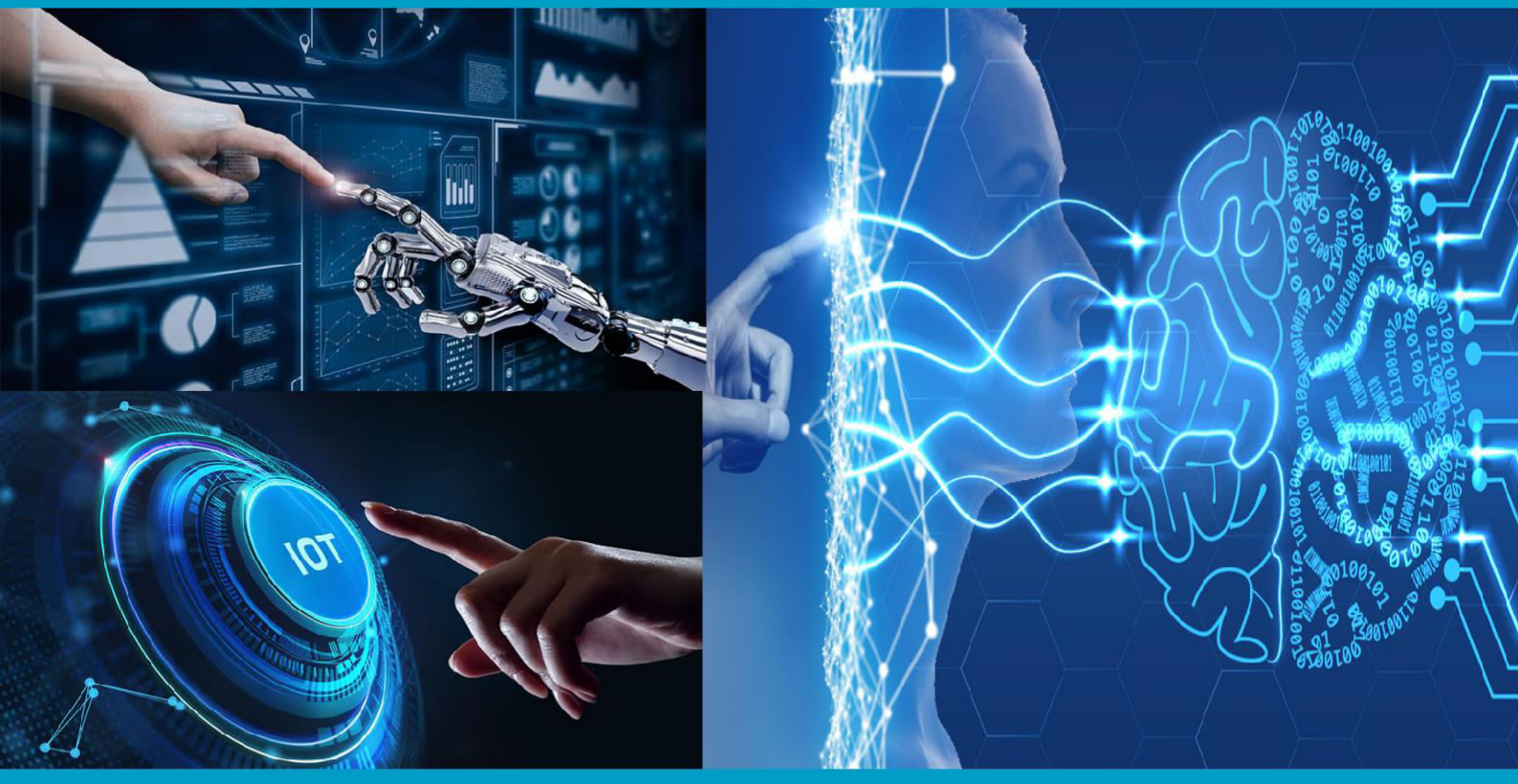
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 5, May 2023 |

PLC Based Automatic Object Sorting Machine

Prof. Mr. Hrishikesh Shirke, Mr. Suyash Misal, Mr. Prathamesh Kurkute,

Electrical Engineering Department, PES Modern College of Engineering, Pune, India

Electrical Engineering Department, PES Modern College of Engineering, Pune, India

Electrical Engineering Department, PES Modern College of Engineering, Pune, India

ABSTRACT: In an industry, sorting products is a time-consuming industrial procedure that is typically done by hand. Constant manual sorting leads to problems with quality uniformity. Different equipment is needed for weighing and then separating when segregation is based on different attributes like weight, colour, or kind. We have put forth an effective system that sorts two different kinds of objects by weight, colour, and type (metal or non-metal) using a load cell, an inductive sensor, and a TCS 230 colour sensor, all under the control of a PLC. By pushing non-compliant articles out of the conveyor belt using a flipper mechanism, the system rejects and discards them. In order to collect items of three distinct types, a circular container with three walls is employed. Each of the two conveyor belts was run by a different DC motor. One type of segregated object is placed on the first belt, which also has a colour sensor at the end, for analysis by the load cell and inductive sensor, and another component is placed on the second belt, which also has a colour sensor for the components from which the load cell and inductive sensor have separated it.

KEYWORDS: sensor, objects, and PLC

I.INTRODUCTION

Automation is the use of control systems to manage various machinery and processes in place of human labour. Automated systems frequently employ sophisticated algorithms, which raises the cost of the design and the amount of energy used. However, this not only saves time and hard labour but also provides workers more time to focus on aesthetics. By using automation, risk that could arise from forcing individuals into dangerous areas is also reduced. Automation is therefore effective in the manufacturing sector. In various sectors, sorting is done according to kind, weight, and colour to make sure the object's quality is constant and up to par. Automated sorting also speeds up production while cutting labour costs. The human negligence-related errors are prevented**.**

II.LITERATURE REVIEW

For our project, a number of articles were read. The condition of the sorting is a crucial component in our project because the products are sorted as they move through the conveyors. The study article "Automatic Object Sorting Machine Using PLC" discusses how the objects are sorted using sensors to assure a safe and dependable conveyor operation, and this is what is mentioned. Numerous studies were conducted and published in the publication "Automatic Industrial Sorting Machine by the Different Sensors for Automation-An Innovative Model Based Approach" to determine the most relevant sensors. The photo sensor registers things by contrast, colour, or any other feature. We were helped by a research article titled "Automatic Sorting Machine Using Conveyor Belt" because our project is totally automated utilising PLC and automated Drives are also playing a key part. This study revealed how a PLC may be efficiently developed for a wide range of control functions while using straightforward ladder logic to manage the entire system.

T Sheela. S. Shivraman in the paper titled "Low-Cost Automation for Sorting of Objects on Conveyor Belt"[1], The system described in the paper "Low-Cost Automation for Sorting of Objects on Conveyor Belt" by T Sheela. S. Shivraman recommended the usage of Raspberry pi 3 as the basis for the automation. Making the model capable of typically detecting an object's colour is difficult because each nostril and the ambient lighting circumstances might cause significant uncertainty. Similar to this, there are fluctuations in the weight and size of the things that a linear actuator collects off a conveyor belt. It is possible to improve this system's ability to properly separate and sort huge, heavy objects by taking additional approaches. Once on the conveyor belt, the objects are further assembled, which greatly streamlines the sorting process.

Relevance to current Research
According to the study, the authors have presented a system that sorts items according to their colour. This system can be improved in the future to sort objects according to their size and form with the aid of an IR sensor that is close enough to meet the requirements for short-range communication.

Babita Nanda (2014) discusses an automatic sorting system that uses a delta PLC[2] and an automated procedure to sort items of various sizes. When the product is finished being manufactured, they automatically go to the conveyor belts. using sensors at various locations to sense and detect materials of various sizes. They are placed in their appropriate containers or boxes after being sorted according to size at various locations. Using infrared sensors, which are incredibly sensitive, for material sensing. PLC manages and controls all of these processes.

Relevance to current Research
The PLC programme that was dumped controls the entire operation. A basic PLC used for small-scale applications is the delta PLC. Implementing a Delta PLC for machine shorting has significantly decreased the difficulty involved in finishing this project. Ladder diagrams are a very frequent tool for programming PLCs. Any mass production unit may employ this system, which is the best. The use of this technique can be found in numerous additional sectors.

Avadhoot R. Telepatil, Prashant M. Jadhav in the paper titled "Colour Object Counting and Sorting Mechanism Using Image Processing Approach"[3] The work "Colour Object Counting and Sorting Mechanism Using Image Processing Approach" by Avadhoot R. Telepatil, Prashant M. Jadhav, . made the suggestion that the main task that needs to be completed at the final dispatch section is the counting and sorting of coloured objects. The traditional method that is preferred by industries is manual sorting. This method involves human operators performing visual inspection.

Relevance to current Research
The old method takes a long time and is inconsistent. As a result, efforts are undertaken to create and implement a method that uses image processing and automation to detect an object's colour. The image of a coloured object rolling over a conveyer belt in the installed system was captured using an appropriate image acquisition device.
.
Amruta Pandit, Jyoti Rangole in the paper titled "Object Counting using Image processing techniques"[4] This paper present image processing techniques that are useful for item counting and significantly cut down on counting time in their study titled "Object Counting Using Image Processing Techniques". For the purpose of counting objects, proper object recognition is crucial. The camera being utilised, the object's size, whether or not the objects are touching, and the lighting conditions all affect how accurate the algorithm is.

Relevance to current Research
With the introduction of automation and a linear reduction in counting time, object counting utilising an image processing system has a wide range of applications that reduce the amount of labour needed for the counting, sorting, and identification processes. In order to provide the aforementioned platform and efficiently complete the tasks, these authors have used the most efficient and effective technique.

B.Nantheni Devi and D.Kanimozhi 2016, discusses implementation of PLC based food packaging machine[5] ,
explains the use of a PLC-based food packaging machine. In the field of automation, they introduce a packing machine using PLC. The primary goal of the article is to use PLC to design and construct a compact and straightforward packaging system. Food materials are dropped into the hopper, where they are shaken by a Direct Current (DC) motor.

Relevance to current Research
Using a weighted device, the weights of the three loads are precisely measured. The packaging system could be totally automated as a result. When compared to the traditional manual system, the system is also capable of reducing product time and increasing product rate. When an object is weighed manually, the process takes longer, which reduces overall speed. So, employing this food packing equipment completely solves the issue.

No.	Paper Title	Author Name	Key Points	Remark
1	Low-Cost Automation for Sorting of Objects on Conveyor Belt	T Sheela. S. Shivraman	Low-Cost Automation for Sorting of Objects [1]	Cost of automation reduced by using techniques and helps to sort huge objects.
2	An automatic sorting system that uses a delta PLC	Babita Nanda (2014)	Using infrared sensors, which are incredibly sensitive, for material sensing. PLC manages and controls all of these processes[2].	Implementing a Delta PLC for machine shorting has significantly decreased the difficulty involved in finishing this project.
3	Colour Object Counting and Sorting Mechanism Using Image Processing Approach	Avadhoot R. Telepatil, Prashant M. Jadhav	Efforts are undertaken to create and implement a method that uses image processing and automation to detect an object's colour [3]	The image of a coloured object rolling over a conveyer belt in the installed system was captured using an appropriate image acquisition device. .
4	Object Counting using Image processing techniques	Amruta Pandit, Jyoti Rangole	Useful for item counting and significantly cut down on counting time [4].	Reduce the amount of labour needed for the counting, sorting, and identification processes.
5	Implementation of PLC based food packaging machine	B.Nantheni Devi and D.Kanimozhi 2016	Use PLC to design and construct a compact and straightforward packaging system [5].	The system is capable of reducing product time and increasing product rate

III.METHODOLOGY OF PROPOSED SURVEY

PLC

A programmable memory is used internally by a digitally operating electronic system to store user-oriented instructions for implementing specific functions like logic, sequencing, timing, counting, and arithmetic to control various machines or processes using digital or analogue inputs and outputs. A PLC's retentive (non-volatile) memory stores its operating system, user programmes, and some data. PLC has expanded the system's logic capabilities in addition to taking the position of the relay. The automation products from Mabrix PLC provide solutions with high performance and flexibility that may be successfully used in a variety of industries and applications.

Block Diagram

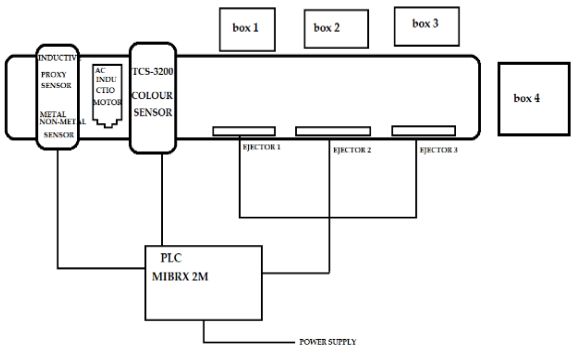


Fig. Sorting Mechanism Using PLC

The plc module indicates that there are three main systems at play. The first is the input module, to which the object, metal, non-metal, and colour sensors are connected. The PLC, which receives signals from input modules and executes actions in accordance with the logic diagram created for it, is the second and most important component of the system. The output module with the output-giving devices is the final one. In this prototype, the object enters the inductive sensor first before travelling on a conveyer belt. A DC motor powers the conveyor belt. • The input for the PLC will come from the inductive sensor. The item will then go to the TCS-3200 (colour sensor). The colour sensor will determine an object's colour and then transmit that information to the PLC. After that, the object will be detected by the photo-sensor by the colour sensor. The half stepper motor will then get the signal from the PLC.If the item is red and made of metal, the ejector 1 will force it into box 1. Ejector 2 will sort the object if it is red and non-metallic. If the thing is blue metal, ejector 3 will sort it.Finally, if the object is blue and non-metallic, the conveyor belt's terminus will automatically sort it. • The PLC software's ladder diagram is used to control the entire process.120/240V AC power supplies are required for PLCS. The entire sorting process is installed on the conveyor chassis, which gives the system stability. The conveyor belt's length is around 60 to 70 cm.

Hardware and Software

1. PLC- Selec Mibrix 4M (230 V)
2. Colour sensor-TCS3200
3. Inductive Proxy sensor
4. Conveyor belt
5. Conveyor chassis
6. Nylon Rollers- 2
7. Motors – 500 rpm (12v) ×4
8. Johnson DC motor- 200 rpm (12v)
9. Relay
10. Urduino Uno
11. Bearings –At rollers
12. Software – Window Based Selec software for ladder programming

IV. RESULTS

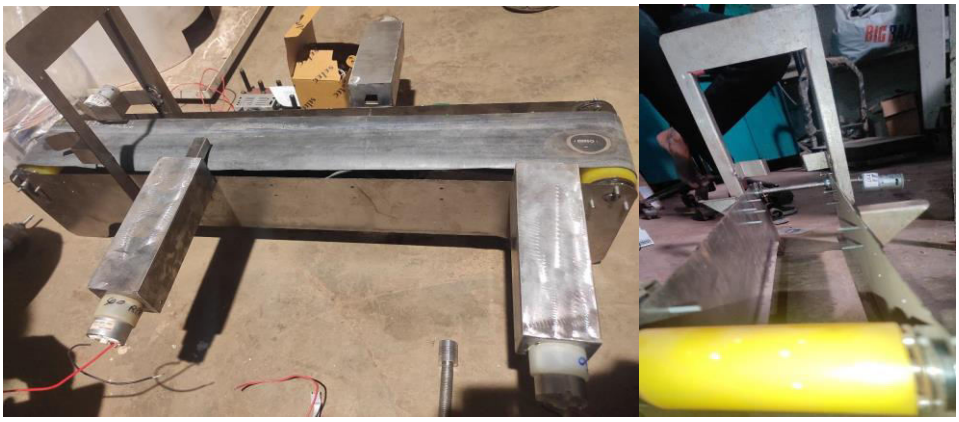


Fig. Actual Prototype of Project

The project demonstrates the successful implementation of automation using a PLC. The sorting machine is able to efficiently and accurately sort objects based on specified criteria, reducing the need for manual intervention and improving productivity.

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 5, May 2023 |

V. CONCLUSION AND FUTURE WORK

We have put forth a system that would speed up and improve the precision of material handling systems. According to the user's specifications, the system would group objects according to their type, such as metal or non-metal, weight, and colour. Utilising a PLC with a frame of logic gates will make it simple to adapt the programme, allowing us to change the system to meet the needs.

Together with PLC and SCADA, it is very helpful in many different industries, but especially in the packaging process. An automatic sorting device improves the operators' efficiency, usefulness, and safety. It guarantees exceptional processing power together with unmatched performance, including colour detection. Of course, we need to include fast DC motors and responsive sensors to speed up the system for industrial use.

Modifying the programme and its constituent parts will help the model. Following are some recommendations. A load cell can be added to measure and regulate the product's weight. A counter can be added to tally the number of items. By adding more sensors, the system can be utilised as a quality controller and its speed may be raised in accordance with production pace. The sensor can also be changed depending on the product type.

REFERENCES

[1] Babita Nanda, St. Martin's, "Automatic Sorting Machine Using DELTA PLC", International Journal of Innovative Research in Advanced Engineering, Volume 1, Issue 7, August 2014.
[2] Joshua Todd Fluke, "Implementing an Automated Sorting System", Mechanical Engineering and Production Technology, Saimaa University of Applied Sciences, 2015.
[3] Bankole I. Oladapo, V.A. Balogun, A.O.M. Adeoye, C.O. Ijagbemi, Afolabi S. Oluwole, I.A. Daniyan, A. Esoso Aghor, Asanta P. Simeon, "Model Design and Simulation of Automatic Sorting Machine Using Proximity Sensor", International Journal for Engineering Science and Technology, April 2016.
[4] Paul F. Whelan, "Automatic Packing System", Member, ZEEE, and Bruce G. Bachelor, Volume 26, Issue 5, September 1996.
[5] Saurin Mukundbhai Sheth, "Automatic Sorting System Using Machine vision", G H Patel College of Engineering and Technology, Volume 12, Issue 5, February 2015.
[6] B. Nantheni Devi1, D. Kanimozhi2, "Implementation of PLC Based Food Packaging Machine", International Journal of Engineering Technology in Computer Science and Electronics (IJIREEICE), Volume21, Issue 3, April 2016.

Impact Factor: 7.580

INTERNATIONAL JOURNAL
OF MULTIDISCIPLINARY RESEARCH
IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

+91 99405 72462 +91 63819 07438 ijmrsetm@gmail.com