Tic-Tac-Toe-Playing Robot

Varshini Rao Venkateshwara Rao[1]
1229838274
[1]Robotics and Autonomous systems, Arizona State University, Arizona, USA

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ABSTRACT

This project uses cutting-edge technologies such as computer vision, robotics, and color recognition to build a Tic-Tac-Toe-playing robot with the goal of improving human-robot interaction. The centerpiece is the myCobot 280M5 robotic arm, which provides an adaptable platform for innovation and is equipped with either the Single Head Suction Pump or the Adaptive Gripper. The fundamental goal of the project is to create a user-friendly interface that seamlessly incorporates state-of-the-art technology and encourages a comfortable and engaging interaction between players and the robotic arm during live Tic-Tac-Toe games.

In addition to building a Tic Tac Toe-playing robot, this project goes beyond traditional robotics by imagining an immersive gaming environment where users actively engage in strategic gameplay with a robotic counterpart. Through the application of computer vision, the myCobot 280M5 robotic arm and its flexible end effectors become a technological marvel that increases the possibilities for interactive experiences. The expected outcome is not only a technical triumph but also evidence of the revolutionary potential of humanrobot cooperation in leisure-related contexts.

1. INTRODUCTION

The goal of the proposed project is to develop a fun and engaging robotic system that can play tic tac toe. This project uses the myCobot Pro robotic arm, which is fitted with an Adaptive Gripper or a Single Head Suction Pump, to create a Tic-Tac-Toe-playing robot. It does this by utilizing cutting-edge technologies like color recognition, robotics, and computer vision. The myCobot80M5's integration with Python, OpenCV, and other technologies presents a special chance to demonstrate the smooth interaction between humans and machines in a playful setting. The goal of this project is to create an engaging and user-friendly interface for interacting with a Tic-Tac-Toe-playing robot while investigating recreational robotics in the context of humanrobot collaboration. The project illustrates how combining cutting-edge technology can fundamentally alter how people interact with robotics in entertainment, even beyond its technical implications.

2. OBJECTIVE

1. Color Recognition Integration: To enable the robotic arm to recognize different color blocks and associate green with "X" and blue with "O" markers for Tic-Tac-Toe games, implement a strong color recognition system.

2. Tic-Tac-Toe Logic: Create a logical framework that will allow the robotic arm to play Tic-Tac-Toe strategically by moving in response to recognized colors, guaranteeing a responsive and interesting gaming experience.

3. Human-Robot Interaction: Provide a simple and easy-to-use interface so that players can communicate with the robotic arm, giving input and having fun in a fast-paced game of Tic-Tac-Toe.

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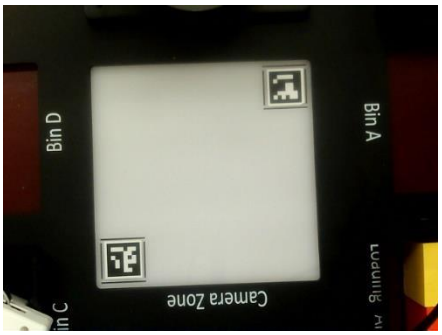
3. EQUIPMENTS

- myCobot 280M5

- End Effectors: Single Head Suction Pump

- USB Camera

- Aruku Markers



4. METHODOLOGY

4.1. **Camera Adjustment**

1 Setup

Before running the color recognition program, it is imperative to adjust the camera to cover the entire recognition area. Follow the steps below for the M5 version:

1.1 M5 Version

- Open a command prompt terminal and navigate to the "aikit_V2" directory. cd Desktop/aikit_V2/AiKit_280M5/
- Execute the following command to open the camera for adjustment.
  python scripts/OpenVideo.py

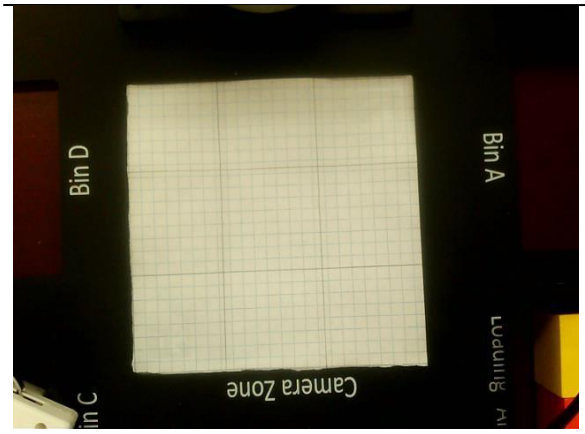
1.2 Verification

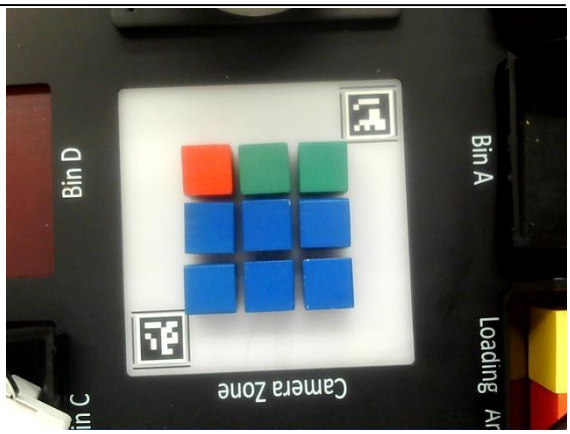
Ensure that the camera covers the entire recognition area, appearing square in the video. If adjustments are needed, modify the camera position accordingly.

Use a C type USB-to-serial converter to connect Mycobot to a laptop.

• COM10 was the port for my robot.

- Creating a 3 by 3 grid in the style of the tic tac toe game and using the eye-to-hand mode to adjust the camera for the best coverage of the recognition area.
- OpenCV was used to implement Python scripts that allowed the myCobot 280M5 robotic arm to recognize colors in real time.
- Mapping out a color-game in which the colors green and blue correspond to the "X" and "O" markers, respectively.

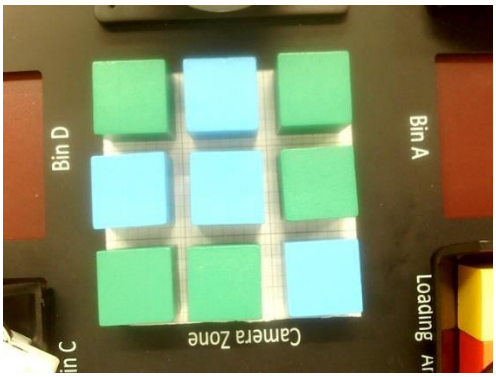




5. Color Block Recognition for Tic-Tac-Toe

A color-game mapping is created during the Tic-Tac-Toe execution phase, linking the colors blue and green to the "O" and "X" markers, respectively. When the robotic arm recognizes color blocks with the help of the applied color recognition system, it reads green as a cue to place a "X" marker on the appropriate grid, and blue as a cue to place an "O" marker. The Tic-Tac-Toe game's strategic movements made by the robotic arm and the visual input from the camera are seamlessly connected thanks to this intuitive mapping, which improves the user experience overall.

1. Using the camera feed, the hue values of the colors are identified and incorporated into the color detection code.
2. Using the pixel to real converter and the locations of the Arucu markers as references, the detected color is integrated with its position on the board.
3. After identifying the colors in the board state, the last step involved integrating the Mycobot 280M5 robot to place the blocks in the vacant spots of the board.



- Created an "alpha-beta" game logic for Tic-Tac-Toe that correlates with the recognized colors, enabling the robotic arm to move intelligently.

- The Alpha-Beta game logic algorithm is designed to optimize the search for the optimal move in adversarial games by intelligently evaluating and pruning potential moves in a decision tree.

- Integrate the myCobot280M5 end effectors and the color recognition system, modifying the Single Head Suction Pump's strategies.

2 M5 Version

- Open a command prompt terminal and navigate to the "aikit_V2" directory. cd Desktop/aikit_V2/AiKit_280M5/
- Execute the following command to start the improved color recognition program. python scripts/project.py

6. USER INTERFACE

- **Developing a user-friendly user interface (UI) to make it easier for people to interact with the robot that plays Tic Tac Toe.**

- **Added user interface elements that let players start the game, move around, and interact with the robotic arm.**

7. RESULTS

Even when it moves in second position, the robot's goal is always to win. There are lots of resources out there for strategies that achieve that. After the project is successfully finished, we hope to have a Tic-TacToe robot that can play dynamic games with users. The robotic arm will be able to respond to particular colors thanks to the color recognition system, converting them into tactical moves on the Tic-Tac-Toe board. The project's outputs will demonstrate how color recognition, robotics, and human-robot interaction can all be combined to create an engaging and dynamic application.

8. Conclusion

This project shows off technical mastery in the domains of computer vision, robotics, and human-robot interaction while also highlighting the potential for creative and entertaining applications in leisure 4 environments. Our goal is to create a real-world example of the fascinating opportunities that emerge when cutting-edge technologies and engaging user experiences come together by creating a Tic-Tac-Toeplaying robot.