AI Color Recognition and Smart Application of Waste Sorting

Applicable Grade Level: Grades 1–3

Duration: 90–120 minutes

Course Objectives

1. Knowledge Objectives

(1) Understand the basic concept of AI and how it helps robots recognize colors to assist in tasks like waste sorting.

(2) Recognize the three primary colors—red, yellow, and blue—and understand that they are the foundation of many other colors.

(3) Know the basic principle of AI waste sorting: using features like color for classification.

(4) Understand the basic color-to-category relationships (e.g., red = hazardous waste, blue = recyclable).

(5) Learn how to use modular Scratch programming to make the ICRobot respond differently to various colors.

2. Ability Development

(1) Improve observational skills by watching how the robot reacts to different colored cards.

(2) Enhance hands-on abilities by participating in programming and handling color cards.

(3) Develop teamwork and communication by dividing roles (card holder vs. remote guide).

(4) Learn to identify and solve problems when the robot misidentifies colors or fails to reach the target.

3. AI Literacy Enhancement

(1) Experience real-life applications of AI technology, such as color recognition in waste sorting, to enhance students' understanding of and interest in AI.

(2) Understand that AI technology requires human design and programming, and cultivate students' awareness of using AI to solve practical problems.

(3) Establish the concept that technology serves life and supports environmental protection, and stimulate students' enthusiasm to explore more application scenarios of AI technology.

Teaching Materials Preparation

- ICRobot (1 per group, ensure programming mode works properly)
- Primary color cards: red, yellow, blue (3–5 cards per group per color; colors should be vivid and non-reflective)
- Computer with camera (1 per group, pre-installed with ICreateCode software and ICRobot driver)
- Floor markers (use colored tape on the floor to mark the starting point, zones for different garbage categories, and the end point; keep a reasonable distance between zones)

Class Process

I. Lesson Introduction (10 minutes)

1. Real-life Scenario Introduction:

Show two images to the class — one with clean and well-sorted garbage bins, and the other with messy bins filled with mixed trash. Then ask:

"Kids, which of these garbage bins looks nicer to you?"

"What might happen if we throw garbage in the wrong place?"

(Guide students to answer: it makes the environment dirty, smells bad, etc.)

"How can we help garbage find its proper home?"

(Encourage students to suggest ideas like sorting trash by category.)

Then say:

“Well, we need to sort our garbage properly. Today, I’ve brought a little helper for garbage sorting — the ICRobot! It’s a color detective that can recognize colors and help us sort garbage correctly!”

2. Demonstrate the robot in action:

Let the ICRobot recognize a red color card and respond accordingly. This demonstration will spark students' curiosity.Say to the class:

“Would you like to know how the robot did that? Today, we’re going to learn all about color recognition and how AI helps us sort waste!”

II. Knowledge Explanation (25 minutes)

1. Understanding the Primary Colors (10 minutes)

The teacher uses a PPT to show pictures of red, yellow, and blue, and explains to students that these are the three primary colors.

Conduct a simple experiment: use transparent colored films of the three primary colors and overlap them in pairs. Let students observe how the colors change — for example:

Red + Yellow = Orange

Yellow + Blue = Green

Red + Blue = Purple

This helps students visually experience the magic of primary color mixing.

Connect these colors to real-life objects to reinforce understanding, such as:

A red apple

Green grapes

A blue sky

2. AI Knowledge and Waste Sorting (15 minutes)

Explain the concept of AI:

“AI is like a smart brain that can learn and recognize different things. In waste sorting, AI can identify colors, shapes, and other features of trash to determine its category.”

Introduce the process of AI-based waste sorting:

“First, people train AI to recognize the features of different types of trash — for example, red items for hazardous waste, blue items for recyclable waste. When trash appears, AI behaves like a detective, observing and categorizing it into the appropriate group.”

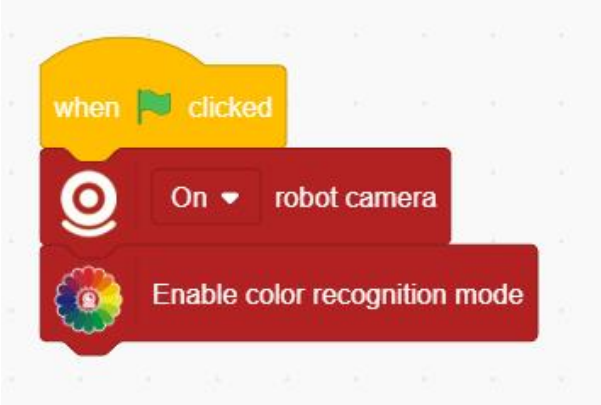
Show real-world images of AI in action, such as smart trash bins that sort waste by color recognition, so students can visually understand how AI works in daily life.

III. Practical Demonstration (20 minutes)

1. Programming Demonstration (12 minutes)

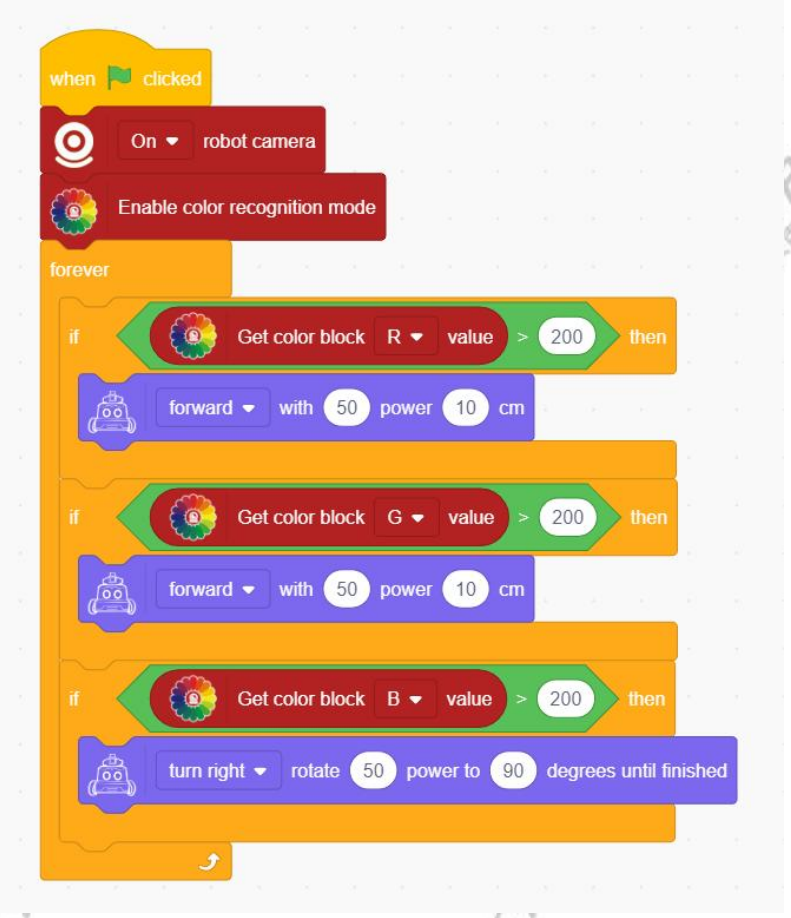
The teacher opens the ICreateCode programming software on the computer and connects the ICRobot device.

First, drag the “On robot Camera” block to activate the computer’s camera and begin video input.



•While demonstrating, explain the programming logic:

"We need to tell the robot what action to take when it sees a certain color — just like giving it commands."



2. Robot Trial (8 minutes)

The teacher holds up different colored cards in front of the camera, allowing students to observe whether the robot responds correctly according to the programmed instructions.

Intentionally introduce a small error — for example, placing the card at an incorrect angle, causing the robot to misidentify the color. Prompt students to think critically by saying:

“See? Sometimes the robot can make mistakes. This might happen if the card is placed incorrectly. So we need to be careful during the activity.”

IV. Challenge Activity (30 minutes)

Group Setup:

1. Students are divided into groups of 4–5. Each group selects one student to be the "card holder" (who will not see the robot or the field throughout the task). The remaining team members are responsible for guiding the robot based on its reactions.

2. Activity Rules Explained by the Teacher:

“The card holder must follow the teammates’ instructions to present the correct color cards in sequence to the computer’s camera. The robot will react based on the color it detects. Your goal is to work together and guide the robot—using its reactions and the floor markings—to deliver each piece of 'trash' (represented by colored cards) to the correct garbage zone and eventually reach the finish line.”

3. Activity Recording Sheet:

Each team receives a task sheet to record:

Which color cards were used

How the robot responded

Any challenges or issues encountered during the task

4. Group Activity Begins:

Students begin the challenge. The teacher observes and offers support, helping resolve any issues such as incorrect programming blocks or communication breakdowns within the group.

V. Reflection & Discussion (15 minutes)

1. Group Sharing:

After the activity, each group selects a representative to share their takeaways and challenges encountered during the task.

2. Teacher-led Discussion:

Question 1: “How did the robot help us track the trash?”

➢ Guide students to answer: The robot used color recognition to track the trash (color cards). The camera acted as its “eyes,” allowing it to detect colors and perform specific

actions based on the programmed instructions to help classify trash.

Question 2: “How else can AI help protect the environment?”

➢ Encourage students to brainstorm. Examples may include:

Monitoring air quality

Controlling industrial emissions

Optimizing waste processing systems

The teacher can elaborate and summarize these points.

Question 3: “Why is waste sorting important? In what ways can we use AI to make garbage classification more efficient?”

➢ Let students freely express their thoughts.

Benefits of waste sorting may include:

Saving resources

Reducing pollution

Protecting the environment

Examples of how AI improves waste sorting:

Smart bins that automatically categorize trash

AI-powered sorting systems in waste processing facilities

VI. Post-Class Extension (5 minutes)

Multiple Choice Questions:

1. What is the “eye” of the smart waste sorting station? ( )

A. Mechanical arm B. Camera C. Trash bin

Answer: B

2. The role of the mechanical arm is similar to which part of the human body? ( )

A. Eyes B. Hands C. Feet

Answer: B

3. Where should a red battery be thrown? ( )

A. Red bin B. Blue bin C. Green bin

Answer: A

4. How does the smart waste sorting station identify which bin to use? ( )

A. By the size of the waste B. By the color of the waste C. By the weight of the waste

Answer: B

True or False:

5. The mechanical arm in a smart waste sorting station can grab anything freely and won't hurt your fingers. ( )

Answer: ✗

6. A blue plastic bottle should go into the blue trash bin. ( )

Answer: ✓

7. With smart waste sorting stations, we don't need to learn about waste classification anymore. ( )

Answer: ✗

8. The "brain" of the smart waste sorting station can recognize the color of trash. ( )

Answer: ✓

9. Which of the following is suitable for the green trash bin? ( )

A. Battery B. Vegetable leaves C. Plastic bottle

Answer: B

10. When the smart waste sorting station is working, it first “sees” the trash, then “grabs” it. ( )

Answer: ✓