Automatic Packaging System Using PLC

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Abstract- *As technology advances, industries need to be able to adapt smoothly when it comes to rapid production changes to meet the market needs of today for innovative products. Majority of systems are controlled by Programmable Logic Controller (PLC) that are programmed with ladder logic in automation industry for sorting and packaging process.*

Objective of our Project is to separate the object according to their color as well as counting the object and fill the objects in the boxes. Main idea of this project is to design and fabricate small and simple conveyor belt based box packaging system. Electrical DC motor used as a actuator to move conveyor belt. For color sensing, RGB Color sensor is used and for proximity detection, IR sensor is used for counting objects. Arduino is used for signal conditioning of RGB Color Sensor. Arduino followed by Digital to Analog Converter (DAC), which gives voltage varying signal to the PLC. PLC RS Logix 1200 is used to control and automate the system by ladder logic diagram software is able to decrease packaging time as compared to traditional manual system.

Keywords- Conveyor Belt, Red-Green-Blue (RGB) Color Sensor, Infrared Radiation (IR) Sensor, Arduino, Programmable Logic Controller (PLC)

I. INTRODUCTION

Industry automation becomes the global trend in manufacturing, packaging process is one of the most uses in industry; more and more companies are switching to automation. This project is devoted to the use of automatic control system in packaging system; the control system will play a major role in control on all parts of the project. This project report is about design and fabricate an automated packaging system, in which objects are sorted according to the colors and into the boxes. Electrical DC motors control were used as actuators for the entire process to move the upper and lower conveyor belts.

Conveyor belt used for transporting objects from one location to another one, which would be packaged into a specific paper boxes later. The control system for the hardware project is to be controlled by the Allen Bradley MicroLogix 1200 Programmable Logic Controller (PLC) device. Ladder logic diagram for programmable Logic Controller were used for control the actual prototype for the experimentation.

II. LITERATURE SURVEY

Several Articles for our project were studied. Since Mechanical Prototype of Conveyor Belt and working of automatic packaging system have been discussed in [4], "PLC controlled Low Cost Automatic Packing". The objects are sorted by using color sensor. the concept of color sorting is an important factor in our project. So this is identified in [7] . "Development of a Prototype Automated Sorting System for Plasting Recycling". PLC is have significant role in automated system. PLC selection have been discussed in [8] "Automated Packaging Maching using PLC".

III. BLOCK DIAGRAM

The block diagram of the Automatic Packaging System is shown in figure, which consists of three inputs (toggle switch , RGB color sensor, IR sensor) to provide the control by system state. Also the system consist of three output (the two DC motor, Electromagnet) as below:-

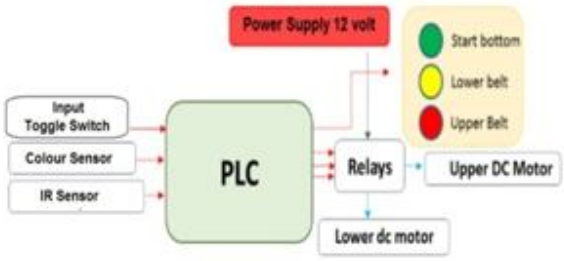
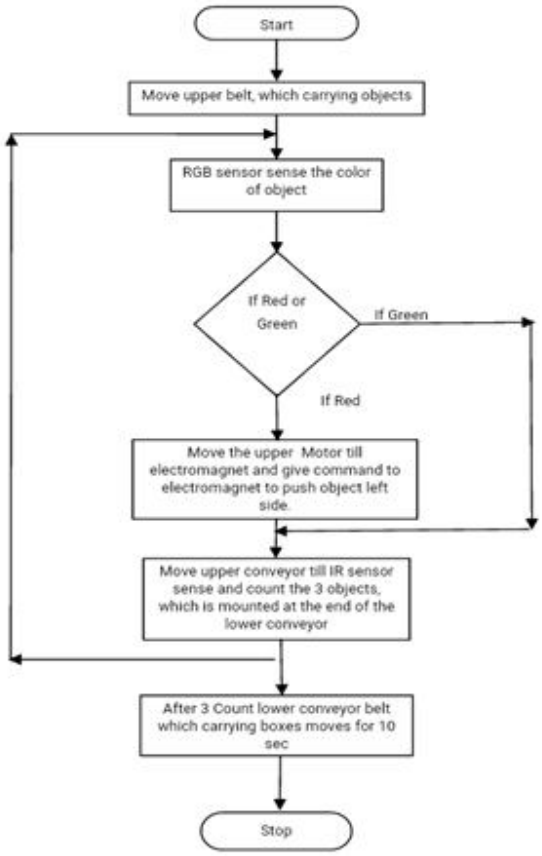


Fig. 18 Block Diagram of the System.

- Toggle Switch: It have two wires connected as sourcing to the PLC one of the wirers is connected to 24 V DC, while the other wire is connected to 0VDC.
- IR Sensors: The first wire of IR sensor is connected to 24VDC of the PLC and the other wire is connected to 0 VDC through the 5VDC relay module.
- RGB Color Sensor: The first wire of RGB color sensor is connected to 24VDC of the PLC through Arduino and the other wire is connected to 0 VDC.

- Lower DC Motor: The DC motor works under 5-12V and the PLC gives 24VDC, then 24VDC relay used. The lower DC motor is connected to output of the PLC.
- Upper DC Motor: The DC motor works under 5-12V and PLC gives 24VDC, then 24VDC relay is used. The upper DC motor is connected to output of the PLC.
- Electromagnet:The Electromagnet works on 12VDC. It is connected to output of the PLC.

IV. WORKING METHODOLOGY OF AUTOMATIC PACKAGING SYSTEM



following controllers are used under software:-

Software

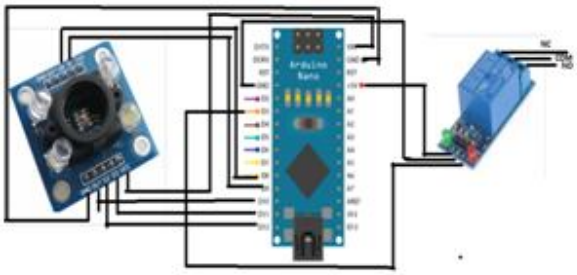
- PLC-RSLinx classic Lite and RSLogix micro starter
- Arduino-1.6.4 windows

- **Arduino:-**

Arduino is a microcontroller. It is used for signal conditioning of RGB color sensor. Its Technical Specifications are as follow:-

- Microcontroller: Atmel ATmega 328 (Nano)
- Operating Voltage: 5V
- Input Voltage: 7-12V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- DC Current per I/O Pin: 40mA
- Flash Memory: 32KB
- Clock Speed: 16MHz

TCS3210 RGB SENSOR AND AT MEGA 328 NANO Arduino:-

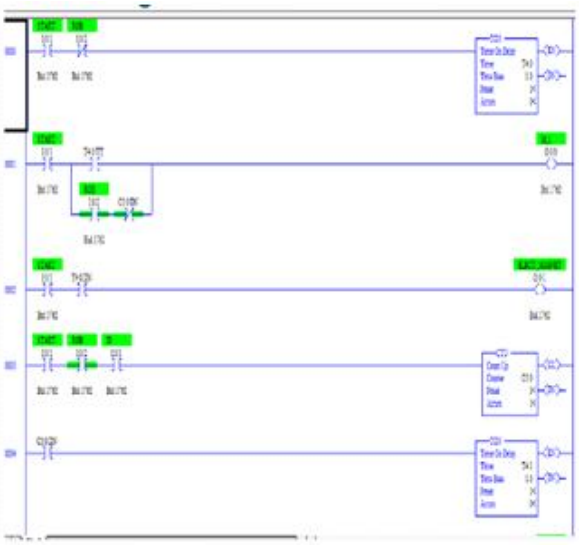


- **Programmable Logic Controller:-**

Programmable Logic Controller (PLC) is a simply a special computer device used for industrial control systems. They are used in many industries such as oil refineries, manufacturing lines, conveyor systems, packaging system and so on.Where ever there is a need to control devices the PLC provides a flexible way to "software" the components together.PLC used to make a system automatically operated through the ladder programming by using software. In this project, Micro Logix 1200 PLC is used. Technical Specifications of MicroLogix 1200 PLC are as follow:-

- Brand: Allen Bradley
- No. of I/O: 14 DI/ 10 DO
- Rated supply voltage: 24VDC

PLC Program:-



V. ADVANTAGES OF AUTOMATION

- Reduction in production time
- Increase in accuracy and repeatability
- Less human error
- Less employee costs
- Increased safety
- Higher volume production

VI. DISADVANTAGES OF AUTOMATION

- Less versatility
- More pollution
- Large initial investment
- Increase in unemployment
- Unpredictable costs

VII. APPLICATION

Manual sorting of any object consumes a lot of time and labour. Hence, PLC object sorting system finds wide application in the following industries.

1. Brick Manufacturing Process:In Brick manufacturing Process the quality of bricks considering their height as a parameter can be checked. If the height is more or less from the original size then the defective bricks can be sorted out.
2. Luggage sorting at Airports: The parcels at airport which has to loaded in cargo planes can be sorted accordingly to reduced the load of the plane.
3. Quality Checking of Solid Objects: If the height of the solid material is taken as a criteria in quality check of that object then this system can be used effectively.
4. In Food Processing Industries: The food packing of the food stuffs of different sizes can be sorted in such type of industries where various quantities of packed food are running on a single line.

VIII. CONCLUSION

An automated packaging machine prototype using PLC MicroLogix 1200 will be design, constructed and implement based on control system concepts. PLC Ladder Diagram will applied for the programming and operation of the presented prototype, in which the operation is passes through two stages, carrying empty boxes to desired location, and packaging the samples into the boxes. The experimental prototype will be tested to improve the automation processes with the use of the PLC ladder diagram.

IX. FUTURE WORK

It is very useful in wide varieties of industries along with the help of PLC, especially in the packaging section. Automatic Packaging and Sorting machine enhances efficiency, practicality, and safety of operators. It ensures remarkable processing capacity as well as peerless performance including color detection.

The model can be improved by making some changes in the program and components. Some

Suggestions are given below:-

- We can add a load cell for measurement and control of weight of the product.
- The system can be used as a quality controller by adding more sensor.
- The DC Motor can be replace with stepper motor.
- The system can be improved by developing SCADA Software.

X. ACKNOWLEDGMENT

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