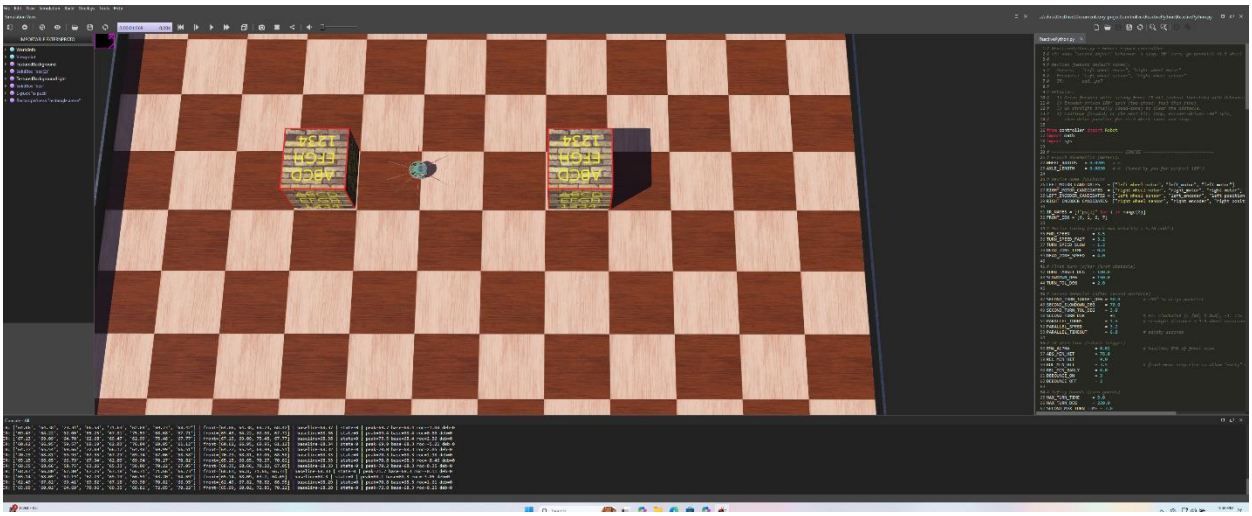
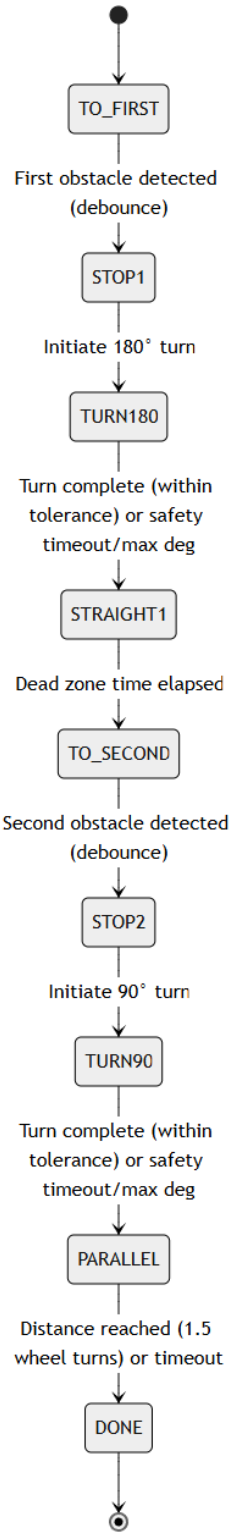
World Screenshot



State Diagram



Project Reflection

Working on this project provided valuable insights into how even seemingly simple robotic behaviors can be surprisingly complex to implement in practice. Getting the robot to move in a straight line was relatively straightforward once the wheel speeds were properly balanced and the baseline sensor readings were stable. However, the challenge began when trying to make the robot turn precisely 180 degrees. Early attempts often resulted in partial or overshot turns, which disrupted the sequence of behaviors. To correct this, I had to adjust the axle configuration and turning speed, fine-tuning the angular velocity until the robot achieved a reliable in-place rotation.

Another major difficulty involved object detection. The infrared sensors did not always respond consistently depending on the surface material and ambient lighting in the simulation environment. To improve accuracy, I had to calibrate the sensors carefully, modifying threshold values and smoothing the readings using an exponential moving average. This adjustment significantly improved the robot's ability to detect when it was close enough to an obstacle to trigger a behavioral transition.

Finally, getting the robot to run parallel to the second object was also challenging. It required balancing the sensor inputs so that the robot maintained a consistent distance from the object without veering away or colliding. This involved iterative testing, fine-tuning motor power, and adjusting the decision thresholds that determined when the robot stopped or turned slightly to correct its path.

Overall, the project reinforced the importance of iterative debugging, calibration, and sensor integration in robotics. Even small inaccuracies in sensor readings or motor control can lead to large behavioral errors, and success often depends on careful parameter tuning and attention to detail.