Design and Development of an Automatic Color Sorting Machine on Belt Conveyor

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Abstract: **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 analysing their pictures. Manual sorting is the tradition approach that preferred by industries that involves visual inspection performed by human operators. This traditional approach is tedious, time-consuming, slow and non-consistent. Color sorting machines are machines that are used on the production lines in fabric industries 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 is used for sorting mainly RGB colors and also colors of different shades. The objects are placed to the conveyor belt. One conveyor belt is used, which is controlled by DC motors. This project consists of conveyors, color sensors, electronic system and motors. The objects are being sorted according to their respective color. As the object is detected using the ultrasonic sensor it sends the signal to the NodeMCU ESP8266. Then the NodeMCU activates the DC motors to start which runs the belt conveyor. The belt conveyor passes the object through the color sensor, where the color of the object is detected and based on its color respective servo motor is used to separate the objects in a particular container. The LCD display is used to show the count of the objects.**

Keywords: **Color sorting, NodeMCU, Conveyor belt, Color sensor, LCD display, IR sensor.**

1. Introduction

Nowadays, in the present state of intense competition, production efficiency is generally regarded as the key of success. Production efficiency includes the speed at which production equipment and production line can be lowering material and labour cost of the product, improving quality and lowering rejects, minimizing downtime of production equipment and low-cost production equipment. Taking this matter under consideration the project is developed which is very useful for industries. Machines can perform highly repetitive tasks better than humans. An employee who has been performing an inspection task over and over again may eventually fail to recognize the color of product. Automating many of the tasks in the industries may help to improve the efficiency of manufacturing system.

This machine consists of mainly Belt Conveyor, IR Sensor, color sensor, DC motor, L293D motor driver and servo motor. The output and input of these parts are interfaced using NodeMCU ESP 8266. The Color Sorting Machines is used for sorting mainly RGB colors. This Color sorting machine separates different colored objects and classifies them into respective containers/cups.

The main advantages of the system are less time required to sort the product, as the whole system is performed by machine there is less possibility of mistake, less man power required. If the industry can produce the product within the required range, then the demand of the product will be increased.

2. Design Methodology

A. Hardware Design

1. *Identify the object and number of colors to sort:* The first step is to determine whether the object is present and number of colors that the machine needs to sort.
2. *Select the sensors:* Once the number of colors are known, we need to select the sensors. Color sensors such as TCS3200 can be used to detect colors.
3. *Design the mechanical structure:* Designing a mechanical structure to hold the sensors and the sorting mechanism. This structure should be stable and steady to ensure accurate sorting.
4. *Select the sorting mechanism*: The sorting mechanism can be a simple conveyor belt and a series of viper sorters connected upon the servo motors, depending on the application.
5. *Connect the sensors:* Once we have the sensors and sorting mechanism, we need to connect them to the NodeMCU ESP 8266. This involves wiring the sensors to the appropriate pins on the NodeMCU ESP 8266.

B. Software Programming

1. *Install the Arduino IDE:* The first step in programming is to install the Arduino Integrated Development Environment (IDE) on the computer.
2. *Write the code:* Write a code that reads the sensor values, compares them to the reference values, and sort the item. The code should be optimized for speed

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and accuracy.

3. *Upload the code:* Once the code is written, we need to upload it to the NodeMCUESP8266.
4. *Test the sensors:* Test the sensors to ensure that they are accurately detecting the colors.
5. *Test the sorting mechanism:* Once the sensors are working correctly, then we need to test the sorting mechanism to ensure that it is accurately sorting the items.
6. *Fine-tune the system:* If there are any issues with the sorting accuracy, finetune the system by adjusting the sensor values or the sorting mechanism.
7. *Evaluate the results:* Finally, the results of the color sorting machine can be evaluated to ensure that it meets the requirements of the application
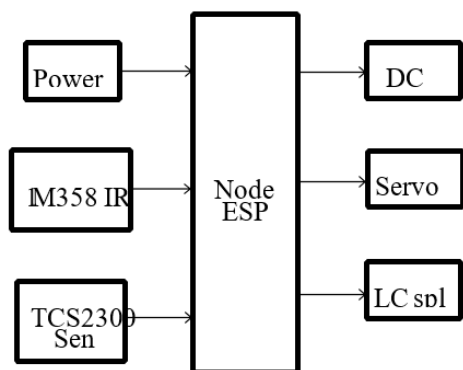
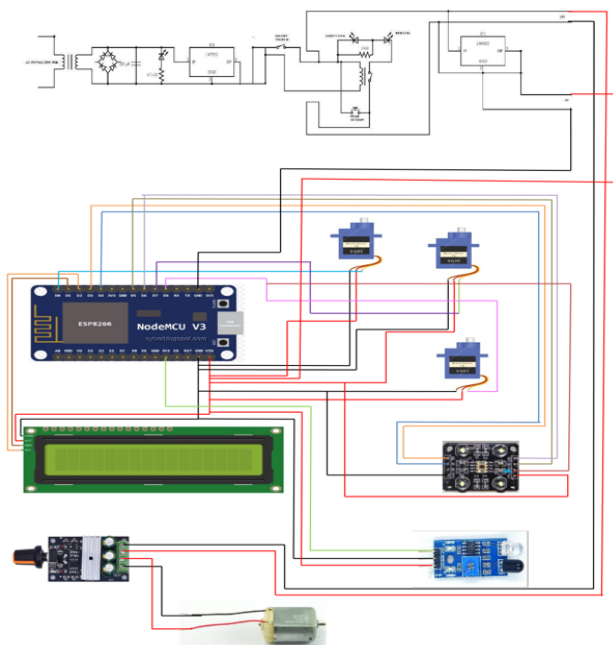

Fig. 1. Block diagram of color sorting machine

Fig. 2. Circuit diagram of color sorting machine

3. Working

The color sorting machine is used for sorting mainly RBG colors and also colors of different shades. The machine consists of NodeMCU ESP8266, Color sensor, IR sensor, LCD display, Servo motor, Dc motor PWM speed controller, Transformer.

1. When the switch is ON, the 230V AC supply is taken from the power supply and it connected to the step-down transformer which gives 12V AC as the output. By implementing the full wave bridge rectifier 12V AC is converted to 12V DC. Here resistors and Capacitors acts as the filter which converts the pulsating DC to 12V DC. We get the 12V DC output at 7812 Voltage regulator, which is passed to the relay and we get the output of 5V DC from 7805 Voltage regulator.
2. Relay acts as the switch for the short circuit prevention. When short circuit occurs normally open pin will activate and the whole process will be terminated and will the stop the current flow through the circuit.
3. Now the supply is given as per the requirement of the components. 5V DC supply is given to the LCD display, NodeMCU Esp 8266, color sensor, and 12V DC supply to the Dc motor PWM speed controller.
4. The DC motor is used to run the conveyor belt and PWM speed controller is used to control the speed of the DC control which in turn controls the conveyor belt.
5. The colored box is placed on the conveyor belt, IR sensor detects the object and if the object is present then the operation begins. The object is moved upon the conveyor belt, color sensor detects color of the object and displays it on the LCD display.
6. Servo motors are placed on the right side of the conveyor belt, as the object moves forward, the shaft which is attached to the servo motors pushes the object into its respective container.
7. The same process is carried out for different shades of color.
8. If the color of the object is other than the RBG color, then the object moves to the end of the conveyor belt and drops into the respective container.

4. Result Analysis

This project of automatic color sorting is excellent one because of its working principle and wide implementation. By applying the idea of this project an industry can easily sort the required product according to its color.

We can conclude that time and human effort can be reduced by implementing such project in industries like candies, food, chip manufacturing and so on.

5. Conclusion

The suggested framework will be a demo rendition which gives expense effective, taking less time and technically the easiest way for differentiating objects. This framework utilizes NodeMCU ESP8266 which makes this model simple to utilize which is more additional effective. Therefore, it is very important to have proper and checked sensors. Further, making desirable changes it can be used in small scale and large-scale industries as well.

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