objects remained on the line; a brief one-second dwell after an object exited allowed the item to clear the output sensor cleanly before the occupancy check re-evaluated the motor state. Once the line was empty, the motor stopped. This closed-loop behavior confirms tight coupling between physical load presence and actuator state, and shows that the system can replace conventional continuous-run operation without compromising throughput.

Energy-Efficiency Analysis

A central objective of the proposed system is to eliminate energy wasted during no-load operation. Let T denote an observation period and t_load the cumulative time during which at least one object occupies the conveyor. A conventional continuously running conveyor consumes motor energy proportional to the full period T, whereas the counter-based system energizes the motor only during t_load. The relative energy saving can therefore be expressed as

$$E\_saving = (1 - t\_load / T) \times 100\%$$

(Harsito *et al.,*)

where t_load/T is the effective load duty cycle. In the scenarios of Table IV, the motor was inactive during every no-load interval, so the idle-time energy that a conventional system would have consumed is entirely eliminated. Consequently, in intermittent-load applications—where objects arrive in batches separated by idle gaps—the counter-based strategy yields energy savings directly proportional to the fraction of idle time, without any loss of throughput. Beyond the direct electrical saving, eliminating no-load running proportionally reduces motor run-hours, which lowers cumulative mechanical stress on the belt, bearings, relay, and transmission, and is expected to extend the maintenance interval and service life of the system. Precise quantification of the electrical saving in watt-hours requires direct current measurement of the motor and is identified as future work.

System Performance Analysis

Considering all tests together, the proposed counter-based conveyor control system performed in accordance with the study objectives. The two photoelectric sensors enabled real-time object detection, allowing the motor to operate only when objects were present. The counter-based method proved more effective than conventional timer-based approaches because motor operation did not depend on estimated travel times; instead, it responded to the actual number of objects entering and leaving the conveyor, yielding more efficient control and improved operational performance. The hard-wired emergency-stop mechanism provided an additional, independent safety layer that can shut down the system immediately in an emergency, enhancing operational safety and reliability. Overall, the developed system improved conveyor operational efficiency, reduced unnecessary electrical energy consumption, and minimized mechanical wear caused by no-load motor operation.

CONCLUSION

This study designed and implemented an energy-efficient automatic conveyor control system based on counter logic using an Arduino Uno and two NPN photoelectric sensors. By comparing, in real time, the number of objects entering and leaving the conveyor, the system energizes the drive motor

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only when the line is occupied and stops it automatically when the line is empty. Sensor characterization confirmed reliable detection from 0 cm up to an effective boundary near 30 cm; the counter-logic test verified that the motor remained active only while counter_in exceeded counter_out and stopped when the counts balanced; and the integrated system test confirmed correct closed-loop behavior under realistic operating conditions. A belt-speed analysis further showed that the selected operating speed keeps each object within the sensing zone far longer than the sensor response time, guaranteeing accurate counting.

Compared with conventional timer-based or single-sensor conveyors, the proposed approach synchronizes motor operation with actual load presence, thereby eliminating no-load running, reducing unnecessary energy consumption, and mitigating mechanical wear—while an independent hard-wired emergency stop preserves operational safety. Future work will focus on direct current and power measurement to quantify the energy saving in watt-hours, extension of the counter logic to multi-lane and variable-speed conveyors, and integration of object classification or IoT-based telemetry to broaden the system's applicability in smart-manufacturing environments.

REFERENCES

1. Prasetyo, *et al.,* "Perancangan Sistem Conveyor Otomatis Berbasis PLC Pada Proses Sortir Barang." *Jurnal Teknik Elektro*, 8. 1 (2021): 45–52.
2. Fauzi, *et al.,* "Monitoring Conveyor Berbasis Internet of Things Untuk Sistem Industri." *Monitoring Conveyor Berbasis Internet of Things Untuk Sistem Industri*, 6.1 (202315–23.
3. Harsito, C., Xaverius, A., Prasetyo, S. D., Wulansari, P., & Pradana, J. A. "Conveyor Pengangkut Sampah Otomatis dengan Load Cell dan Flow Sensor." *Journal of Mechanical Engineering Manufactures Materials and Energy* 5.1 (2021): 18-33.
4. Hendri, H., Jasmir, J., & Siswanto, A. "Miniatur Conveyor Otomatis Berbasis Mikrokontroler." *Jurnal Processor* 9.1 (2014): 34-43.
5. Imran, A., Firdaus, F., & Pakondo, M. R. "PROTOTYPE ROBOT LENGAN PEMINDAH BARANG PADA CONVEYOR SECARA OTOMATIS BERBASIS ARDUINO UNO." *Jurnal Media Elektrik* 20.3 (2023): 112-118.
6. Ramadhan, *et al.,* "Implementasi Conveyor Otomatis Menggunakan Sensor Ultrasonik Berbasis Arduino Uno." Jurnal Teknologi Industri, 8.1 (2022): 20–27.
7. Manullang, R. S., & Ritonga, D. A. "Perancangan conveyor pada mesin pengisi botol otomatis." *Jurnal MESIL (Mesin Elektro Sipil)* 3.2 (2022): 30-36.
8. Putri, R. A., Kholis, N., & Baskoro, F. "Automatic Packaging Conveyor Tracking System Based on Arduino Uno Using Photodiodes and SRF04 Ultrasonic Sensors." *INAJEEE (Indonesian Journal of Electrical and Electronics Engineering)* 4.2 (2021): 38-43.
9. Restuasih, S., Gamayel, A., & Agustino, R. "Design of Arduino Uno-Based Automatic Object Sorter Belt Conveyor System Using Ultrasonic Sensors." *Journal of Global Engineering Research and Science* 1.1 (2022): 36-44.
10. Akbar, R. S., Arifin, T. N., Wahyuningsih, E., Awaldi, S., & Rahmawan, D. "Prototype Mesin Conveyor Pemilah Otomatis Berbasis IoT (Internet of Things)." *Switch: Jurnal Sains dan Teknologi Informasi* 3.5 (2025): 72-81.
11. Saputra, *et al.,* "Rancang Bangun Conveyor Otomatis Menggunakan Sensor Proximity." *Jurnal Sistem Kontrol Dan Instrumentasi*, 5. 3, (2020): 88–95.
12. Wijaya, *et al.,* "Sistem Conveyor Pemindah Barang Berbasis Infrared Dan Motor DC." Jurnal Rekayasa Elektrika 7. 2 (2021) 60–67.
13. Wulandari, Rindi. "Design of Conveyor System Based on Microcontroller." *Indonesian Journal of Computer Science*, 12. 6, (2023).

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