

Color-Based Automated Sorting System

Our project is an object classifier using conveyer belt which detects objects using webcam and does triple segregation on the basis of two colors and classifies the unidentified object as trash.

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Key Features of the Sorting System

Color-Based Sorting:

Detects green and blue objects for sorting using HSV filtering.
Objects not matching color ranges are marked as "trash" automatically

Single Actuator:

We have achieved trinary classification with use of only a single actuator

Live Object Tracking:

Arduino with servo controls for real-time detection using webcam and OpenCV.

Automated Sorting:

Servo-controlled 3D-printed arm pushes objects into correct bins.

Arduino Control:

Arduino Uno handles motor control based on serial commands from Python.

Modular Design:

Easily expandable to support more colors or features in future.

Hardware Components

Arduino Uno

Main microcontroller for motor and servo control



Gear Motor

Drives conveyor belt at steady speed



Servo Motor

Rotates 3D-printed arm to sort objects



Sorting Arm

Custom 3D-printed arm for classification



Conveyor belt transports objects to detection zone boxes.

System Workflow

1

Place Object

Object is placed and moved forward by the gear-driven conveyor belt.

2

Image Capture

Webcam captures real-time frames as the object passes through the detection zone.

3

Color Detection

OpenCV checks object color (green, blue, or trash) using HSV filtering.

4

Python Sends Command to Arduino

Based on the color, a signal (G, B, T) is sent via serial communication.

5

Object Reaches Sorting Point

Conveyor continues until object aligns with the sorting arm.

6

Servo Sorts the Object

Arduino activates servo to move the arm and push the object into the right bin.

Software Tools and Integration



OpenCV (Python)

Used for real-time color detection using HSV filtering. Captures video frames from the webcam and classifies objects as green, blue, or trash.



Arduino IDE

Controls servo and gear motors based on received commands. Handles real-time movement of the sorting arm and conveyor operation.



Python Serial Communication (pyserial)

Sends color classification results to Arduino via USB (e.g., 'G', 'B', 'T') to trigger appropriate sorting actions.

Challenges Encountered

HSV Calibration

Tuning color ranges for different lighting.

Timing Sync

Coordinating object detection with servo movement to sort at the correct moment.

Conveyor Speed

Maintaining consistent belt speed to ensure objects stay in the camera's detection zone long enough.

Webcam Integration:

Ensuring real-time, stable frame capture without lag or frame drops for accurate detection.

Arduino-Python Communication:

Reducing delays and ensuring reliable real-time data transfer over serial communication.

Future Improvements

AI/Deep Learning Integration:

Transition to AI models like CNNs for more accurate and robust classification beyond color detection.

Multi-Color Detection:

Expand detection to support a wider range of colors for more versatile object classification.

Automated Sorting System:

Implement advanced robotic or pneumatic arms for efficient sorting of classified objects.

Cloud-Based Data Analysis:

Utilize cloud computing for real-time data storage, analysis, and remote monitoring for system optimization

A serene landscape photograph of a sunset over a mountain range. The sun is a bright, glowing semi-circle on the horizon, casting a warm orange and yellow light across the sky. The mountains are silhouetted against the bright sky, creating a layered effect. The foreground shows dark, silhouetted trees and foliage. The overall mood is peaceful and contemplative.

Thank you!