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Microcontroller Based Product Sorting by Using Colour Sensor

Manoj Kharade, Sarthak Bhavsar, Swati Rathod, Kajal Molane, Suraj Mishra

[1]*Assistant Professor, Trinity College of Engineering and Research, Pune, India.*

[2]*Student, Trinity College of Engineering and Research, Pune, India.*

Corresponding Author: kajalmolane6@gmail.com

Abstract: - This paper presents a microcontroller based control system that can be applied for product sorting on basis of color. In many industrial applications, there is a need of sorting. Sorting can be done by using many ways according to the dimensions, colours, weight, using machine vision (image processing), material of an object etc. For example, in Thermal Power Station, electromagnetic sorting technique is used to sort ferromagnetic materials from coal. This project consists of components such as microcontroller, conveyors, colour sensors, electronic system and motors. The objects are being sorted according to their respective colour. The main conveyor has support of two separate branches which leads towards a pair of proximity sensors. In this project, the system provides a user-friendly environment to establish an easy communication between humans and process.

Key Words: -*Microcontroller, Color Sensor, Product Sorting.*

I. INTRODUCTION

In most of the industries, packaging systems use a line bridge as a sorting element in their industry. While some industries use manual sort in their systems as labor is available and they find the sorting systems are of higher cost. But to see, the manual sorting process has its own cons. It requires plenty of time and excess efforts. But even after that there is no guarantee that the objects will be sorted precisely and there will be 100% accuracy in it. In some industries like the pharmaceutical industry objects are produced according to batches and when this sorting fails, the entire batch needs to be discarded. It wastes a lot of efforts and cost of producing the objects. So to assist these industries, a system that will sort objects automatically according to their color can be designed and the result obtained will be totally accurate. microcontroller will be acting as the main controller here. A Color sensor is used to detect the color of the product that is to be sorted. The identification process of the color is based on the frequency analysis of the output of the color sensor. The main objective of the paper is to present a way to has been to sort the object based on the color for sorting in the industries. The proposed system works on a microcontroller which is widely used in the industries. The system will work when any colored object is placed on the conveyor belt. The object can be colored Red, Blue, Green or a mixture of any of these colors. A color sensor is attached on the side of conveyor belt for detection of the object. The color sensor will read the color values in terms of RGB percentage of the object color and compare it with a predetermined value threshold already programmed using the microcontroller. If the color sensor will find the color to be above the threshold it will instruct the microcontroller to activate the piston right next to the color sensor. The piston will now push the object into a bucket

right in front of it. If the color sensor reads a different value, then the set threshold it will just pass it forward where another piston will sort the product in another bucket. The system will become more complex if we want to increase the number of objects sorted based on different colors. Microcontroller has been used to control the various operations. It is a very useful in a wide variety of industries with the help of a microcontroller especially into the packaging section. Automatic sorting machine enhances the efficiency, practicality, and also the safety of the operators. It ensures that the remarkable processing capacity is also peerless performance including the color detection. Although we need to add a higher speed DC motor and sensor with an appreciable response to speed up the system for the industrial application. The model can be improved by making some changes into the program and components. Some suggestions are given for improving the system like adding a load cell for the measurement and control of weight of the product. A counter can be used for counting the number of products. System speed can be increased accounting to speed of production. Adding more sensors for quality control will benefit. The sensor can be changed according to the application as a future scope of this project. DC motor can be replaced with a stepper motor. Microcontroller can be replaced with a PLC. Segregation which is based on size can be done by installation of sieves of various sizes PH sensors installed for food industry application to check the freshness.

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II. EXISTING SYSTEM

The current existing systems contain use of different technology is made according to different conditions like budget and scope of industry. Some more components that can be included to make the system better are robotics systems, microcontroller based system, sensor based system and pneumatic based system, etc. Further the accuracy of the system depends mostly on the use and type of color sensors. Currently existing systems usually contain an RGB based color detection system. The ratio of RGB declares the exact color of the product that is being sorted. In current systems, use of different technology is made according to budget and scope of industry. It includes robotics systems, microcontroller based system, sensor based system and pneumatic based system, etc.

A. Robotic Systems-

servo motors are used to control the robotic arm whose degree of rotation is controlled by the on timer of the pulse rail appearing at its control inputs. According to the structure of robotic arm various degree of rotation for the servomotor are assigned to carry out the operations. The arm of robot is realized using aluminum brackets. Four types of brackets are arranged for this purpose. The robotic arms are too costly and complex due to the complexity and the fabrication process. Two different types of the brackets are used for holding the servo motors and two different types of brackets are used for the extensions and interconnections of the robotic arm. The IR sensor identifies the box and it sends the data to a microcontroller which controls the arm motion according to the height of box. The motion of the servo motor is controlled in a manner so that each box is dropped into a respective boxes place in a predetermined position. It takes approximately half a second for the robotic arm for a single motion. Eight steps of motion of robotic arm are required for a box to be picked up and to be dropped in the correct basket. That includes motion of arm from the default position, picking a box, motion to the correct basket, dropping the box to the basket and return to the default position. The number of steps taken by the arm to pick the box and drop the box counts to seven steps and from there to back to default position needed one step. It takes approximately one second for the microcontroller to identify height of the box. Therefore, the total time needed for picking and dropping the box including identifying the height is around five seconds. Four motors are used in the robotic arm. One to control the rotational motion of the base, one to control the angle at the elbow, one to control the wrist movement and last one to control the gripper, that is to hold and drop the ball. To open and close the gripper, a lever mechanism is used. So a single motor has enough power for the gripper control. Fingers come closer to pick and hold the box and move apart when it drops the box. There are two positions that are designed for the fingers by using a single servo motor. One in close position and the other in open position. Two motions are permitted for the motor at wrist and elbow that is to move up and down.

The advance system of product sorting is according to weight and old system was based on sensor. There were some systems which counts that how many objects are going from the conveyor belt. Such systems make use of sensor. When carton passes through conveyor, at the side of conveyor normally transmitter and receiver infrared sensor were used. Whenever the carton cuts the infrared beam, the electronic counter system in digital form gets '0' which was counted as count. Sensor based systems are used to sense coming object and count them. But the drawback of the system is that it can only sense the object but it cannot calculate the weight of object. So it doesn't have the provision of sorting carton as per required weight.

B. Microcontroller Based Systems

The microcontroller based systems are having kind of artificial efficiency as microcontroller can be programmed as per the system requirement. The microcontroller is programmed to count the carton passing from conveyor and also to measure weight of carton box. There are many such systems that are available which are used online check-weightier to calculate the weight of object. If we use microcontroller, then cost price of the system get increased. The major drawback of using microcontroller is that its hardware requirements will also go on increasing as it does not contain inbuilt timer, counter. All this drawback of existing system is overcome in microcontroller based object sorting automation which sort object according to the height.

A pneumatic powered system with a belt conveyor is used to feed the boxes. It is driven by means of a motor. Capacitive sensors are fixed at required heights to sort the respective boxes. Three double acting cylinders are used for sorting of the boxes when actuated by the sensors. The setup consists of a belt conveyor moving at an optimum speed. This belt conveyor is loaded with boxes of three different heights. There are three different sensors at suitable heights to sense the boxes. The highest length box will be sensed by the 3 sensors. The smaller of the two boxes will be sensed by only first sensor and will be sorted at third station. It is a traditional method to make use of pneumatic pressure pump for pushing or sorting the objects. But the major drawback in using all these old methods is the setup cost and their maintenance. Using pneumatic pressure pump requires a heavy setup which includes air compressor, control valves, air filter, pressure regulator, lubricator, direction control valve, flow control valves and all linking assembly.

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III. Components Of System

A. Photoelectric Sensor

This system contains 4 proximities optical sensor in another words photo electric sensor need to detect subject and height of subject. IRD 183 diffuse type photoelectric sensor is place in this project.

Fig.1.Photoelectric Sensor

B. AC Induction Motor

To run assembly of conveyor belt 3 phase induction motor is used. This motor is use with the help of Variable Frequency Drive. Which is used to control speed as per we need.

Fig.2.AC Induction Motor

C. Conveyer Belt

In this system there are two conveyors first for pre feed and second for main conveyor. The conveyor belt is part of mechanical piece that use to move material one part to another.

Fig.3.Conveyer Belt

D. Dc Geared Motor

This part is use to move subject. The right or left of diverter is done by this part. The object is push by metal strip which is connected motor shaft.

Fig.4. DC Geared Motor

E. Object Guider

The misalignment of objects is properly done by this component. Object guider is put or place the object at center of conveyor. The box has to pass through diverter which is sensed by first sensor. Improper way of box location will cause problem afterword. Guider can easily arrange proper location placed objects.

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Fig.5. Object Guider

F. Microcontroller

The microcontroller should be easy to use. It also consists of hardware & software design to do all industrial apparatus as well as process. The main points of microcontrollers it can be program and reprogram. Some highly sell microcontroller are 8051, Arduino, AtMega, PIC, etc.

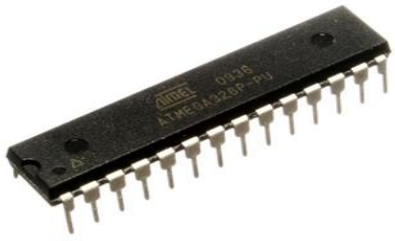

Fig.6.Microcontroller

IV. ADVANTAGES

- More accuracy.
- Higher efficiency.
- Better precision as margin of error is reduced to greater extent.
- High degree of intelligence.
- Low failure rate with longer life.
- Reliable operation.
- Fully automatic operation.
- Low maintenance.
- Online programming is possible.
- Overall increase in quality of objects.

V. DISADVANTAGES

- Requires programming to be controlled.
- System suitable for batch products only.
- If system fails, the entire batch will be wasted.

VI. APPLICATIONS

- In pharmaceutical industries for sorting tablets or capsules according to colors.
- In hardware industries to sort metallic and non-metallic objects.
- In food industry to identify rotten fruits and vegetables.
- In small scale and large scale industries, to sort the products based on the various
- parameters e.g. color.
- In production units to scan and identify the defects in raw materials.
- In malls (to segregate and separate different clothes, toys, bags etc.) and in small shop.

VII. FUTURE SCOPE

In industries like packaging process and similar, this system can be very useful along with the help of microcontroller. Automatic sorting machine enhances efficiency, practicality, and safety of operators. It ensures remarkable processing capacity as well as peerless performance including colour detection. We also need to add high speed DC Motors and sensors with appreciable response to speed up the system

for industrial application. The model can be improved by making some changes in the program and components. Some suggestions are given below.

- A load cell can be used for measurement and control of weight of the products.
- We can also add a counter for counting the number
- of products.
- Speed of the system can be increased accounting to the speed of production.
- Quality control can be performed by adding more sensors.

- The sensor can be changed according to the type of product.

REFERENCES

[1]. C. Zhang and K. S. Seasick, "Colorimetric sensor array for soft drink analysis", J. Agric Food Chem., vole 55, pp 237-242, 2007.

[2]. P. D. Oram and J. Strine, "Color measurement of a solid active pharmaceutical ingredient as an aid to identifying key process parameters", J. Pharm Biomed Anal, vol 40, pp 1021-1024, 2006.

[3]. M. Frank, Nobert Kaiser, Wolfgang Buss, Ramona Eberhardt, "High-speed industrial color and position sensors", Electronic Imaging'99, pp 50-57, 1999.

[4]. A. Acquit, J. Frisbee, Danny Diamond, King Tong Lau, Alan Farrell, Bird Quilt, Dermot Diamond, Development of a smart packaging for the monitoring of fish spoilage", Food Chem., vole 102, pp 466-470, 2007.

[5]. E. J. Cadieux Jr, "System and method for visually inspecting a cigarette packaging process", ed: Google Patents, 2002.

[6]. D.J. Lee and R. S. Anbalagan, "High-speed automated color sorting vision system", in Optical EngineeringMidwest'95, pp 573-579, 1995.

[7]. J. V. Popov-Ralji, et al, "Investigations of bread production with postponed staling applying instrumental measurements of bread crumb color", Sensors, vol 9, pp 8613- 8623, 2009.

[8]. J. V. Popov-Ralji and J. G. Lalii-Petronijevi, "Sensory properties and color measurements of dietary chocolates with different compositions during storage for up to 360 days", Sensors, vol 9, pp 1996-2016, 2009.

[9]. R. Baribeau, "Color reflectance modeling using a polychromatic laser range sensor", IEEE T Pattern. Anal., vol. 14, pp. 263- 269, 1992.

[10]. H. Escid, et al., "0.35 mm CMOS optical sensor for an integrated trans impedance circuit", the International Journal on Smart Sensing and Intelligent Systems, vol. 4, no. 3, pp. 467481, September 2011.

[11]. Norfazlinda Binti Daud, "Application of colors sensor in an automated system", Technical University Malaysia, May 2007.

[12]. Bickman, Josh, "Automated Color-Sorting uses optical technology", vol. 13, 1996.