

# Exploring Robot Programming with Python

## DevFest 2022

This document can be downloaded at <https://ailab.space/events/devfest2022>.

### 1 The Challenge

It is time to put together what you have learned so far to program a mobile robot to accomplish given tasks. You will **form two teams**. Each team will comprise of **five robots** and the members that operate these robots.

Your team will program the AlphaBot2 mobile robots to compete in the following challenges:

1. Teleop Box Steal
2. Autonomous Maze Navigation

These two challenges will take place at the same time. **30 minutes** will be given to program the autonomous robot and practice teleoperating the manual robot. After that, the challenge will start with a time limit of **10 minutes**. **Three robots from each team** will start Challenge #1 while the other robots (**two from each team**) will compete in Challenge #2. If the robots from Challenge #2 have completed the maze while Challenge #1 is still ongoing, the team can switch the robot to manual mode to help the team in Challenge #1.

#### 1.1 Challenge 1: Teleop Box Steal

For **Challenge #1** (Teleop Box Steal), the top half of the environment will be used where **three robots** will operate manually, i.e. its "Teleop challenge" **world (Figure 1)**.

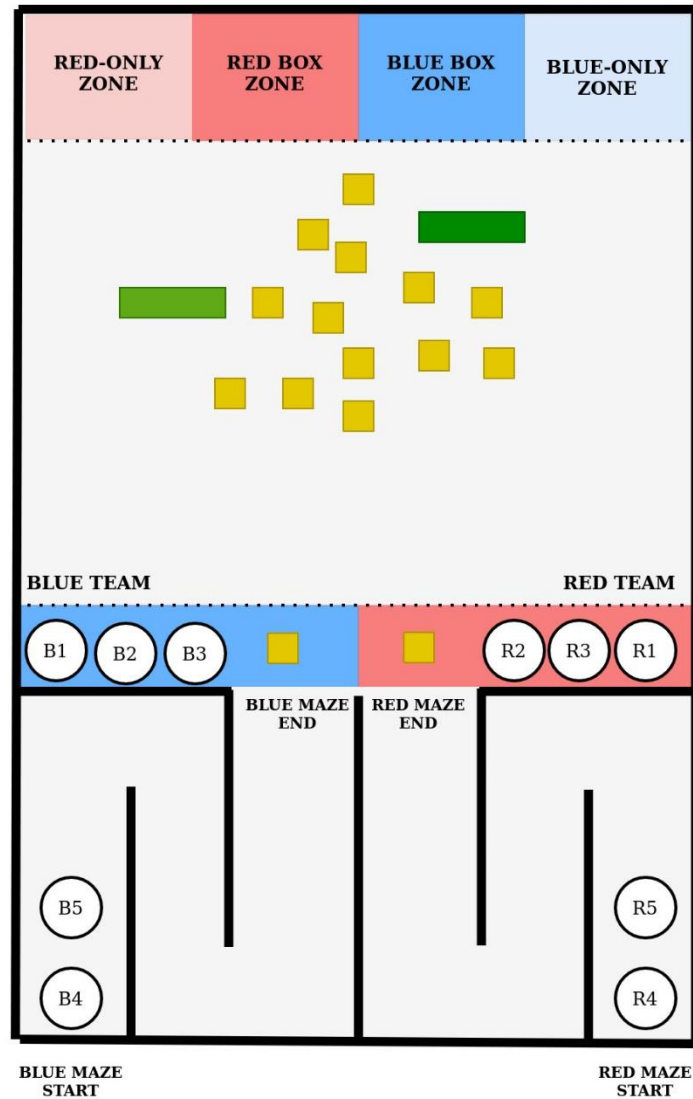


Figure 1. "Teleop challenge" world of the robot

- In this boxed environment, two teams will compete to secure as many points as possible by pushing the boxes to their team zone at the top center.
- Each team consists of **three robots** that will work together to secure the boxes by pushing them to their team zone. There are two different types of boxes, the small boxes, and the large boxes. Each **small box (gold)** is worth **1 point** whereas each **large box (green)** is worth **3 points**.
- The robots are manually controlled through teleoperation.
- You will have **30 minutes** to practice and modify your robots' scripts.
- This challenge will have a time limit of **10 minutes**. The team with the most points will win the challenge.
- You will have 30 minutes to practice teleoperating your robots.
- There are no rules, you may steal the other team's boxes if you wish. Plan your strategy!
- In the **final 1 minute**, no robot is allowed in the opponent's (color) zone. If a robot enters its opponent's (color) zone within

the final 1 minute, the team will be penalized by **2 points** and the culprit robot will be removed immediately and returned to its start zone.

## 1.2 Challenge 2: Autonomous Maze Navigation

For **Challenge #2** (Autonomous Maze Navigation), here's the environment where the robot will operate, i.e. its "Maze" world (**Figure 2**).

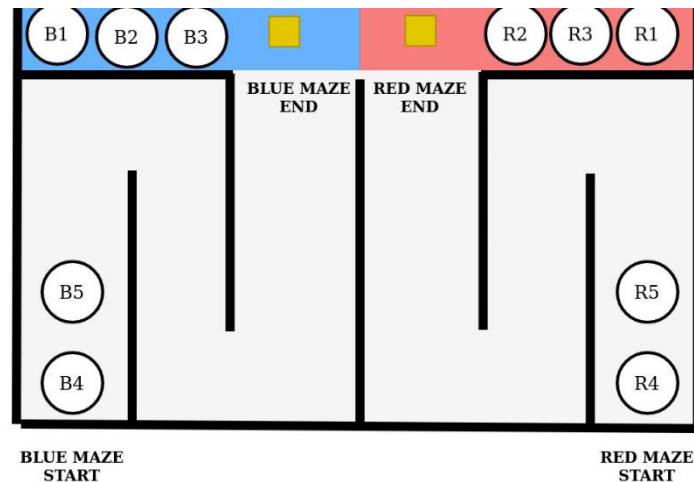


Figure 2. "Maze challenge" world of the robot

- In this maze environment, the robot will be tasked to autonomously navigate to the goal position (maze end).
- Unlike the previous challenge, **two robots** will be representing each team to compete in this challenge.
- You will work in pairs for this challenge to create an algorithm to solve this maze.
- Each robot should start from its start zone and maneuver autonomously towards the end of the maze. At the end of the maze, the robot should sound a beep and stop.
- You will have **30 minutes** to program and test the robots.
- This challenge will have a time limit of **10 minutes**. The robot that can complete the maze will be awarded **5 points**.
- The robot should be fully autonomous. Teleoperation (manually controlling the robot) will not be allowed in this part of the game field.
- After solving the maze challenge, you may switch your robot to manual mode and help your teammates in Challenge #1 if the Challenge #1 has not ended.

## 2 Preparation

This is what you should do:

### **Challenge #1 (Teleop)**

1. Choose three robots and the members to compete in this challenge.
2. Familiarize yourself with running the teleoperation scripts and practice controlling the robot.
3. If you wish, you may modify the teleoperation script to make it easier to control the robot. For e.g., changing the key inputs, and duty cycles of the motor to increase or decrease the travel speed of the robot.
4. You will have 30 minutes to practice controlling your robots and/or modifying your robot script before the challenge starts.
5. You may want to have a strategy.

### **Challenge #2 (Autonomous)**

1. Choose two robots and members to represent the team in the maze challenge.
2. Discuss and work together to design and implement robot behavior that can successfully complete the maze while avoiding the walls.
3. You will be using the functions learned from the workshop to give intelligence to the robot.
4. You will have 30 minutes to program your robots' autonomous navigation behavior to complete the maze.

In summary, you have 30 minutes of robot development and practicing time. Since the autonomous challenge will require more work, you may allocate some manpower to familiarize themselves with the controlling the robot for Challenge #1 and some to design and implement an intelligent behavior for Challenge #2.

- The End -