Automatic Color Based Product Sorting

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Abstract-

Sorting of products is a very difficult industrial process. Continuous manual sorting creates consistency issues. This paper describes a working prototype designed for automatic sorting of objects based on the color. TCS230 sensor was used to detect the color of the product and the PIC16F628A microcontroller was used to control the overall process. The identification of the color is based on the frequency analysis of the output of TCS230 sensor. Two conveyor belts were used, each controlled by separate DC motors. 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. The experimental results promise that the prototype will fulfill the needs for higher production and precise quality in the field of automation. To reduce human efforts on mechanical maneuvering different

types of sorting machines are being developed. These machines are too costly due to the complexity in the fabrication process. A common requirement in the field of color sorting is that of color sensing and identification.

The purpose of this model is to design and implement a system which automatically separates products based on their color.

This machine consists of three parts: conveyor belt, color sensor, and dc motor. The output and input of these parts was interfaced using PIC microcontroller.

1. Introduction

Machines can perform highly repetitive tasks better than humans. Worker fatigue on assembly lines can result in reduced performance, and cause challenges in maintaining product quality. 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. The purpose of this model is to design and implement a system which automatically separates products based on their color. This machine consists of three parts: conveyor belt, color sensor, and dc motor. The output and input of these parts was interfaced using PIC microcontroller.

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1. Literature Survey

According to survey [1], This paper describes a working prototype designed for automatic sorting of objects based on the color.

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analyzed by the color sensor, and the second belt is for moving the container, having separated compartments, in order to separate the products. The experimental results promise that the prototype will fulfil the needs for higher production and precise quality in the field of automation.

According to survey conducted by Malathy Jawahar [2], Component color matching is an important aspect in leather product manufacture and this is currently being carried out manually by experienced assorters.

The error in component color matching results in a product being rejected although all the quality parameters are otherwise met. Hence large leather product manufacturers are looking for an objective, cost effective and faster color sorting system.

Fatigue & subjectively associated with manual color sorting of components & productivity is also lower.

According to survey conducted by Timothy Henry, Laurence, Ishak [3], The aim of the study is to design and construct a color sensor based optical sorting machine and was carried out through several stages.

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According to survey conducted by Imam Hossain Saydee, S.M.G. Mostafa, Bayazid Al Imran [4], The system we have invented which is the combination of two individual processes successfully integrated into one system. On the beginning of the process shrinking is done through the hot chamber and later different sized products get separated into the different conveyer to go to market finally.

According to survey conducted by Sushrut Nagesh Kulkarni, Sanjay Kumar Singh [5], we have presented our system in this paper. We are using Raspberry Pi, which is an open source board based on Linux. In today's technology, raspberry pi has been a key in a major number of applications in automation. Our objective will be to examine its utility and effective use as a mechanical system in Sorting of Objects. Besides we are making use of a web camera that scans the

image of the particular object to be sorted. The scanned image is then further processed using OpenCV to detect the shape and color of the object. OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. Complication of robotic arm because it is used irrespective of object size.

According to survey conducted by Kai Zhou , Zhiwei Meng , Mingyang He , Jialin Hou , Tianhua Li [6], The grasping mechanism adopted a 4-degree-of-freedom (4-DOF) manipulator, and the machine vision control system adopted a monocular camera, which can realize the positioning and classification of the grasp-target. Finally, an automatic sorting test platform for agricultural products using a visual servo was built. Target classification, positioning and sorting tests were conducted using tomatoes and oranges as the test objects. The test results show that the success rate of the target positioning is close to 98%, that of the target classification is close to 98% and that of the grasping is close to 95%. Process is based on target based sorting technique.

According to survey conducted by Malvin Nkomo [7], The paper describes the development of an RGB color-sorting SCARA Robotic Arm that can distinguish color coded products in a defined workspace area and sort them according to their component color. The paper describes the development of an RGB color-sorting SCARA Robotic Arm that can distinguish color coded products in a defined workspace area and sort them according to their component color.

The design utilises System-on-Chip technology to design a low cost, low time-to-market/turnaround-time color sensing solution for a robotic arm for academic purposes using the SCARA geometry as a test platform. The paper covers the PSoC solution for the RGB light-to-frequency sensor network using the TCS230 module and IR sensors, the signal processing and the SCARA robotic arm construction.

According to survey conducted by Dharmannagari Vinay Kumar Reddy [8], In this case, it is desirable to create an autonomous robot that can identify objects from the conveyor belt and relocate them if the object meets certain criteria. In this case, it is desirable to create an autonomous robot that can identify objects from the conveyor belt and relocate them if the object meets certain criteria. In this case, it is desirable to create an autonomous robot that can identify

objects from the conveyor belt and relocate them if the object meets certain criteria.Targeted work because of robotic arm.

According to survey conducted by TuongP h ou c Tho, Nguyen Truong Th 'II hI [9], The sorting system uses the camera placed on the top of the mechanical conveyor belt. With the images captured by the camera, the software will perform the algorithms to identify the location and characteristics of the object (ei. tomatoes), the data of objects is used by pick and place process that synchronize with controller of robot. The sorting process comprising the steps of: detecting the object, determine the object properties (ei. color, size, shape, ...), locate the object, calculate the actual gripping position, the results of the sorting process will be stored and converted into signals to communicate with the control system of robot to perform the sorting tasks. The algorithms will be experimented on Delta robot 3 D.O.F, results will be analyzed and evaluated to calculate the workspace of Robots, so that the productivity and energy efficiency is appropriate. It uses robot so it is targeted work, therefore more maintaining is required and less efficiency is there.

According to survey conducted by Md. Jamilur Rahman, Deb Prosad Das [10], This project is a combination of electrical, mechanical and visual subsystems. A Pixy cam along with the image processing software does the job of color detection. We have used several servomotors for rotating the arms of the robot. The arms can move horizontally from its base and vertically up and down. The gripper is capable of moving quite far for proper gripping of objects. This multi-DOF (Degree of Freedom) robotic sorter can be a very useful tool in fully automating a production process, which uses conveyer belts. The overall improvement in the efficiency of the production process can be significant by using this machine. Predefined targeted work therefore less efficient in providing results.

According to survey conducted by S. A. Khan, T. Z. Anika, N. Sultana [11], This paper represents the design and implementation of color sorting robotic arm which can detect the exact position of an object and can pick up the object to place it in designated place. This robotic arm is like human arm which can rotate according to its predefined angles. On the other hand, detecting an object on color basis is done by ultrasonic sensor & color sorting sensor. The heart of this project is microcontroller board ATMEGA328P

which controls servo motors used in base, elbow, wrist and grip. The prototype of this project was made and used for picking red, green and blue color objects. The system can only identify Red, Blue, Green color.

According to survey conducted by Ruchita R. Mhaski, P.B. Chopade, M.P. Dale [12], we are inspecting the quality of tomato based on shape, size and degree of ripeness. An edge detection algorithm is used to estimate the shape and size of tomato and color detecting algorithm is used for the ripeness determination. All these algorithms are implemented on Raspberry Pi development board which will become independent and cost effective system. Our system includes Raspberry Pi development board, conveyor belt, motors, Pi camera. All the interfacing of the above devices will be carried out and will make a cost effective embedded system for the determination of shape, size and degree of ripeness of tomato. Same system can be utilized for other fruits and vegetables also. It will going to be used in Food industry only.

1. Proposed System

This system is designed for automatic colored based products. It is based on Machine Learning (ML). It consists of servo motor, conveyor belt, sorting arm and a camera.
When products with different colors are placed on the conveyor belt they undergo through camera which sends the information of the product to the color sorting controller.
After receiving the information the controller detects the color of the following product. Once the color is detected, the products are sorted into different compartments based on the color.
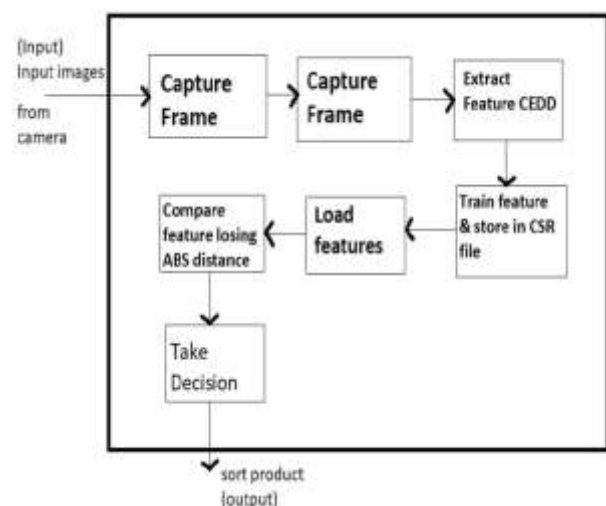

Fig. Proposed system

1. Conclusion

According to our survey, we came to a conclusion that most of the work previously done was not fully automatic so we developed a sorting machine using PIC for automatic color sorting, taking into consideration three colors namely green, red and black. This system sorts products automatically using machine learning. This system improves manufacturing process and reducing errors hence improving products quality and saving time.

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