OzoBlockly Editor

ORA: AI-Guided Sorting and Coordinate Transformation Challenge

Student Guide

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Introduction

In this lab, you will step into the cutting-edge world of industrial automation by bridging the gap between artificial intelligence and physical robotics. Your mission is to program ORA to perform a complex "search and sort" operation that mimics real-world smart manufacturing.

Unlike traditional robotic programs that follow fixed paths, this challenge requires ORA to both think and see. Using an integrated camera and LLM, your system must analyze a standard 8.5" x 11" grid to identify shapes on the grid. The LLM acts as the robot's brain, determining not only whether an object is a square or a circle but also its spatial location on the grid.

The core of this challenge lies in coordinate transformation. You will develop the logic necessary to translate two-dimensional paper coordinates into ORA's three-dimensional workspace. This involves mapping the paper grid's X and Y axes to the robot's grid, ensuring that ORA can navigate to the center of each shape.

Once the location is calculated, ORA must execute a flawless pick-and-place routine. Squares must be sorted into one designated bin, while circles are moved to another. This project simulates the high-tech logistics systems used in modern fulfillment centers, where AI and robotics collaborate to handle unpredictable variables. By the end of this challenge, you will have mastered the workflow of integrating vision-based AI with precision mechanical motion, transforming a static image into a dynamic, automated solution.

Lab Setup

Figure 1 shows a snapshot in time of the setup for this challenge. On the left are "bins" where ORA will place the circles and squares. On the right is the grid on which the circles and squares are manually placed, one at a time. A camera is suspended above the grid, attached to a wooden dowel rod that is attached to a ring stand. The height of the camera is adjusted so that the grid is close to filling the camera's field of view. The lamp in the bottom left corner of the snapshot provides good lighting for the grid. The snapshot shows an instant of time after ORA has placed a square and a circle into their bins. In the snapshot, ORA is about to pick up another square at location (x, y) = (120, 120) with the suction gripper. The bins and grid are printables that accompany this challenge lesson.

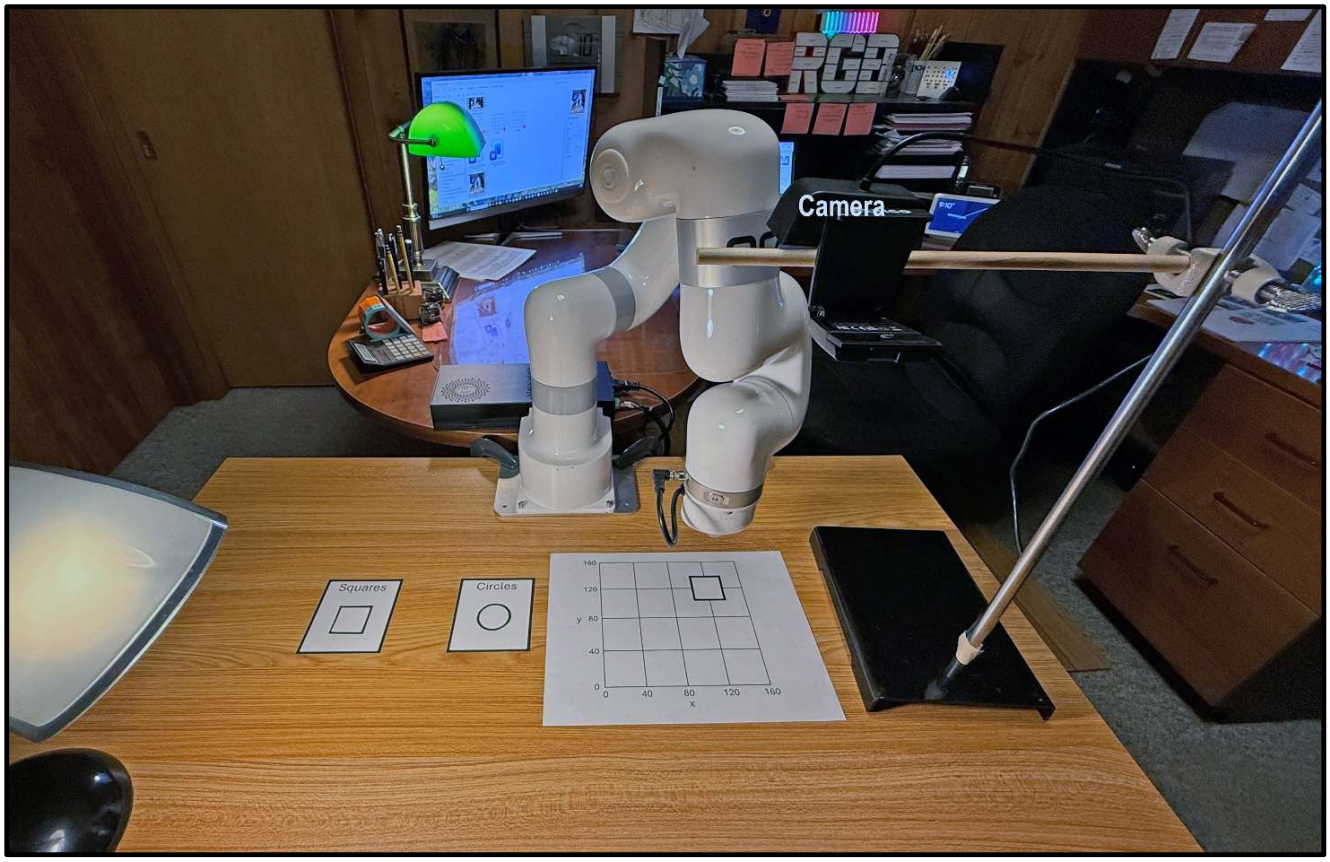

Figure 1

To get a better understanding of how the challenge works, you should view the accompanying 15-second time-lapse video that shows six shapes being transferred from the grid to their respective bins.

Two <u>VERY IMPORTANT</u> Notes Regarding Safety

1. You should include the Ozobot Editor block shown in Figure 2 at the beginning of your program, perhaps right after the *Program start* block or in a function where you initialize a number of things required by your solution to the challenge. Why? When ORA is moving at a slower speed, say 20% or less, you have more time to prevent an impending collision. Of course, this also allows a person more time to move out of the way of ORA's moving arm! This is particularly important throughout the development process while creating your program, when you are more apt to make errors in coordinate values in *move to coordinates* blocks.

Figure 2

2. Make sure that the **Emergency Stop Button** is within easy reach. It might even be a good idea to have one student with his or her hand above the button when the program is started, in the event that it becomes necessary to instantly terminate all motion of ORA's arm and cancel any commands.

Embark on an exciting journey into the world of robotics and artificial intelligence with this challenge. You'll gain hands-on experience in programming ORA to perform intelligent search and sort operations, simulating real-world smart manufacturing. This challenge combines creativity and problem-solving as you transform theoretical concepts into action, mastering coordinate transformations and enhancing automation. Join your fellow students in this innovative project that prepares you for the future of technology. Get ready to unleash your potential and make robots think and act!