

Machine Vision Quality Inspection

Use an optical sensor to classify parts and reject items that do not meet the color specification.

Customer Lockwood Aerospace Manufacturing	Department Quality Assurance	Difficulty Intermediate	Time 1-2 class periods
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Production Goal: Automatically identify and route production batches.

Background

An aerospace connector supplier uses color to identify production batches. Parts from the wrong batch must not reach assembly. Your workcell must measure hue, classify each incoming disk, and route it to an accepted or rejected location.

Learning Objectives

- Collect and interpret optical-sensor data
- Select threshold values from repeated measurements
- Use conditional logic for automated decisions
- Calculate inspection accuracy

Equipment

- VEX CTE Workcell
- Optical sensor
- 6-Axis Arm
- Red and green disks plus one unknown/test disk
- Python project
- Engineering notebook

Student Instructions

- 1 Turn on the optical sensor light at a consistent power.
- 2 Collect at least ten hue readings for each known color and record the range.
- 3 Choose threshold values that separate the two groups.
- 4 Create an inspection function that returns the detected class.
- 5 Program the robot to inspect and route each disk.
- 6 Test a randomized sequence of twenty disks without changing thresholds.
- 7 Record true color, detected color, and destination.
- 8 Calculate accuracy and revise thresholds only if the data supports a change.

Engineering Requirements

- Inspect twenty randomized parts
- Achieve at least 95% correct classification
- Send uncertain readings to a reject location
- Return to a safe position between parts

Constraints & Safety

- Use one optical sensor
- Keep lighting and inspection distance consistent
- Do not identify colors manually during the final run
- Hardware locations remain fixed

Deliverables

- Hue calibration table
- Python inspection and routing program
- Twenty-part confusion/accuracy table
- Threshold justification
- Reflection

Reflection Questions

- 1 Why were repeated readings necessary?
- 2 Which color had the widest range?
- 3 How should the system handle an uncertain value?
- 4 How could ambient light affect production?

Engineering Support

Engineering Tip

Use the midpoint between non-overlapping data ranges as a starting threshold, then verify it with randomized tests.

Common Mistake

Choosing a threshold from one reading often fails when lighting or part position changes.

Stretch Goal

Add a third color or a confidence band that automatically rejects borderline readings.

Career Connection

Machine-vision and quality engineers build inspection systems that prevent defective or incorrect parts from reaching customers.

Before You Submit

- Notebook evidence included
- Requirements checked
- Testing documented
- Reflection completed