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Color Based Product Sorting Machine: a Systematic Literature Review

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Color Based Product Sorting Machine
A Systematic Literature Review

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ABSTRACT:

Color Based Product Sorting has a wide usage in many places like candy industries, agricultural industries, etc. This system puts forward a mechanism to detect color and sort items through image processing. Once identified a mechanism is used to sort the candies into particular bins baskets. We here demonstrate this mechanism using a camera with electronic circuitry along with a sorting mechanism using 3 bins. The system uses raspberry pi connected to a controller circuit to achieve this task. The controller circuit consists of a camera attached to it that detects the color of a small object in front of it. A motor is used to feed an object to the camera chamber. As soon as the color is detected a signal is sent to the sorter mechanism which uses a motor to position the sorting tube towards the respective section. A feeder is then used to push the object towards the tubs so that it gets sorted and the next object is pulled in by the feeder. The action details are sent to the IOT server using the Iot gecko platform to keep track of the number of objects sorted in each section. Thus we achieve a completely automated sorting system.

Keywords: Color sorting, Product sorting, Image processing, Matlab, PLC

1.Introduction:

Product lines widely use sorting systems as a bridge between production and packaging systems. Industries use sorting systems to sort products/raw materials as per specified criteria to reduce manual effort and improve accuracy. Manual sorting is a time consuming and effort intensive process. Automatic sorting systems allow for fast and efficient sorting of products. To demonstrate the sorting system we developed a raspberry pi based color sorting system project that uses a microcontroller with an attached camera to automate the system. The system consists of a tray to carry products and a camera to identify the color type of the products, the system now uses the servo motor to position the sorting tube towards the respective section. A feeder is then used to push the object towards the

tubs so that it gets sorted and the next object is pulled in by the feeder.The camera is used to identify objects passing on the way based on specific color. As soon as the required color is identified the sensor passes a

specific signal to the microcontroller which in turn operates the respective cylinders to push out products in respective bins. So this way we have developed a fully automated color based sorting system.The Internet of Things (IoT) will be a present correspondence model that envisions a not so aloof future, clinched alongside which those questions from claiming standard normal presence will be furnished for microcontrollers, handsets for electronic correspondence, Furthermore sensible gathering stacks that will make them prepared will talk with one another Also with the clients, turning under a vital bit of the web. The IoT idea, consequently, goes for making the Internet considerably more immersive and inescapable. Besides, by empowering simple access and collaboration with a wide assortment of gadgets, for example, for example, home apparatuses, observation cameras, checking sensors, actuators, showcases, vehicles, etc, the IoT will cultivate the advancement of various applications that make utilization of the possibly huge sum and assortment of information produced by such questions give new administrations to subjects, organizations, and open organizations. For a closer future, the IoT is relied upon to have house and business utilizes, to add to the personal satisfaction. For instance, brilliant houses will empower their tenants to naturally open their carport when achieving home, set up their espresso, TVs and different occupations. Keeping in mind the end goal to understand this potential development, rising advances and thoughts, and administration applications need to develop relatively to coordinate market requests and buyer's needs. Besides, gadgets should be produced to fit client needs as far as accessibility anyplace and whenever. Additionally, new principles are required for correspondence similarity between fluctuated things.

2. Object Sorting:

Color identification systems are increasingly being used for automated applications in industries mainly for detecting the automation errors and monitoring overall quality of the speed at production line. They are also used at the assembly lines to identify and also classify the products based on color. The main objectives of their use include to check the quality of product and to facilitate the sorting and packaging, they are also used to assess the quality of product in the storage and to monitor the waste products as used in

the food industry. Because of this increasing demand there has been an abundance of color sensors and the choice in industries is dependent on the specific application. We have low cost and simple color sensors which will be preferred over the overly sophisticated solutions for a less demanding application. In such a case our top priority is to reduce the cost and power consumption. Colored names can also be used to conjure a reasonably consistent perception. There are 3 primary colors: Red, Green and Blue. All the colors in the visible range can be obtained by mixing these 3 primary colors. Due to the fact that the human color vision is actually accomplished in part by three different types of cone cells which are in the retina, that is why 3 values are necessary and also sufficient to define any color. Color Theory has described that there are 3 values which are coordinates of a point in a 3D space which give rise to the concept of color space. Hue, Saturation and Luminance is an example of a color coordinate system.Color names can be used and conjure reasonably consistent perceptions. There have eleven basic color names have been identified such as white, gray, black, red, yellow, green, blue, orange, purple, pink, and brown. Most or all colors can be described in terms of variations and combinations of these colors. Due to the fact that human color vision is accomplished in part by three different types of cone cells in the retina, it follows that three values are necessary and sufficient to define any color.

3.Techniques used in object sorting:

Some of the major techniques used in product sorting are mentioned below:

3.1 Image processing:

In image processing, pictures are caught, transmitted, and prepared in advanced frames. Computerized picture handling is one of divisions in electronic territory where the picture is altered to pixels, put away in an advanced stockpiling and prepared by the PC. In result, it diminishes cost, computational speed, and adaptability. The center assignment of advanced picture preparation is safeguarding pictures and improving them to the new data structures, to give a superior premise to acquiring and examination of related exercises. Also, the image processing prompts improvement of picture highlights intrigue and helpful data about the scene from the upgraded picture could be figured. Propelled picture getting ready, remove information of a photo for taking care of and examination. After taking the photo from the camera, the framework exchanges to a PC for preparing and capacity by utilizing distinctive procedures, for example, picture catching, picture digitization, commotion sifting and highlighting recognizable proof.

3.2 Arduino based sorting:

In this method, the color sensor detects the color of candy and generates output in this output sensor data transfer to Arduino. The Arduino will process this data according to the code uploaded in it and command the servo to move and sort color candy on the basis of their color.

3.3 PIC based sorting:

The proposed system is designed for automatic sorting of Red or Green or Black colored products. The prototype consists of two DC motors, two conveyor belts, a PIC and a color sensing circuit using TCS230. DC motors are used to control the conveyor belts. After integrating the programmed PIC and the TCS230 circuitry with the structure of the model, we measure the frequency of signals corresponding to each color by observing them on a CRO. Based on this study the timer delay value is adjusted by reprogramming the PIC. The time required for the product to reach the corresponding container in the separator placed on the second conveyor belt is also considered. L293D Hybrid IC is used to drive the second motor both in clockwise and anticlockwise direction, which provides the to and fro movement of the container of dimensions 9cm x 30cm x 7cm (Width x Length x Height). Separators were used to create compartments of equal sizes meant for collecting objects of the same color. The end section consists of a DC motor (12V, 30rpm), which is used to control the movement of the second conveyor belt in order to position the separator according to the sensor output. The whole framework, excluding the DC power supply, weighed 1.5kg approximately and was 27cm tall, 35cm wide and 77cm long.

3.4 PLC based sorting:

A PLC which is based on a sorting system where we use pneumatic cylinders with color sensors to automate the entire system. The system consists of a conveyor belt to carry products and a color sensor to sense the color type of the product, the system will then utilize 2 pneumatic cylinders which have solenoid valves to actuate and push the product in their respective collection station. The color sensor has been used to identify the object passing on the conveyor based on a specific color. As soon as the required color is identified the color sensor passes a specific signal to the PLC which will in turn operate the respective cylinder to push out the product in the respective station. This way we can

fully automate the sorting system. Sorting these products is a very difficult process. Continuous manual sorting creates a consistency issue. This paper has described a working prototype designed for the automatic sorting of objects based on their color. Color sensor is used to detect the color of the product and the PLC microcontroller was used to control the overall process. The identification process of the color is based on the frequency analysis of the output of the color sensor.

3.5. MATLAB:

Sorting of products is a very difficult industrial process.Continuous manual sorting creates consistency issues. This project describes a working prototype designed for automatic sorting of objects based on the color. TCS230 sensor is used to detect the color of the product and theArduino Uno and MATLAB are used to control the overall process. The identification of the color is based on the frequency analysis of the output of the TCS230 sensor. Twoconveyor belts are used, each controlled by separate DCmotors. The first belt is for placing the product to be analyzed by the color sensor, and the second belt is for moving the container, having separated compartments, in order to separate the products.

4.Literature review:

- Stepan Ozana, Zdenek Slanina, Martin Pies VSB, deals with simulation, control and visualization of color-sorting machines. It is based on Matlab. The proposed method can be in several subjects, namely Control Systems or Design and Realization of Controllers. This work briefly gathers principles of creation program and scheme for state-controlled process in Simulink. Particular methods of artificial intelligence were used for color detection.

- Harshita Borkar implements color processing in different industries gives us more leverage to solve the consistency problem of continuous manual sorting. The Arduino Nano microcontroller, TCS3200 color sensor, servo motor, and other electronic components are used to study, develop, and build a color sorter. The comparing technologic can be proposed in the project. The TCS3200 color sensor

is the best sensor for color sensing and we built the color sorting machine using arduino nano.

- *Design And Development Of Colour Sorting Robot (Lim Jie Shen, Irda Hassan)-2015.* In this method, the first step begins with the background material study, after the background study is completed, the next very important classification color detection connection, color recognition connection , the manufacturing of the robot body after the following steps have the construction of the assembly parts is very important, and the troubleshooting analysis is carried out in the last part.
- *Arduino Based Color Sorting Machine using TCS3200 Color Sensor (Ch. Shravani, G. Indira, V. Appalaraju)- 2019.* Sorting objects is an essentially mechanical process that requires hard work. Chronic manual organization leads to consistency problems. Above all, machines can do boring tasks that humans are superior to. Worker burnout in sequential manufacturing structures can lead to reduced execution and purpose issues when it comes to holding the object well. An employee who has repeatedly researched may eventually forget to recognize the color of the article, but not a machine. This document was used near the organization of elements that is fully used on shading based on the shading of the TCS3200 shading sensor associated with servo motors associated with Arduino.

- *Automatic Color Sorting Machine Using Arduino Mega Microcontroller (Aye Myat Myat Myo , Zar Chi Soe)-2019.* The paper describes a system that can work with success and classify the thing by its color. the color sorting machine may be a good color sorter that may acknowledge RGB color balls and Drop the balls within the right place". There are classifiers that use PIC microcontrollers however cannot. Several are often simply created exploitation Arduino programming. "The real contribution of this technique is that it can cut back the time needed for color sorting, creating this system a lot more economical than the present one". This sorter not solely reduces the manual effort but conjointly the time required. , but also forestall color blind individuals from selecting the wrong color and being unable to settle on the proper color.

- *Arduino Based Color Sorting Machine (N. Monika, C.R. Pramod , B.S. Vinod)2020.* There is a wide range of many products in our daily life, and the manufacture of these products occurs in many large and small industries. The organization makes quality a consistent theme. Too many items to sort. Organizing elements in an industry is a tedious process that is usually done physically.However, classifying items by physical methods is more time-consuming. To save time and be accurate in sorting, we introduce automatic color sorting machines. Color sorter is a device that sorts the object by its color. We use the TCS3200 color sensor to detect the color of any object and after detecting the color. The servo motor rotates and according to mechanism the object will be allocated to a particular box. They can be used in a variety of applications where color discrimination and color classification is important. Some of the application areas are agribusiness (color sorting of grain), food industry, diamond and mining industry, recycling, etc.

- *Arduino Based Lemon Sorter Machine (Ajay H. Chauhan, Neema Ukani, Pratik V. Yennewar, Sandeep Sonaskar, Nilakshi Hiwanj, Saurabh Chakole) 2021.* In This paper they are sorting the lemons using the sensor. All over the world, the demand for automation is increasing sharply in industry. Arranging objects according to their color tone is a very problematic task. This document gives us an idea on the selection of fruits according to their color palette. “Here in this paper they design and implement an efficient color sorter using the TCS3200 color sensor based on Arduino NANO. This design provides best or more accuracy, performance and repeatability”. Easy to use and build, reducing human error, human effort, and industry expense.

5. Applications of sorting machine:

Specifically, manufacturers use color vision to solve three primary vision applications:

1. Color verification -- Verifying that a certain part's color matches whatthe

vision system is programmed to find.

2. Color sorting -- Sorting parts based on color.

3. Color inspection -- Inspecting coloured parts for defects that grayscaleimage processing tools can't detect.

6. Future scope:

Here instead of using a webcam vision camera is to be used. The machine vision camera obviously will have better resolution, zooming capacity and clarity and moreover an inbuilt circuitry for external triggering. So it will save the circuitry used for interfacing the sensor with the computer as the sensor output will be directly made available to the camera so it will also save time as the computer will not be in the connection at all.

Here only part sorting is done but in future by some modification we can also include following things:

- Number of parts are sorted
- Number of parts passed
- Checking label on the part
- Check the crack or dent on the part ● Measuring dimension

7.Conclusion:

The suggested framework will be a demo rendition which gives expense effectiveness, taking less time and technically the easiest way for differentiating objects. This framework utilizes raspberry pi which makes this model simple to utilize which is more additional effective. The main failure will be caused if the detecting of objects according to color is not done. Therefore, it is very important to have proper and checked cameras. Further, making desirable changes can be used in small scale and large scale industries as well.

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