

Princess Sumaya University for Technology

King Abdullah II Faculty of Engineering

Electrical Engineering Department



Princess Sumaya جامعة
University الأميرة سميرة
for Technology للتكنولوجيا

COLOR SORTING MACHINE

Authors:

Tala Hashem	20190406
Tala Ibrahim	20190891
Dana Khasawneh	20190362

Supervisor:

Dr.Belal Sababha

Abstract

A color sorting machine is a device that uses various technologies, such as sensors, to automatically sort items by their color. The machine can be used for a variety of applications, including sorting food items, sorting recyclable materials, and sorting industrial products. The project typically involves designing and building the machine, programming the machine to correctly identify and sort items by color, and testing the machine to ensure it is functioning properly. The end goal is to create a machine that can sort items quickly and accurately, reducing labor costs and increasing efficiency in various industries.

TABLE OF CONTENTS

1	Introduction	2
1.1	Objectives	2
1.2	Theory.....	2
2	Procedure and Methods	4
3	Design	3
4	Results	5
5	Conclusions	5
5	References.....	5

1 INTRODUCTION

A color sorting machine is a device that uses various technologies, such as cameras and sensors, to automatically sort items by their color. The project of designing and building such a machine is a complex one, and typically involves a team of engineers and technicians with expertise in mechanical engineering, electrical engineering, and computer programming. The goal of the project is to create a machine that can accurately and quickly sort items by color, thereby reducing labor costs and increasing efficiency in various industries. This can be applied in many sectors like agriculture, food, recycling and many more. In this project, the engineers and technicians will work together to design and build the machine, program it to correctly identify and sort items by color, and conduct thorough testing to ensure that the machine is functioning properly. The introduction of color sorting machine projects aims to improve the efficiency and accuracy of sorting processes, and ultimately have a positive impact on the industries that use them.

1.1 OBJECTIVES

The objectives of a color sorting machine project typically include:

1. To design and build a machine that can accurately and quickly sort items by color: This includes selecting the appropriate technologies, such as sensors, and designing the mechanical components of the machine to ensure proper functioning.
2. To program the machine to correctly identify and sort items by color: This includes writing software code that can analyze images captured by the cameras and sensors and make decisions about which items to sort.
3. To ensure the machine is user-friendly and easy to maintain: This includes using LCD to display the color of each item at each iteration. Also, it includes a push button that acts as an interrupt to display the number of items in each basket as well as a switch to start the sorting operation.
4. To conduct thorough testing of the machine: This includes testing the machine's ability to accurately and quickly sort items by color.

1.2 THEORY

The theory behind color sorting machines is based on the principles of color science and machine vision. Color science involves the study of the physical properties of light and color, as well as the human perception of color. Machine vision, on the other hand, involves the use of sensors to interpret visual information and make decisions based on that information.

Color sorting machines use a combination of these technologies to identify and sort items based on their color. The machine typically includes a color sensor which has photodiodes that capture the intensity of each of red, blue, and green lights. Once the color of each item has been identified, the machine can sort the items into different categories or groups based on their color.

List of components and how they work:

1.TCS3200 COLOE SENSOR: The TCS3200 color sensor is a commonly used device for color detection and measurement. It works by detecting the intensity of light in different color bands (red, green, and blue) and using that information to determine the color of an object. The sensor operates using the principle of a photodiode array and a color filter.

2. T-pro Mini Servo Motor SG-90 9g Servo: The T-pro Mini Servo Motor SG-90 9g Servo is a small and lightweight servo motor that is commonly used in robotics, RC cars, and other applications that require precise control of position or movement. The servo motor works by using a combination of a DC motor, a gear train, and a feedback control circuit.

The DC motor provides the power to rotate the output shaft of the servo. The gear train, which is made up of several gears, is used to reduce the speed and increase the torque of the motor. This allows the servo to produce a large amount of torque at a relatively low speed.

3. The standard 16X2 LCD character module: A standard 16x2 LCD character module is a type of liquid crystal display (LCD) that is commonly used for displaying text and other characters in electronic devices. The module consists of a LCD panel, a driver circuit, and a backlight.

The LCD panel is the heart of the module and it is made up of a matrix of liquid crystal cells that can be controlled to display characters and symbols. The cells are arranged in a grid of 16 columns and 2 rows, which is why it is referred to as a 16x2 LCD.

The driver circuit controls the operation of the LCD panel and is responsible for sending the data and commands to the LCD. The driver circuit is typically made up of a series of shift registers, a controller IC, and other components.

4. Pic (16F877A): The PIC16F877A is a microcontroller developed by Microchip Technology. It is based on the PIC architecture and is commonly used in embedded systems and other control applications. The PIC16F877A has a wide range of features including: -An 8-bit CPU -35 I/O pins - 8K bytes of Flash program memory -368 bytes of RAM -A variety of peripheral modules such as timers, A/D converters, and communication interfaces.

The PIC16F877A is programmed using a specialized programming language called assembly, or using a high-level language such as C or Basic with the help of a compiler. Once programmed, the PIC16F877A can be used to control various devices and systems by processing inputs and outputs, performing calculations, and making decisions based on the program code.

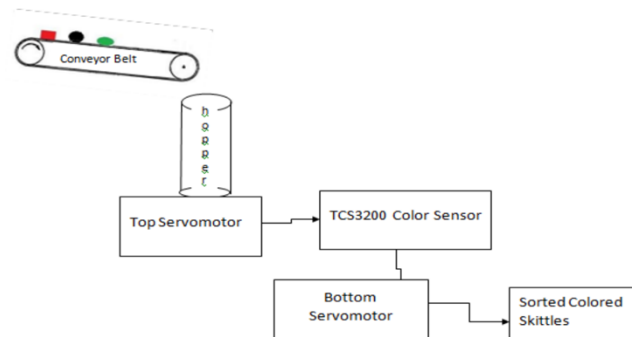
2 PROCEDURE AND METHODS

The procedure and methods for a color sorting machine project typically include the following steps:

1. Research and Analysis: Conducting research on the different technologies available for color sorting and analyzing the specific requirements of the industry or application for which the machine will be used.
2. Design and Engineering: Designing and engineering the mechanical and electrical components of the machine, including the cameras and sensors, and the sorting mechanism.
3. Programming: Writing software code to control the machine's operation, including image processing algorithms to analyze images captured by the cameras and sensors, and decision-making algorithms to determine which items to sort.
4. Fabrication and Assembly: Fabricating and assembling the different components of the machine, including the mechanical components, cameras and sensors, and control systems.
5. Testing and Calibration: Conducting thorough testing of the machine, including testing its ability to accurately and quickly sort items by color, and calibrating the machine to ensure optimal performance.

3 DESIGN

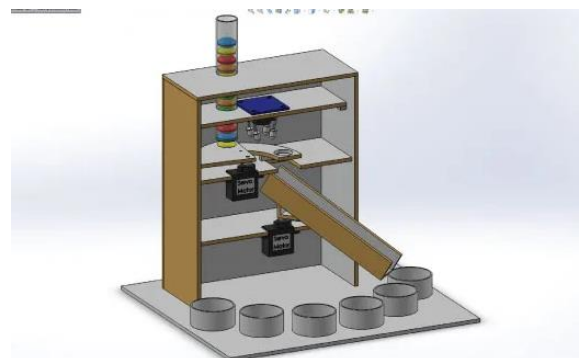
All we need for this project is one color sensor (TCS3200) and two hobbyist servo motors, which makes this project quite simple yet very fun to build it. In the first place, using the Solidworks 3D modeling software which shows the design of the color sorter and here's its working principle:



>Initially, the colored skittles which are held in the charger drop into the platform attached on the top servo motor.

>Then the servo motor rotates and brings the skittle to the color sensor which detects its color.

>After that the bottom servo motor rotates to the particular position and then the top servo motor rotates again till the skittle drop into the guide rail.



4 RESULTS

The color sensor will detect the light of the item after the switch is pressed, then convert it to frequency and based on frequencies it will sort it to blue ,red or green and drop the item on the basket. In case the push button is pressed, the lcd will display the total number of items in each basket.

5 CONCLUSIONS

Used the pic16f877a to design an embedded system model that sorts items based on their color. Also, make use of output devises such as led's, push buttons and sensors and interface them with the microcontroller.

6 REFERENCES

- [1] <https://howtomechatronics.com/projects/arduino-color-sorter-project/>
- [2] <https://www.youtube.com/watch?v=g3i51hdfLaw>