

# **Automated Color Sorting System** **using MATLAB & Simulink**

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# Introduction

The **Automated Color Sorting System** is designed to **identify and sort objects based on their colors** using **MATLAB & Simulink**. The system consists of:

- ✓ A **conveyor belt** that moves objects
- ✓ A **color detection system** using image processing
- ✓ A **robotic arm** that sorts objects into bins

This system efficiently automates color-based sorting processes for **manufacturing, recycling, and logistics applications**.

## Objectives

The main objectives of this project are:

- **Detect object colors** (Red, Green, or Blue) using image processing
- **Move objects** on a conveyor system for processing
- **Use a robotic arm** to place objects into bins based on detected color
- **Display output bin number** corresponding to each color

## System Overview

The system consists of three major components:

- A **Conveyor Belt System** that moves the object to a detection point.
- A **Color Detection System** that reads the color from an image and classifies it.
- A **Robotic Arm Control System** that sorts the object into the correct bin based on color (Red → Bin 1, Green → Bin 2, Blue → Bin 3).

All components work together to mimic a real-world automated color sorting system using mechatronics principles.

## Tools & Software Used

- **MATLAB (Basic Version)** – For writing the image processing script and preparing inputs.
- **Simulink** – For modeling the system behavior and simulation.
- **Image Processing Toolbox (optional)** – Only for viewing or extracting colors.

Advanced toolboxes like Robotics Toolbox and Simscape Multibody were not used.

## Implementation Steps

### Conveyor Belt System

- **Pulse Generator:** Simulates motion of the conveyor.
- **Integrator:** Accumulates pulse values to represent object position.
- **Compare To Constant:** Checks if the object has reached the detection point.
- **Switch Block:** Controls whether the conveyor passes the object based on the compare result.
- **Display Block:** Shows conveyor movement or position value.

This subsystem helps in simulating the real-world object motion towards the sensor.

## Color Detection System

- **MATLAB Script:** Extracts RGB values from the center pixel of a loaded image.
- **RGB Normalization:** Values are scaled between 0 and 1.
- **Time Series Conversion:** Required for Simulink to accept the RGB inputs.
- **MATLAB Function Block:** Determines the bin number based on RGB dominance.
- **Output:** The bin number (1, 2, or 3) is sent to the next subsystem.

## Robotic Arm Control System

- **From Blocks:** Receive input from both Color Detection and Conveyor Position systems.
- **Multiport Switch Block:** Based on the detected bin number, the system decides which path the object should take.
- **Display Block:** Shows final sorting result:
  - 1 → Red Object to Bin 1
  - 2 → Green Object to Bin 2
  - 3 → Blue Object to Bin 3

This subsystem simulates the robotic decision-making process.

## Results & Output

- The system is tested with different images containing red, green, or blue objects.
- For each image:
  - The center pixel color is extracted.
  - The RGB values are analyzed.
  - A bin number (1, 2, or 3) is generated based on the dominant color.
- The final bin number is shown in a **Display Block** within the Simulink model.
- Sample output:
  - **Input: Red Object → Output: 1**
  - **Input: Green Object → Output: 2**
  - **Input: Blue Object → Output: 3**

## Conclusion

This project successfully demonstrates a beginner-friendly automated color sorting system using only the basic components of MATLAB and Simulink. It mimics industrial applications such as packaging and recycling lines. The avoidance of advanced toolboxes makes this project ideal for educational and academic environments, especially for introducing students to mechatronics and automation concepts.