

# PLC based Color Sorting Conveyor System

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**Abstract--**In manufacturing industries, there is a need of sorting objects. Manual sorting is a tedious, time-consuming, slow and non-consistent task and requires skilled labor. Whereas, automated systems are time-efficient, fast and reliable in terms of sorting. The objects may be of the same color or different. The system would be able to detect the objects and then differentiate each object based on its color. Objects may have different colors. Thus, different objects and different parameters require different type of processing. Our aim is to classify objects using image processing algorithms based on the parameter of color. The input for the system will be an image and then it will be processed for detecting the color, and accordingly the products will be further sorted using embedded algorithms. PLC will be the main controlling unit of the system. Thus, our designed automated system will be able to sort products based on their colors.

## I. INTRODUCTION

In many sorting industries, object sorting is the major task that needs to be done. Manual sorting is the traditional approach that is preferred by industries that involves visual inspection performed by human operators. This traditional approach is tedious, time-taking, and non-affordable for industries. It has become difficult to hire personnel who are trained and willing to undertake the tedious task of inspection. Therefore in proposed system the efforts are made to design and implement automatic technique for identifying and sorting the products on the basis of their color using Embedded Vision.

overview on the Automatic Detection and Sorting Mechanisms. The journals were analyzed and content is presented. After analyzing what systems have been published in the journals, we presented our ideas which were focused on improving the existing system. In many processes the human eye is a key factor in the sorting and inspection of all kinds of objects. In most of these processes vision systems offers for more effective, fast and quality control over product. Furthermore, Time is the most important factor for small and large scale industries. Hence this mechanism is very handy.

## III. EXISTING SYSTEM

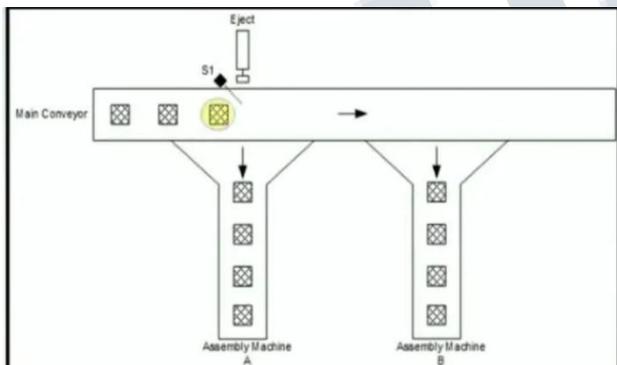
There are various existing technologies which are being used in industries. They are made according to need of the customer, budget and technologies.

### 3.1 Arduino based system

The Color sorting machine using Arduino is an engrossing and easy project for techies, who would like to combine Electronics, Mechatronics and Programming. The Color Sorting Machines is used for sorting mainly Red Green and Blue colors. This color sorting machine separates different colored objects and differentiates them into respective baskets. This sorting unit is fully automated with the use of Arduino microcontroller. This mechanism is built with Arduino along with different sensors, two Servo Motors and conveyor belts.

### 3.2 IOT based System

Color Based Object Sorting has a wide usage in the pharmaceutical as well as toy sorting industries. This system offers a mechanism to detect color and sort items through image processing. Once identified a mechanism is used to sort the toys or any other object into particular



**Fig 1: System Diagram**

In recent years the importance of process automation has increased as the growth of any industry directly depends on it. For precise output and accuracy in industries, robots with sensors and actuators are used.

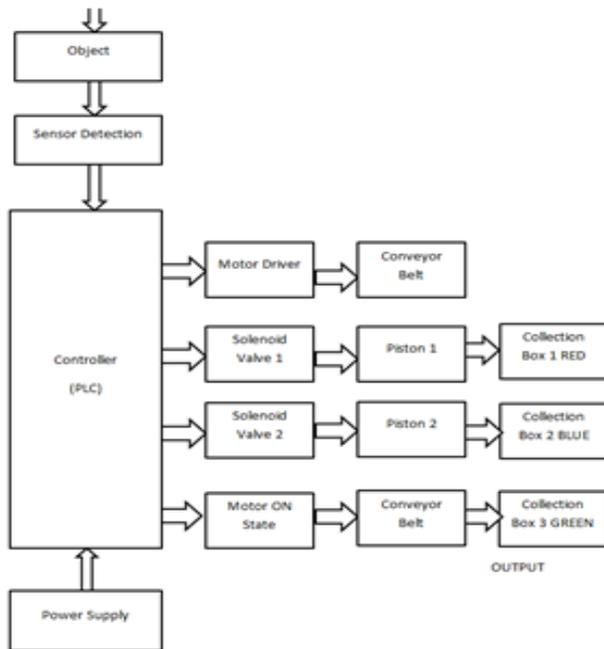
## II. 2 LITERATURE SURVEY

As part of our pre-study, we conducted an elaborate literature survey. The literature survey presents an

baskets. The system uses TCS 3200 which is IOT firmware connected to a controller circuit to complete this task.

TCS 3200 is responsible for detection of objects based on their color and two servo motors are used to push or put them into desired baskets. Thingspeak is an open source IoT platform through which we can analyze, visualize and control the whole process.

**IV. PROPOSED SYSTEM DESIGN**



**Fig 2: Proposed System Block Diagram**

In our project we have two conveyor belts. Function of the first conveyor belt is just to feed different color objects to the second conveyor which is a main conveyor of this system. The main conveyor belt will take these objects in front of height measuring station. Main conveyor is run by 3 phase AC induction motor controlled by Variable Frequency Drive interfaced with PLC. The system assembly consist of two to three racks or holing stands according to the requirement, 1st one holds start sensor which will start the conveyor and 2nd and 3rd stands hold 1 sensor each. which are arranged to measure object's color. If place two sensors at a particular distance in such a way, if object's front and back edges cut the sensor lines at a same time, then we can also measure the object's width. The push assembly consists of DC geared motor energized by manipulated power supply. The shaft of dc geared motor is placed with metal plate which acts as a separator. Three pneumatic actuators are used in order to push the objects into the respective baskets according to their colors.

When the start sensor will sense the object it will signal PLC to start main conveyor. Objects will have to travel from the conveyor belt. When the object will come in front/under the first sensor, the color sensor(Lx-111-p) will detect its color. If the color is RED it will send signal input to PLC and the PLC will send generate output and pneumatic actuator will push this object out of the assembly line.

Similarly, if the object is not RED 1st sensor won't send any signal to PLC and object will continue to travel on the conveyor belt. 2nd Sensor will detect its color, if its blue then again same process will repeat.



**Fig 3: 3D design**

**V. HARDWARE IMPLEMENTATION**

**5.1 PLC**

PLC is the main controller used. PLC is mainly used for the adaptation of manufacturing processes. PLC consists of the Central Processing Unit (CPU) and the Input/Output (I/O) interface system. This PLC is user friendly and designed to perform industrial scale complex operations. PLCs play an important role in the field of automation. Using complex SCADA systems, A PLC can be programmed according to the operational requirement of the industry.



**Fig 4: 128\*64 Display PLC Module**

I/O Capacity-48  
 Display – Graphical LCD, 128\*64 pixels  
 Communication Options - Serial RS232 And Serial RS422/485  
 Digital I/O – 8 inputs  
 Relay Outputs  
 inputs + Outputs.  
 Analog IO  
 4 Analog inputs, 12-bit  
 Analog Outputs, 12-bit  
 4 Universal Inputs, 10-bit

**5.2 LX-111-P Color Sensor**

This sensor is used to detect the color of the object. It is interfaced to the PLC. The sensing range is 10 +/- 3mm, 0.394 +/- 0.118 in. It requires

**5.3 Conveyor Belt**

A belt conveyor system consists of two or more drums. Object, whose color is to be detected is placed on the conveyor belt. We can control the speed of this conveyor belt according to requirements of the industry.

**5.4 MCB (Miniature Circuit Breaker)**

Circuit breaker operates as an electrical switch. It is meant and designed to protect any kind of electrical circuit from damage caused by excess current from an overload or short circuit. Circuit breakers are of different sizes, from small devices to protect low-current circuits or large devices to protect house hold circuits. The primary and main function of a circuit breaker is contracted as over current protection device.

**5.5 Induction Motor**

230 Volt, 60watt , Single phase A single phase induction motor is consists of a single phase winding on the stator and a cage winding on the rotor. When this single phase supply is connected to the winding, a pulsating magnetic field is produced.due to inertia rotor doesn't rotate. Therefore this induction motor is not self-starting and it requires some action. 4.2.1 Motor Speed controller\_

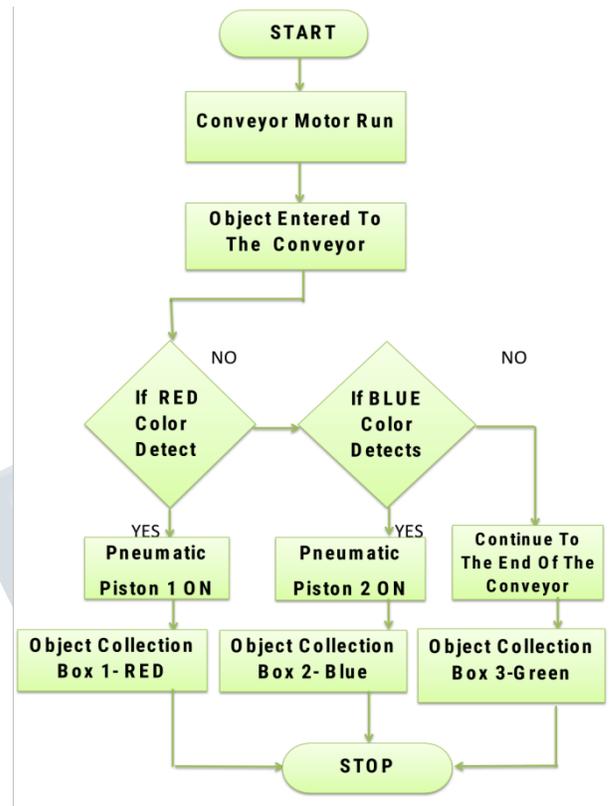
- i. By changing the applied voltage.
- ii. By changing the applied frequency.

**5.6 Relay**

Relay is used to connect or disconnect two circuits and acts as a switch. However, instead of operating it manually a relay is used.which in turn connects or disconnects. Relays can be of various types like electromechanical, solid state. Electromechanical relays are frequently used. Specifications-

- 1. High Capacity, Low Profile relay.
- 2. Low coil Power of 400mW.

**VI. SYSTEM FLOW**



**Fig 5: System flow**

**VII. SYSTEM CONCLUSION**

From the surveys we did andbased on it we observed that conventional methodologies to sort an object are time-consuming. Hence industries cannot afford it. Where as the system we have used reduced the time factor as well as it has brought more accuracy on the assembly line. It is not only time saving but also reduces human resource factor from the sorting operation which ultimately reduce overall cost of the operation. And compared to other automated systems. it brings ease of coding and design.

**VIII. FUTURE SCOPE**

Future work can be implemented in this project. We can extend the single sensor inspection into multi line color inspection thereby increasing the accuracy. We can implement this system in other fields by changing its design and code according to industry requirements. It can be implemented in quality control of products before final dispatch, pharmaceutical and waste management industries.

### **IX. ACKNOWLEDGMENT**

We have great pleasure in presenting our system title, “PLC Based Color sorting conveyor system”. We would like to express our sincere and whole hearted thanks to our guide Prof. A.Dakre who distributed with us his valuable knowledge and provided guidance.

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