

# Automatic Object Sorter with Conveyor Belt Arrangement for Distinguishing and Object Count Application

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**ABSTRACT:** Sorting is a process in which two or more objects of similar, yet different characteristics are arranged in a systematic order. This is generally carried through manually or by using sensors in automation. Automatic color sorting is very much convenient in industry. Color and size are the most important features for accurate classification and sorting of product which can be done by using some optical sensors or analyzing their pictures. Color sorting machines are machines that are used on the production lines in bulk food processing and other industries. They separate items by their colors, detecting the colors if things that pass before them and using mechanical or pneumatic ejection devices to divert items whose colors do not fall within the acceptable range. The Color sorting machine using microcontroller is a fascinating and renowned project for techies, who would like to combine electronics, machine building and programming. The Color Sorting Machine is used for sorting mainly RGB colors. A simple robot arm is used to apply a color sorting to a physical system. The objects are placed to the conveyor belt using robot arm with servo motors. One conveyor belt is used, which is controlled by DC motors.

**KEYWORDS:** Conveyor Belt, DC Motors, PLC Microcontroller, Color Sensor, LCD

## I. INTRODUCTION:

Industries today are approaching to use color sensor to fulfil their needs for a higher production and precise quality. Historically, components used for color sensing were considered expensive and required precision support circuitry, limiting their application mostly to specialized instrumentation. However, new technologies of color sensors with higher levels of integration are becoming available, allowing for more cost-

effective solutions. As the cost of color sensing comes down, the number of applications using color sensing is increasing. Color sensors play a significant role in end equipment such as color-monitor calibration, color printers and plotters, paints, textiles, cosmetics manufacture and medical applications such as blood diagnostics, urine analysis, and dental matching. The complexity of a color sensor system is based largely on the number of wavelength bands, or signal channels, it uses to determine color.

Automatic inspection using machine vision in industries where number of objects are made and packed, there is no mechanism to sort the different objects from production. Normally the sorting is done manually. Manual sorting of objects is so difficult and time consuming. So sorting the objects automatically has become an important necessity of most of our industries. Automatic inspection of products is more efficient and time saving technique as compared to manual sorting. There are number of methods to sort objects, but our concern was to sort objects on the base of their color. Usually in industries where different products are manufactured, each product has its own packaging, and definitely a unique color, so in our case the most accurate technique is to identify the color of each object. By using color sensor and finally a decision is made, whether the object was blue, red, green or any other. If the object is green then it is placed in the green object section. Other color objects are treated similarly. We can also count the no. of objects which were sorted.

Moreover, interfacing of mechanical system with the microcontroller was of our concern. Other mechanisms created in this project are timer circuits, conveyor belt system and to and fro motion control of DC motor to use it as a linear

actuator. Now the project is in working condition and automatically sorts the different objects on the basis of their colors. First the object is placed at desired location, IR sensor detects whether the object is placed under it, then color sensor recognize the color of object and generates signal and send to Microcontroller for further action. Then object is pushed on conveyor belt. Timer circuits hold the signal until the object reaches in front of desired actuator that pushes the object at its desire location.

## II. LITERATURE REVIEW:

### Mohammad

**MoghaddamVahedet.al.**<sup>[1]</sup>[2014], This paper deals with sorting Date fruits based at different stages of maturity, namely Khalal, Rotab and Tamar to meet consumer's demands. The system comprises a conveying unit, illumination and capturing unit, and sorting unit. Physical and mechanical features were extracted from the samples provided, and the detection algorithm was designed accordingly. An index based on color features was defined to detect Date samples. Date fruits were fed on a conveyor belt in a row. When they were at the center of the camera's field of view, a snapshot was taken, the image was processed immediately and the maturity stage of the Date was determined. When the Date passed the sensor, positioned at the end of the conveyor belt, a signal was sent to the interface circuit and an appropriate actuator, driven by a step motor, was actuated, leading the Date toward an appropriate port. For validation of proposed system performance, entire samples were again sorted by experts visually. Detection rate of the system for Tamar and Khalal was satisfactory. Although the detection rate was insufficient for the Rotab stage, there was no a significant difference between system accuracy and that obtained by the experts. The speed of image processing system was 0.34 s. System capacity was 15.45 kg/h.

**Vishnu R. Kale et.al.**<sup>[2]</sup>[2014], This paper presents a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color. This paper presents a mechatronics color sorting system solution with the application of image processing. Image processing

procedure senses the objects in an image captured in real-time by a webcam and then identifies color and information out of it. This information is processed by image processing for pickand-place mechanism. The Project deals with an automated material handling system. It aims in classifying the colored objects by color, size, which are coming on the conveyor by picking and placing the objects in its respective pre-programmed place. Thereby eliminating the monotonous work done by human, achieving accuracy and speed in the work. The project involve sensors that senses the object's color, size and sends the signal to the microcontroller. The microcontroller sends signal to circuit which drives the various motors of the robotic arm to grip the object and place it in the specified location. Based upon the detection, the robotic arm moves to the specified location, releases the object and comes back to the original position.

### Hardware Overview:

#### 1. Conveyor belt:



A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys(sometimes referred to as drums), with an endless loop of carrying medium the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. There are two main industrial classes of belt conveyors in general material handlings such as those moving boxes along inside a factory and bulk material handlings such as those used to transport large volumes of resources and agricultural materials, such as grain, salt, coal, ore, sand, overburden and more.

## 2. DC Motor:



Geared motors can be defined as an expression of DC motor which already had its insight details are here. A geared DC motor has a gear assembly attached to the motor. The motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps to increasing the torque and reducing the speed. Using the correct combination of gear in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduces the speed of the vehicle but increase its torque is known as gear reduction.

## 3. Microchip PIC 16F877A Microcontroller

Microchip manufacture a series of microcontrollers called PIC. There are many different flavors available, some basic low memory types, going right up through to ones that have Analogue - To- Digital converters and even PWM built in. We are going to concentrate on the 16F877A PIC. Once you have learnt how to program one type of PIC, learning the rest is easy. There are several ways of programming the PIC - using BASIC, C, or Assembly Language. We are going to use the assembly language There are only 35 instructions to learn, and it is the cheapest way to program the PICs, as you do not need any extra software other than the freebies.

## 4. Color Sensor



This color sensor identifies color and gives serial output of RGB value. It can identify 16.7 million color shades giving RGB value for the detected color. The detected color is identified as amount of three primary color values namely Red, Green & Blue with 8 bit accuracy for each primary color. Any color can be separator combined into

three primary colors Red, Green and Blue using the RGB values.

## 5. Liquid Crystal Display (LCD)



The LCD panel used in this block interfaced with micro-controller through an output port. This is 16 character x 2 line LCD module, depending on the availability of LCD panel 3 line or 4 lines panels can be used for the purpose, so that more information can be displayed simultaneously. These panels are capable of display numbers, characters and graphics. The display contains two internal byte-wide registers, one for commands and the second for characters to be displayed. It also contains a user programmed RAM area (the character RAM) that can be programmed to generate any desired character that can be formed using a DOT matrix. To distinguish between these two data areas, the HEX commands byte 80 will be used to signify that the display RAM address Initial State Hex (00H) is chosen. 4 lines x 16 characters LCD panel is used for displaying the demodulated information. Since the panel contains 4 lines more information can be displayed simultaneously. The micro-controller units are constructed with 16F877A IC's, this is 40 pin IC. The LCD contains 16 pins out of which 8 pins are data pins and 3 control pins. The LCD is interfaced with Micro-controller used in this project work is having 16 I/O lines and 10 I/O lines are interfaced with LCD panel, D0 to D7 of LCD panel are called as 8-bit data pins and this panel acquires the information from Microcontroller through this data pins.

### Methodology:

1. Gathering & processing all information related to the system by studying various journals, research papers, books, articles etc
2. Collecting all hardwares
3. Designing of Printed Circuit Board (PCB)
4. Software Designing
5. Assembly of all parts
6. Trial on manufactured machine
7. Interpretation of results

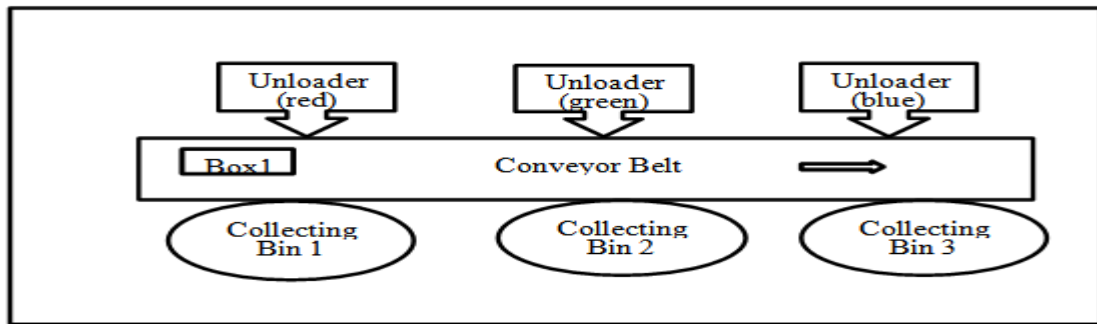
**WORKING:**

Color sensor is interface with Peripheral Integrated Circuit (PIC) Microcontroller in serially. The color sensor will send a hex value of respected colors that is means a machine code of different colors to PIC Microcontroller. PIC microcontroller will take a different color value and according to the value of colors it will send a respected signal to the motor. We are using a DC gear motor having

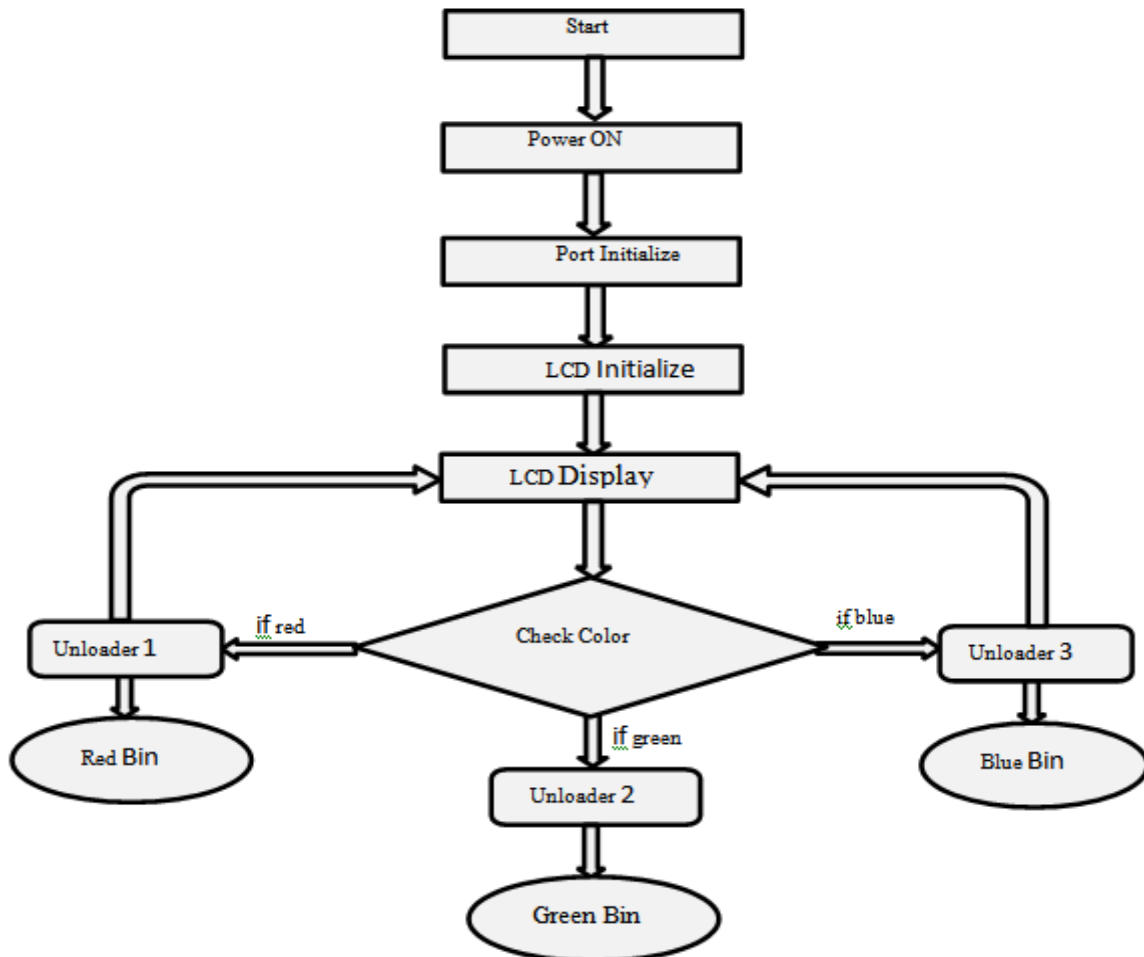
100 RPM that will rotate clock wise and anticlockwise. For motor controlling we are using L2938 motor driver IC which will rotate a motor in clockwise or anticlockwise direction.

For sorting of red color object we are using motor 1 in clockwise direction above the conveyor and for sorting the green color object we are using motor 2 in clock wise direction above the conveyor.

**Working Block Diagram**



**Flow chart**



### Circuit Action:

The sensor switches each primary color RGB, one by one and checks what intensity of color is reflected by the surface of detection. This reflected intensity is converted to 8 bit value. For example a RED surface will strongly reflect RED. While a Yellow surface will reflect RED and GREEN both. According to the induction principle of the three primary colors which create various other colors in nature, once the value of three primary colors is confirmed, the color of the tested object is known. Knowing the value of RGB helps people gain the color of the light which is projected onto the sensor since each color correspond to only one value of RGB . For example When RED shade of color is detected you would get following type of data in terminal Red=130 Green=030 Blue=030 L=010 This value read the microcontroller and sends the signal to particular stepper motor. Hear the stepper motor is used as piston to push the corresponding object. Before piston we use IR receiver to detect the object and for counting also. The current buffer IC ULN2003A use to drive the steppermotor. The main working – For example RED object is detected then microcontroller waits for cut red piston IR signal then red piston stepper motor rotate and red object push from conveyer belt. And count the RED Object and the data sends to controller. And so on program is design to display the entire object counted value which is passed over conveyor.



### Advantages

- a) Less material handling
- b) Maintain the quality of the product
- c) Consume less time, hence increase the production rate.
- d) Low Maintenance
- e) Solve all manual sorting problems
- f) Significantly reduce the number of manual workers in sorting plant
- g) Achieve high sorting speed

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