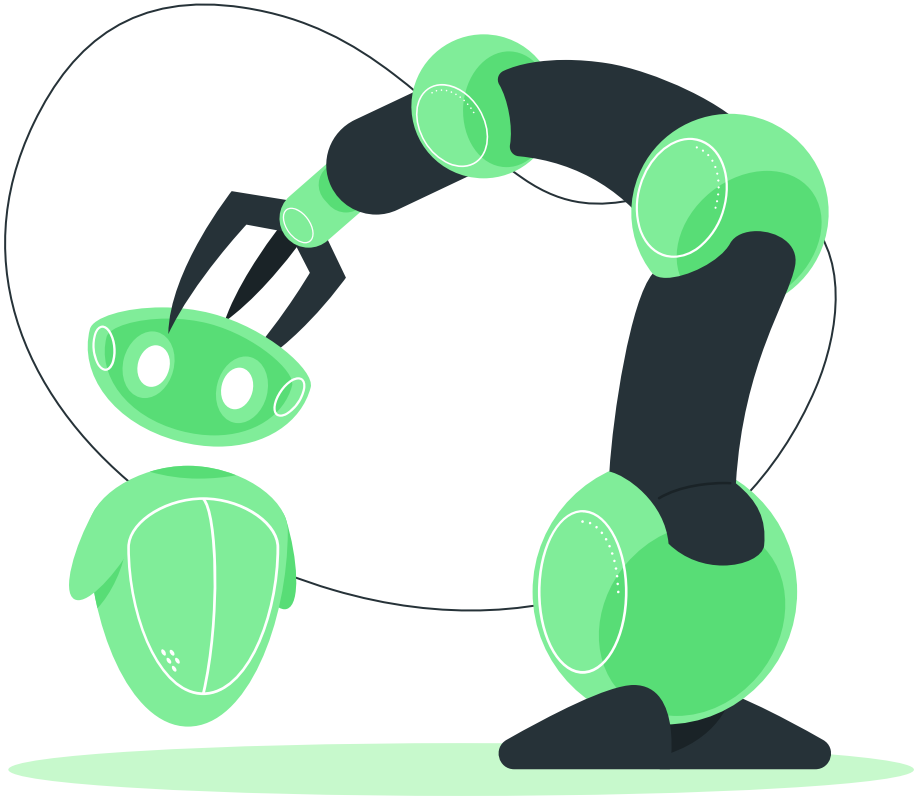
Labs and Final Project

Hsiao-Mei Wu
National Taiwan University
2022/09/30

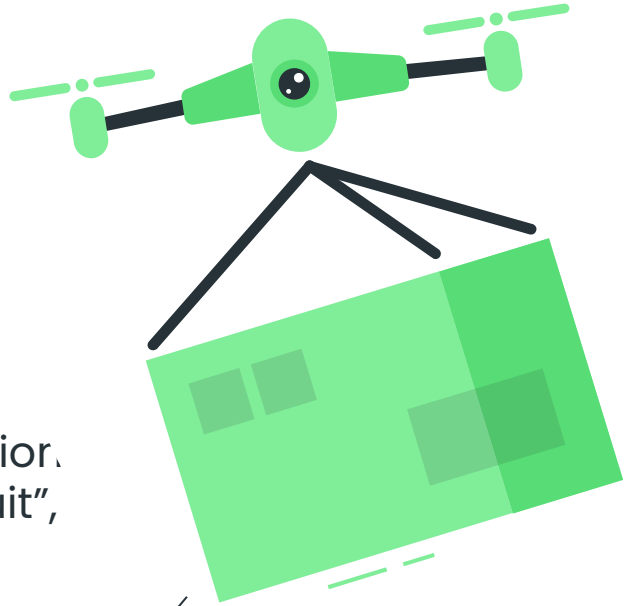


Outline

1. **Lab 1 to Lab 4**
   Basic knowledge
2. **Lab 5 to Lab 7**
   Step by step for you to finish the final project
3. **Final Project**
   The goal of the course
4. **Grades & Schedule**
   Contest rules and important dates

Lab 1 - Lab 4

Basic knowledge including “Combinatior
Circuit”, “Oscillators”, “Sequential Circuit”,
“Raspberry Pi & Arduino”



Lab 1: Combinational Circuits

1

Understanding Logic Gates and Truth Tables

Using NOT, AND, OR, NAND, NOR IC Gates

2

Boolean Formulas and Truth Tables

$$F = (A \cdot B) + (B \cdot C) + (A \cdot C)$$

Lab 2: Oscillators

1

4 Kinds of Oscillators

Lab 3: Sequential Circuit

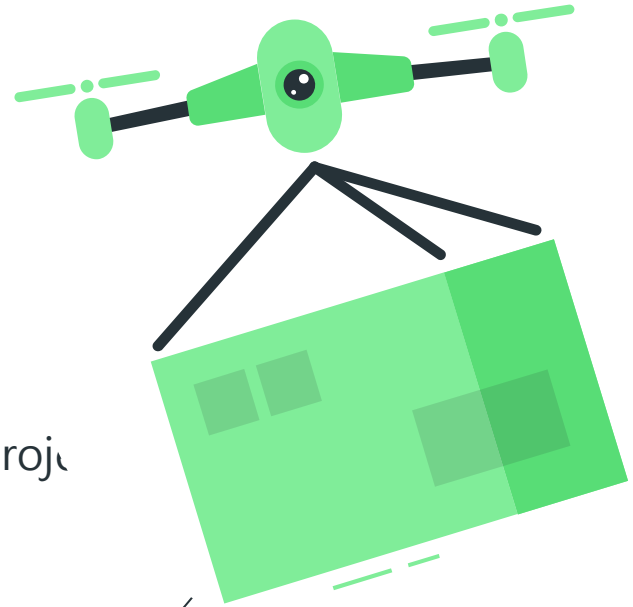
1. Power on reset circuit (POR)
2. Latch
3. Counter
4. BCD to 7-seg. decoder

Lab 4: Raspberry Pi & Arduino

1. Setup
2. Internet connection (SSH, FTP, VNC)
3. Linux
4. Integrated with Arduino

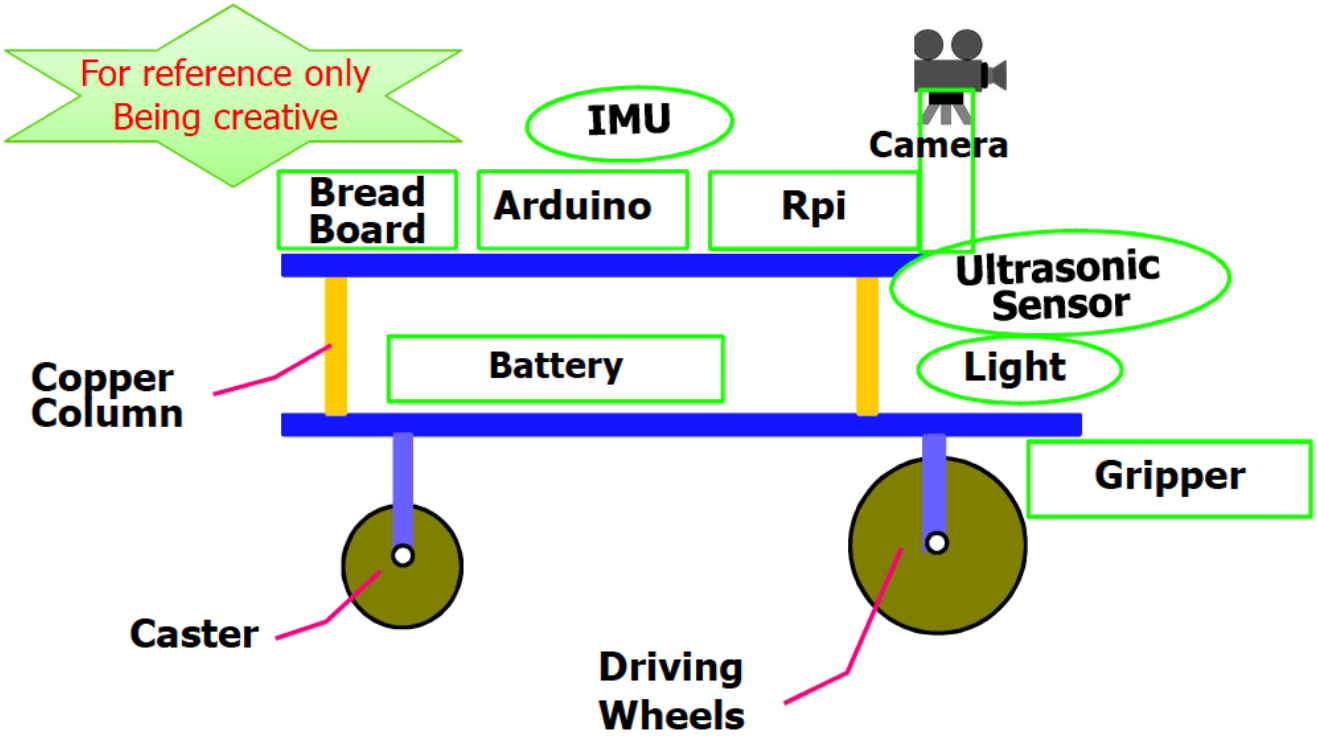
Lab 5 – Lab 7

Step by step for you to finish the final proj



Lab 5a: Vehicle Platform

Create a logistics vehicle controlled remotely

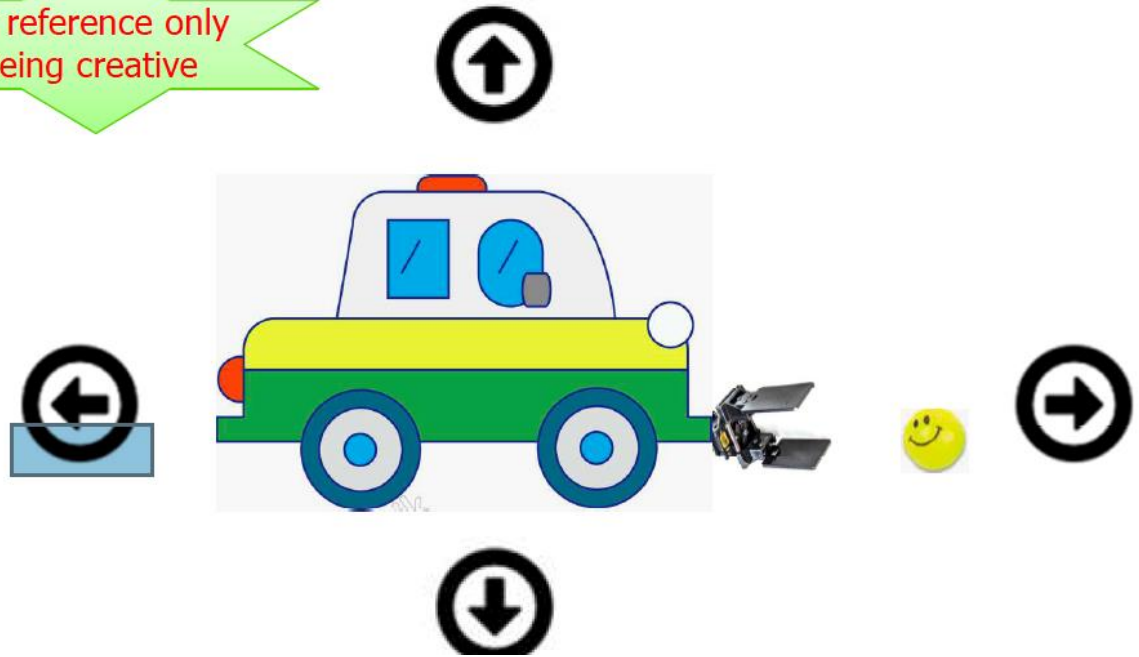


Lab 5b: Move and Grab

Python

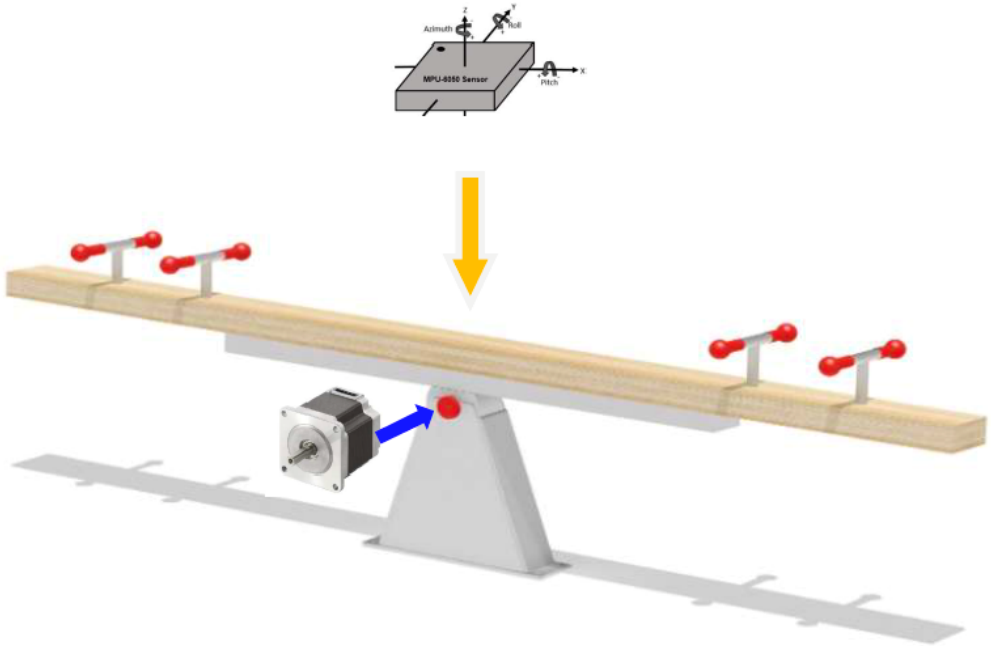
Move forward, backward, left/right turn and grab

For reference only
Being creative

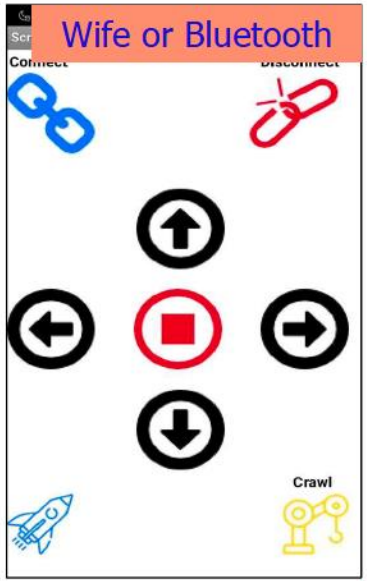


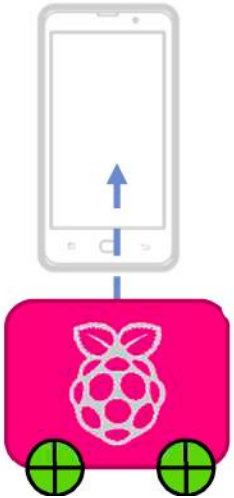
Lab 6: Seesaw Balancer

Use an IMU to sense the inclination of a seesaw and control/keep it at horizontal posture



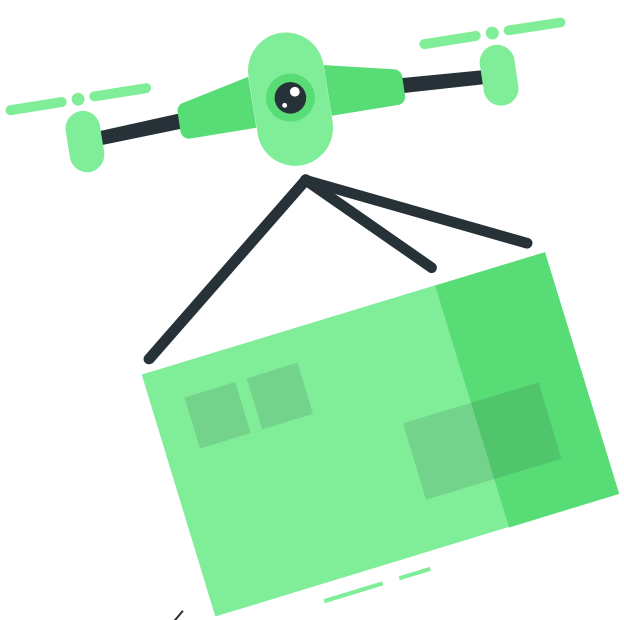
Lab 7: Interface

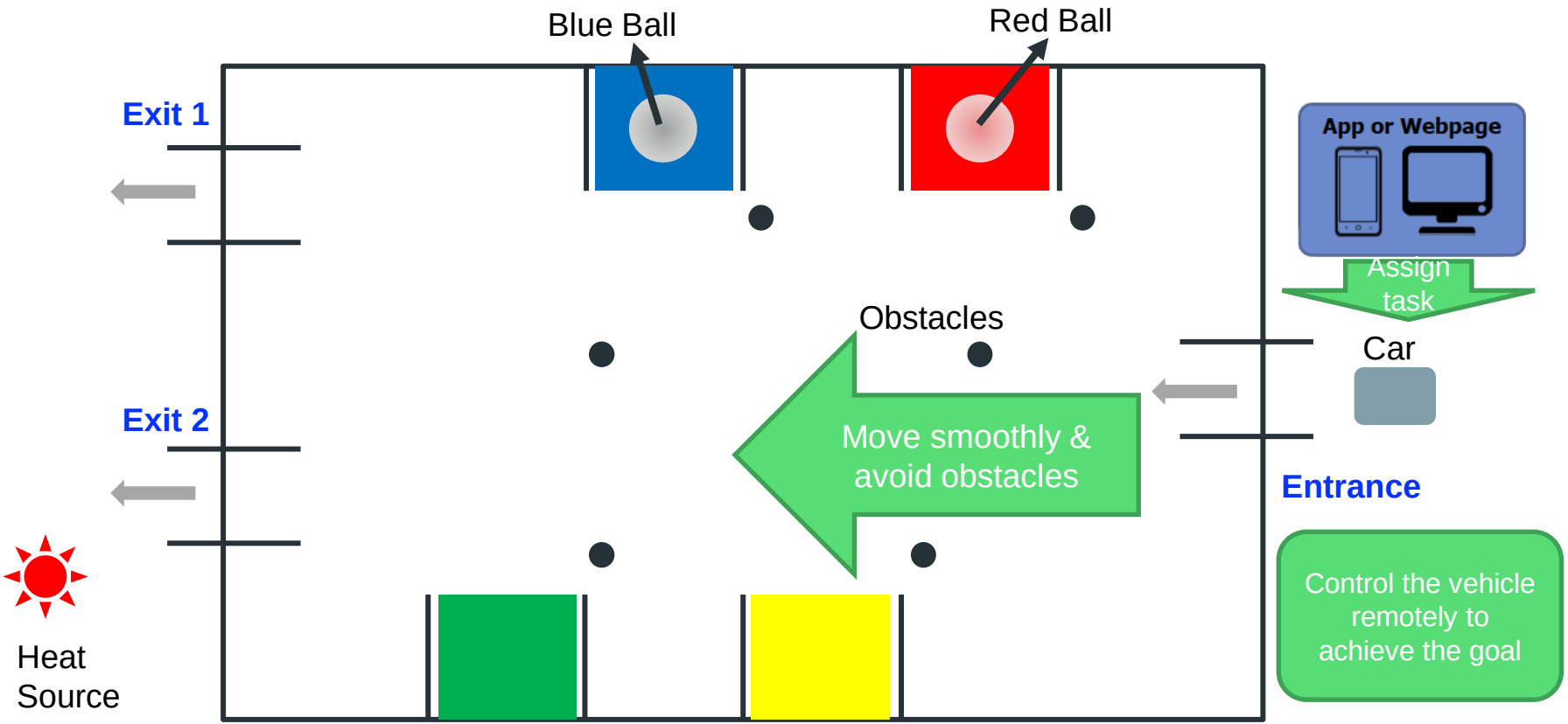


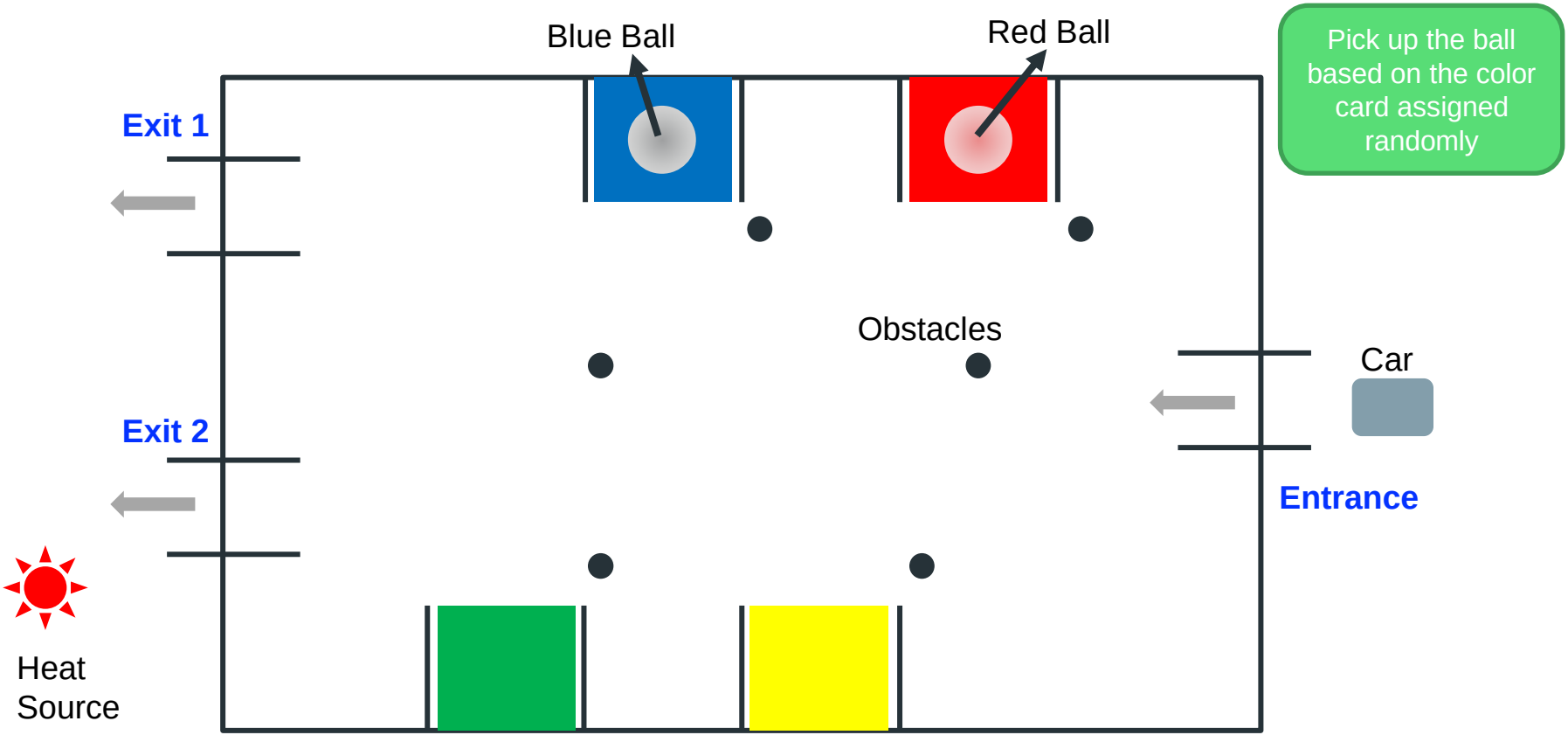


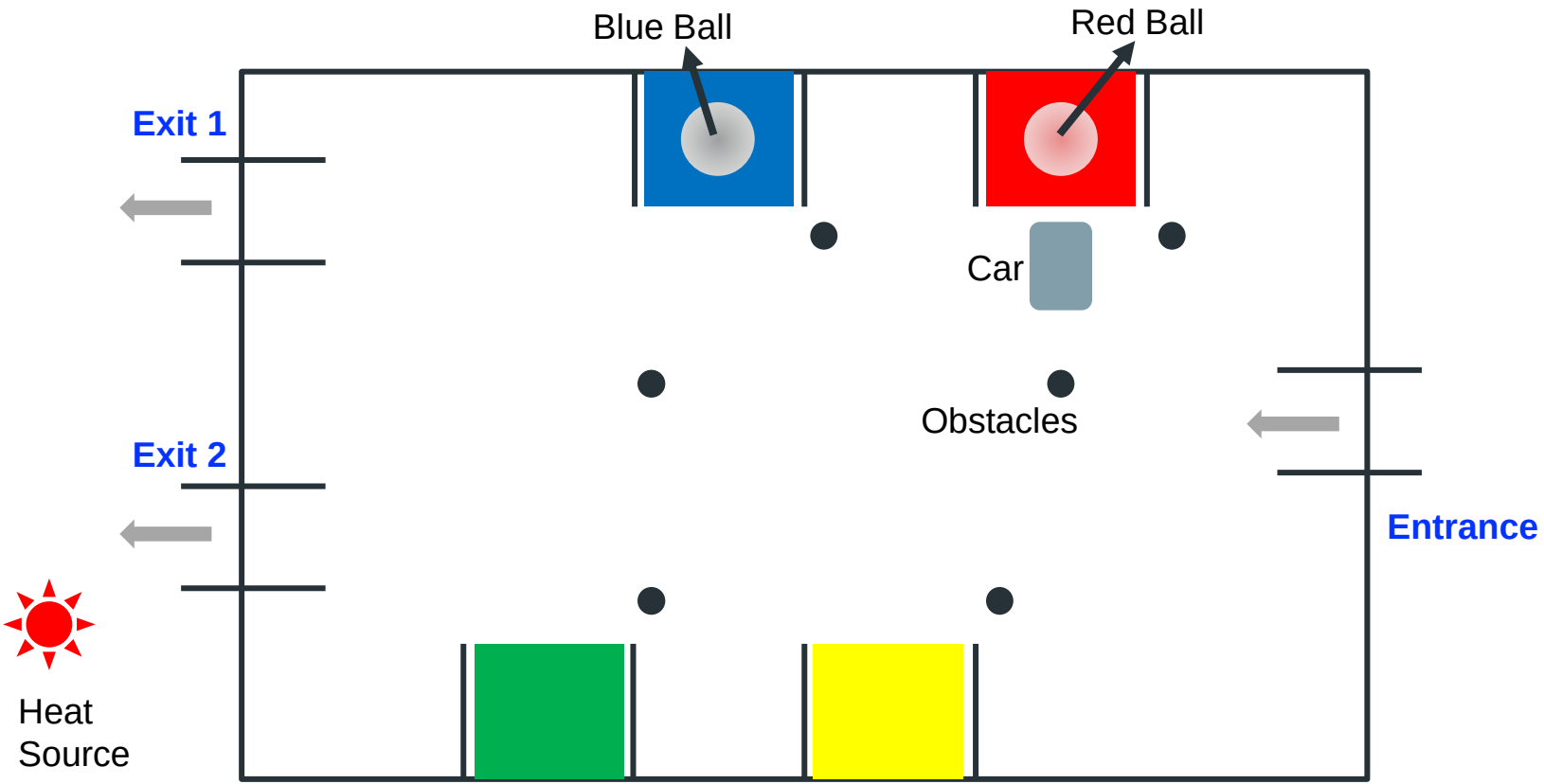
Final Project

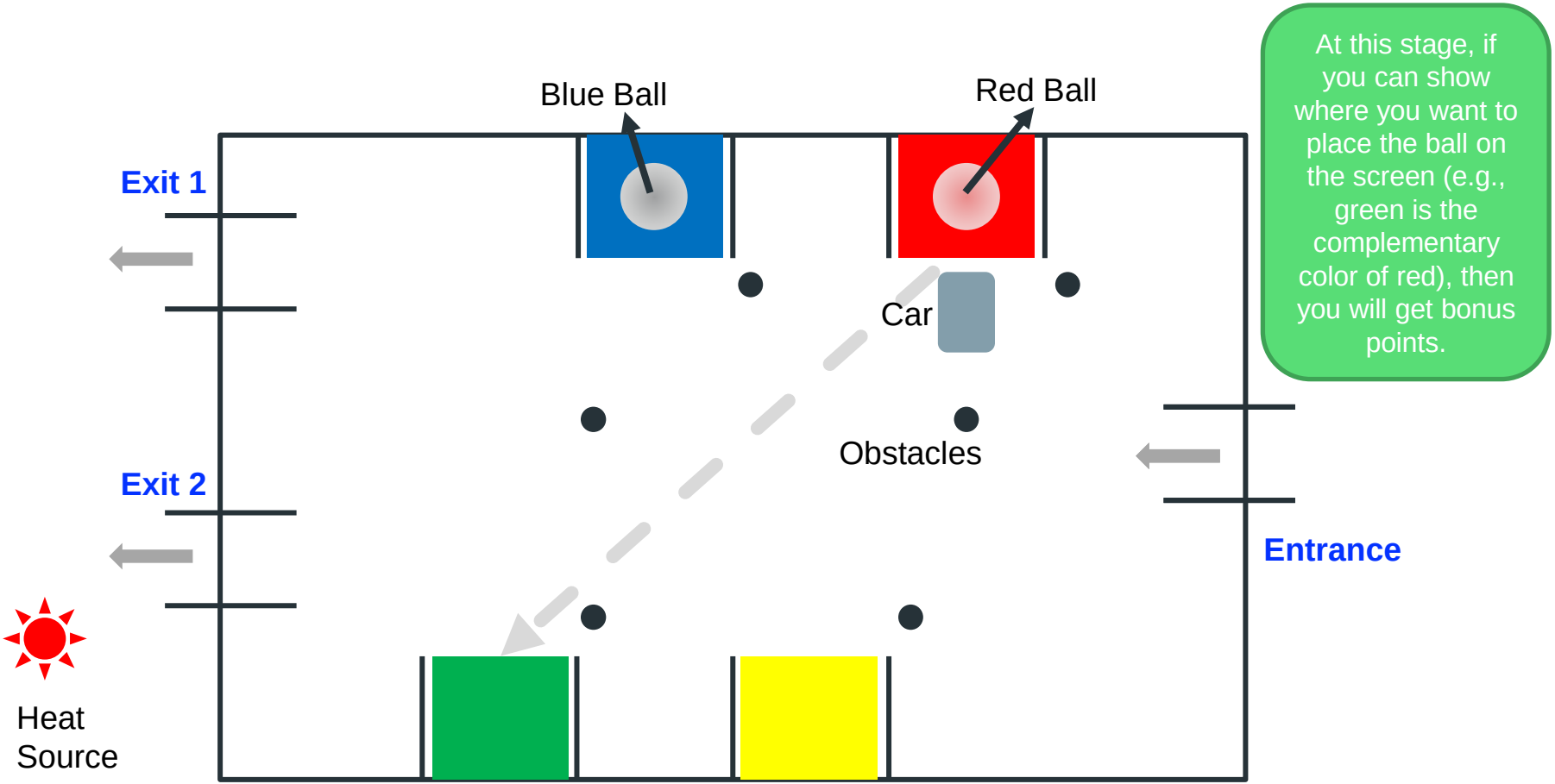
The goal of the course



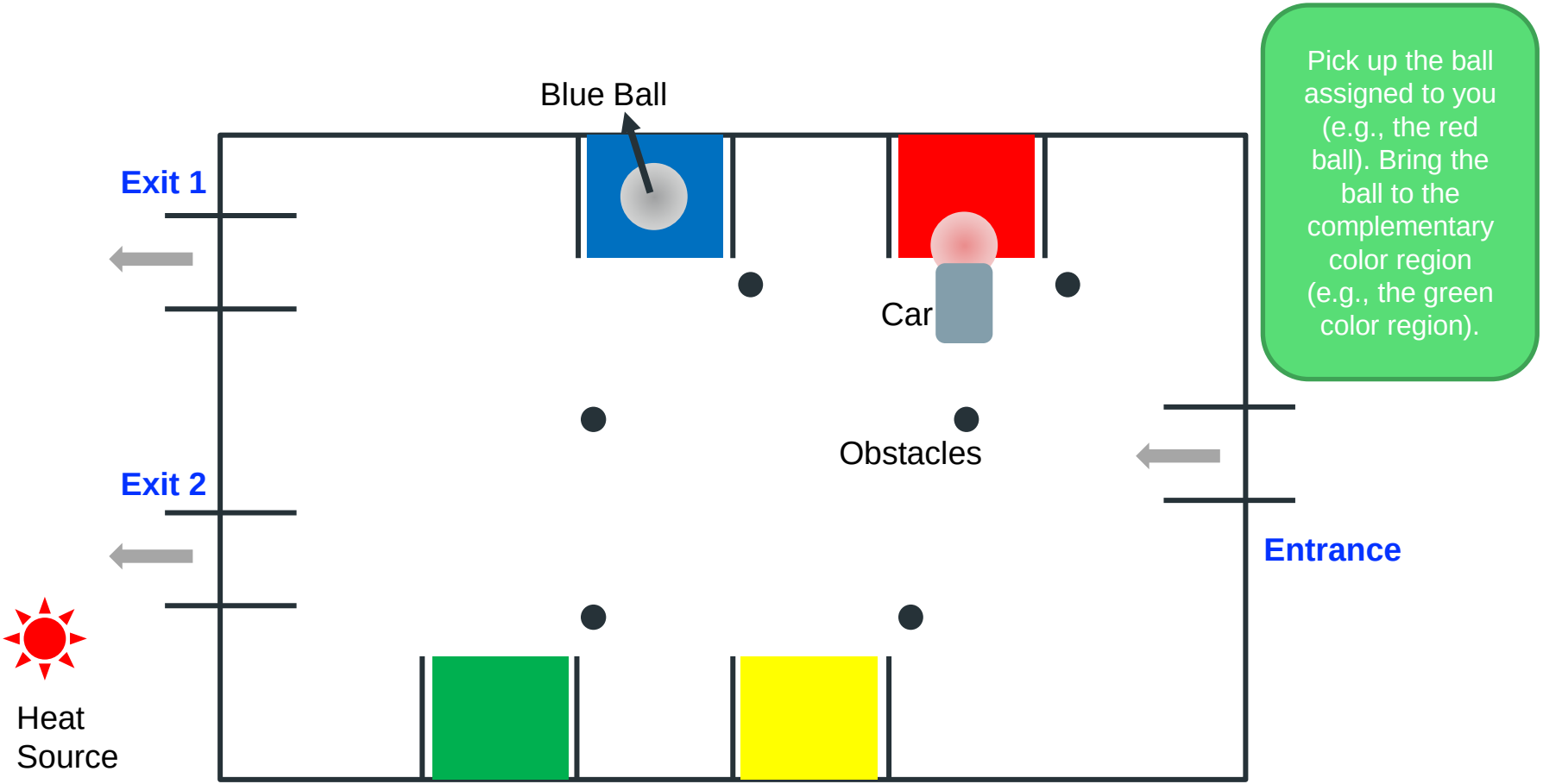

Blue Ball
Red Ball
Exit 1
Exit 2
App or Webpage
Assign task
Obstacles
Car
Move smoothly & avoid obstacles
Entrance
Heat Source
Control the vehicle remotely to achieve the goal

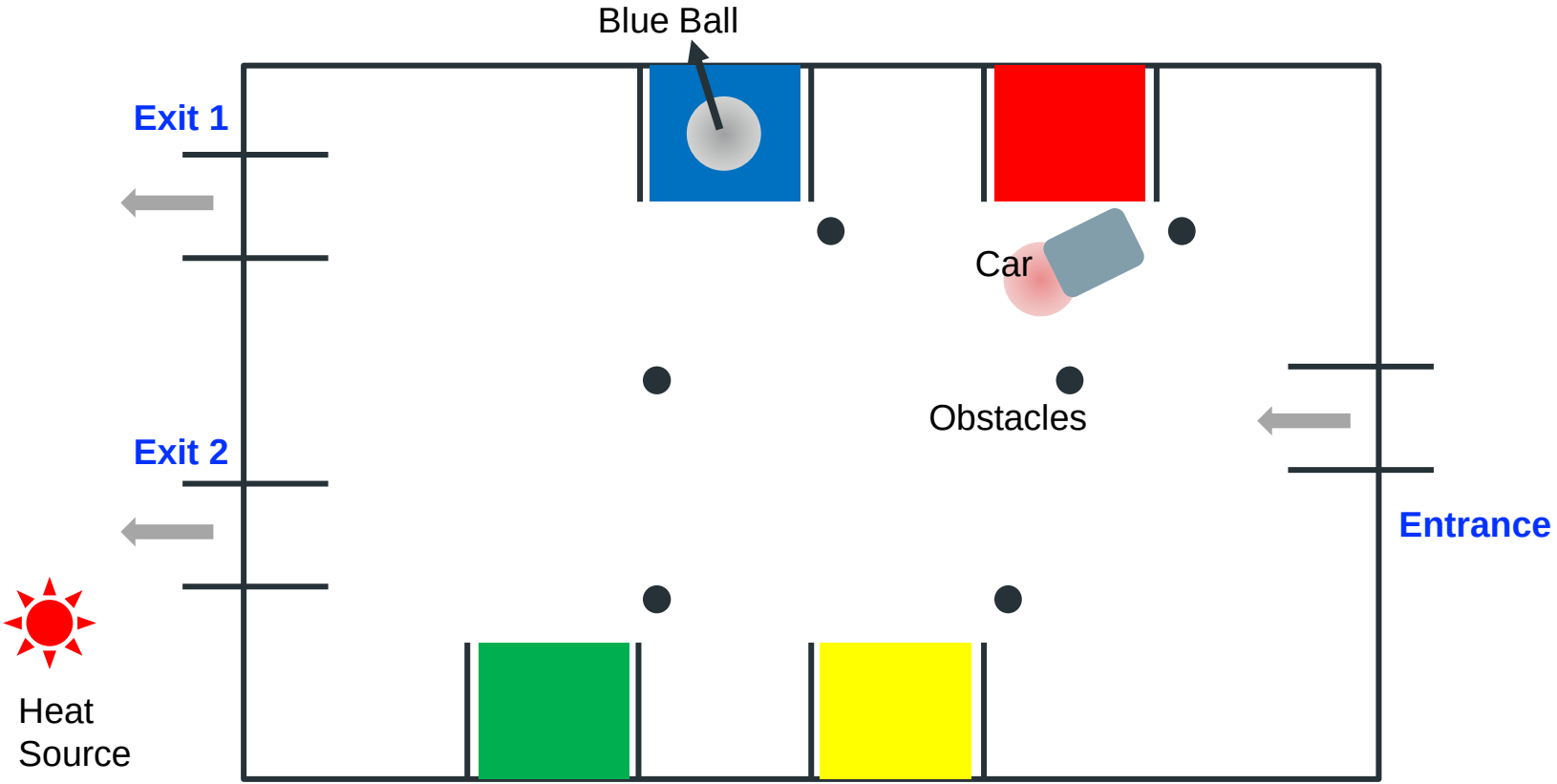

Blue Ball
Red Ball
Pick up the ball based on the color card assigned randomly
Exit 1
Obstacles
Car
Exit 2
Entrance
Heat Source

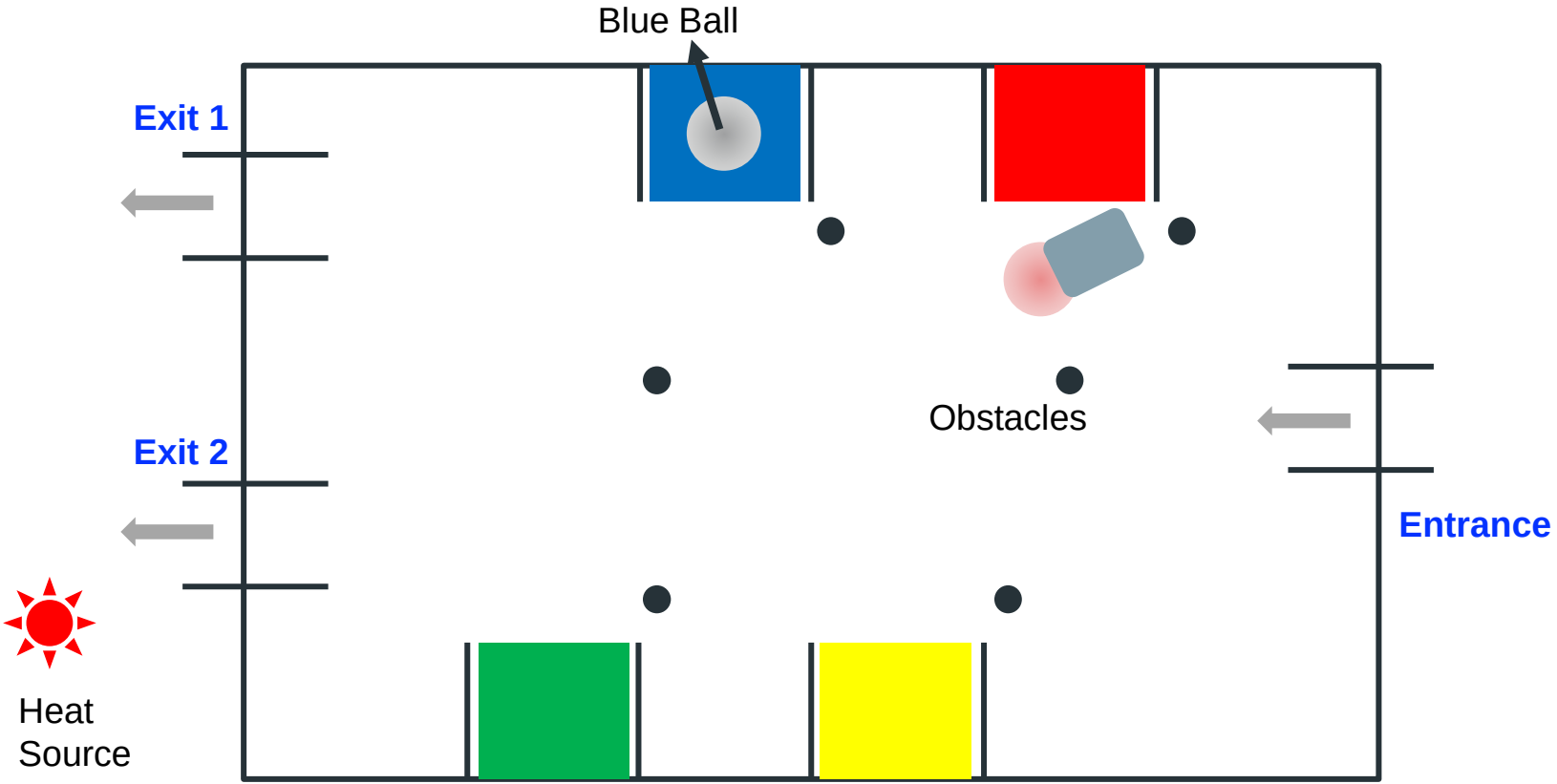

Blue Ball
Red Ball
Exit 1
Car
Obstacles
Exit 2
Entrance
Heat
Source

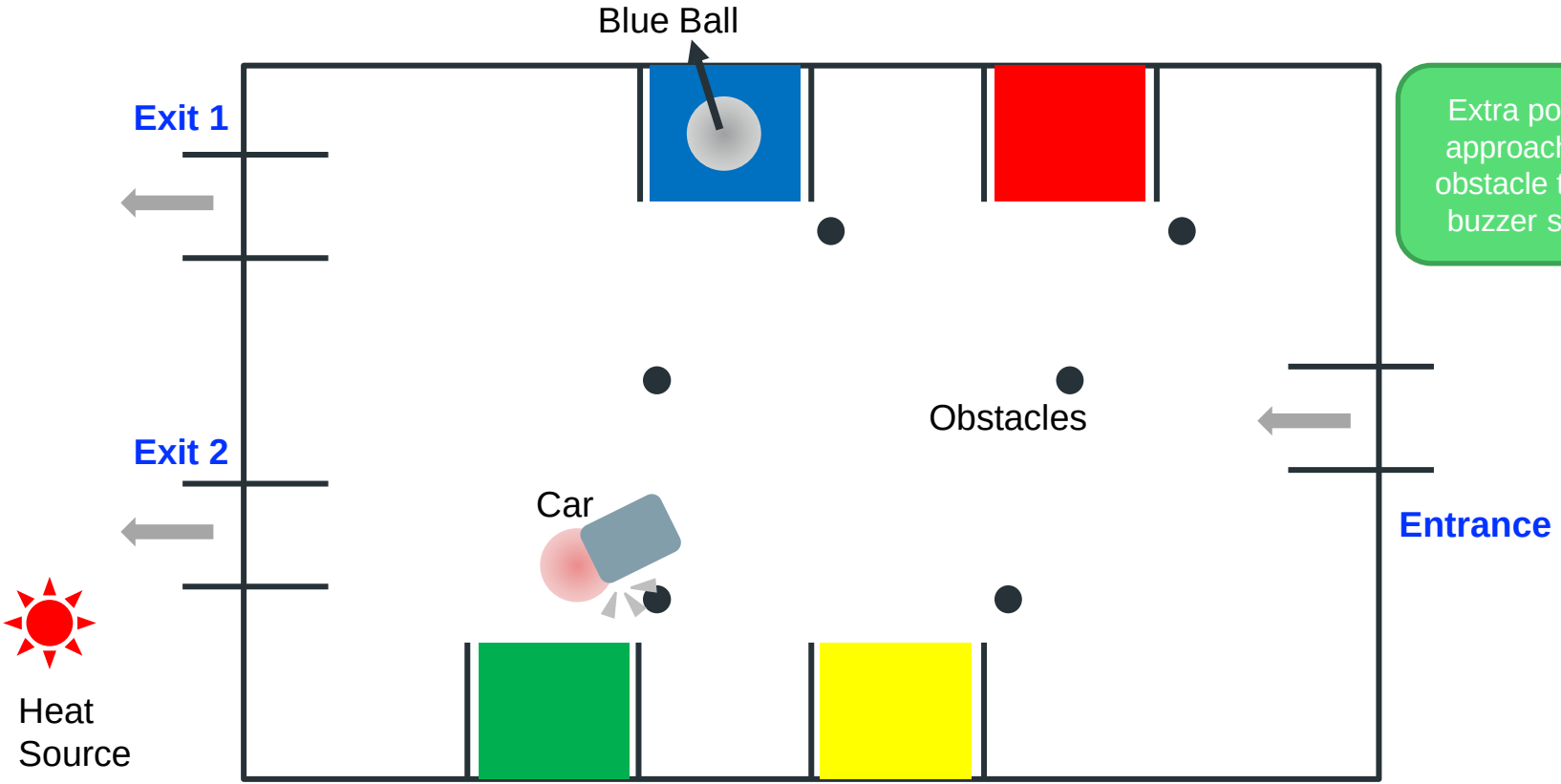


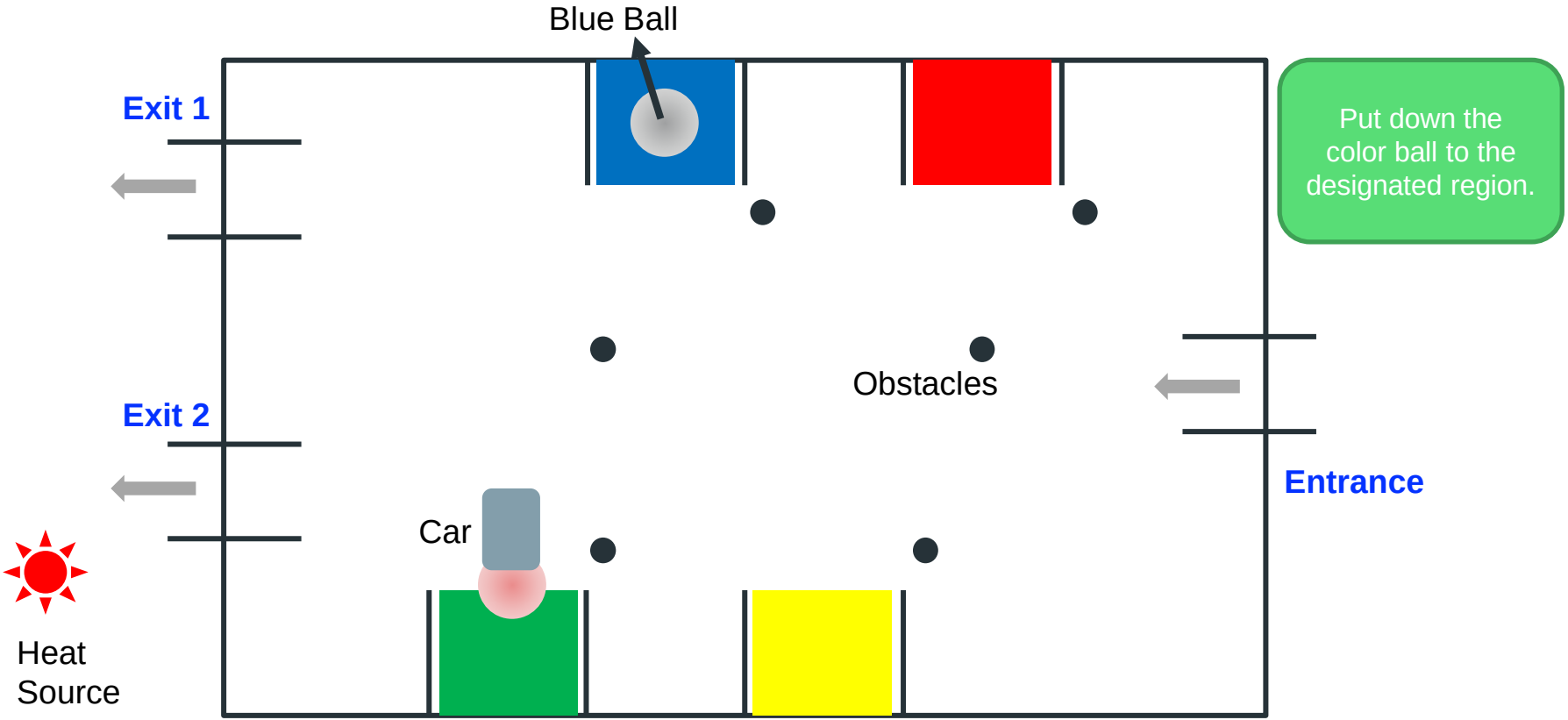
At this stage, if you can show where you want to place the ball on the screen (e.g., green is the complementary color of red), then you will get bonus points.

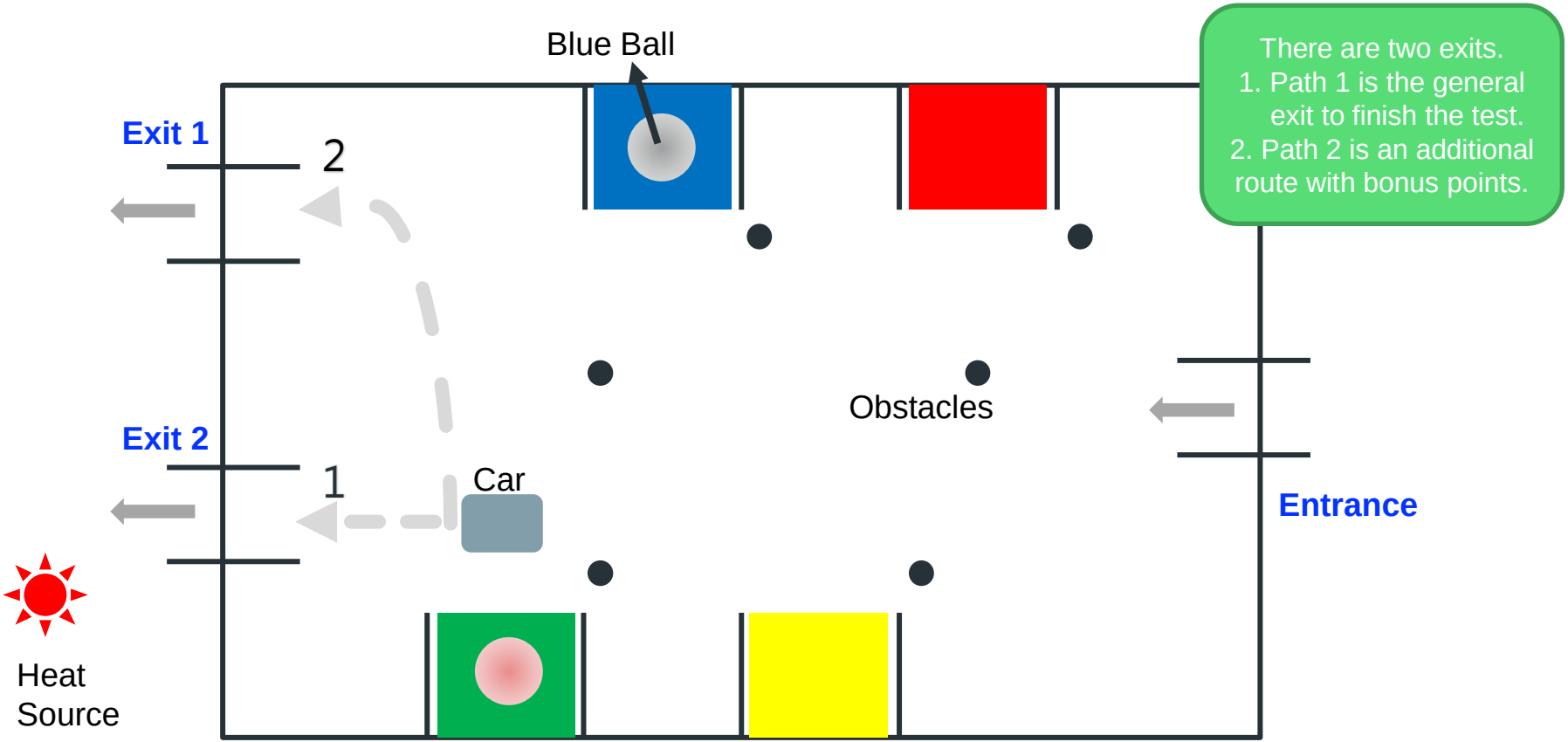

Blue Ball
Exit 1
Car
Obstacles
Exit 2
Entrance
Heat
Source
Pick up the ball assigned to you (e.g., the red ball). Bring the ball to the complementary color region (e.g., the green color region).

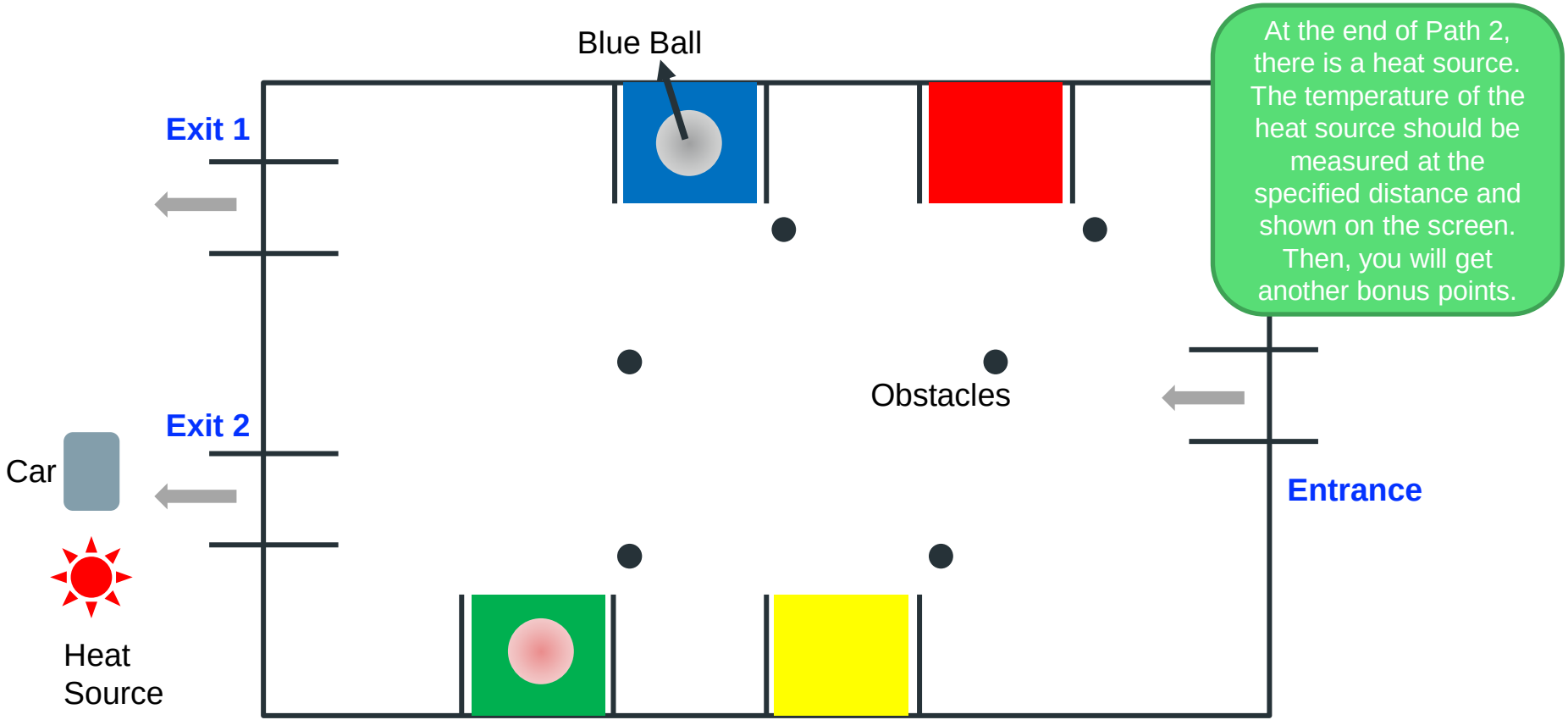

Blue Ball
Exit 1
Car
Obstacles
Exit 2
Entrance
Heat
Source


Blue Ball
Exit 1
Exit 2
Obstacles
Entrance
Heat
Source

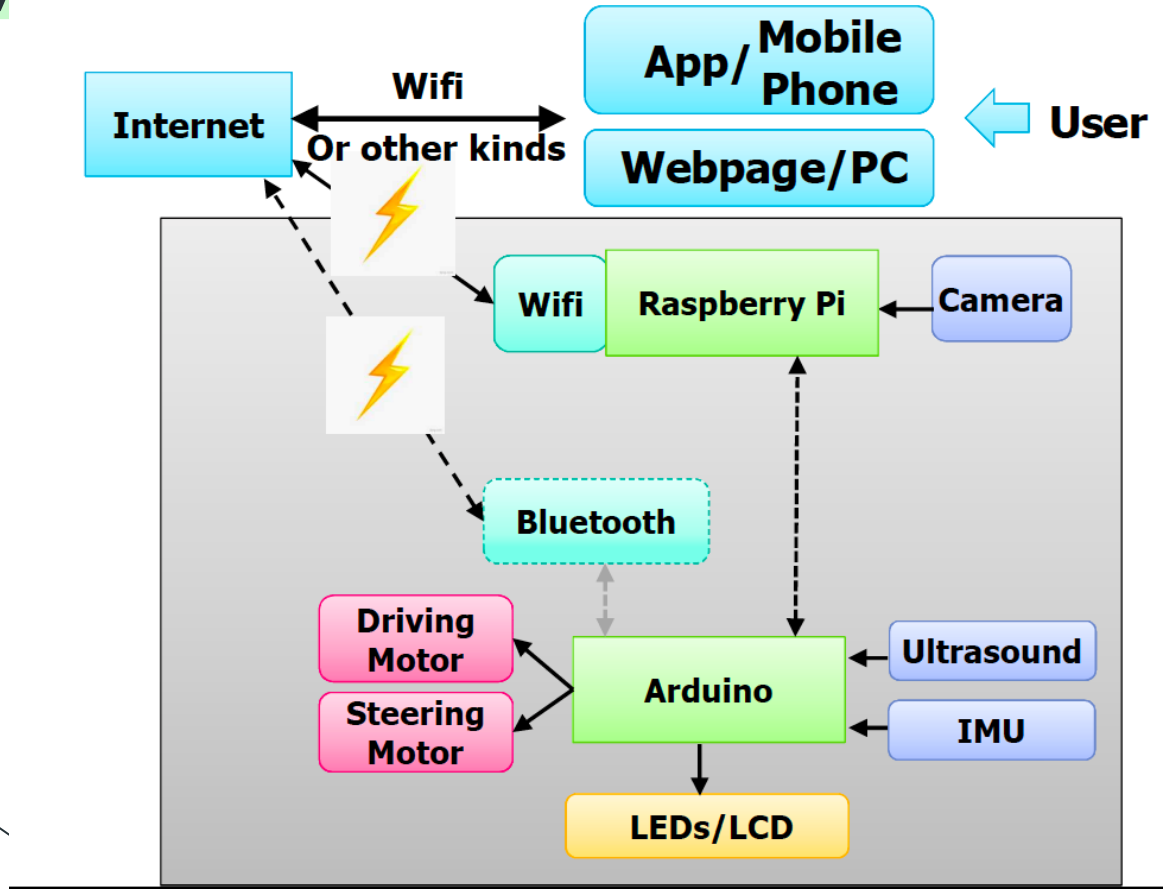

Blue Ball
Exit 1
Exit 2
Obstacles
Car
Entrance
Heat Source
Extra points for approaching an obstacle to make buzzer sounds.


Blue Ball
Exit 1
Exit 2
Obstacles
Entrance
Car
Heat
Source
Put down the color ball to the designated region.


There are two exits.
1. Path 1 is the general exit to finish the test.
2. Path 2 is an additional route with bonus points.
Blue Ball
Exit 1
2
Exit 2
1
Car
Obstacles
Entrance
Heat Source


Blue Ball
Exit 1
Exit 2
Car
Heat Source
Obstacles
Entrance
At the end of Path 2, there is a heat source. The temperature of the heat source should be measured at the specified distance and shown on the screen. Then, you will get another bonus points.

System block diagram



Materials used in the project

Rpi

Rpi board, SD card, Power supply, Mouse, HDMI/VGA converter cable , Webcam

Arduino

Arduino board, Power supply, USB line

Breadboard & electronic elements/devices

Sensors

Ultrasonic sensor, IMU, Temperature sensor

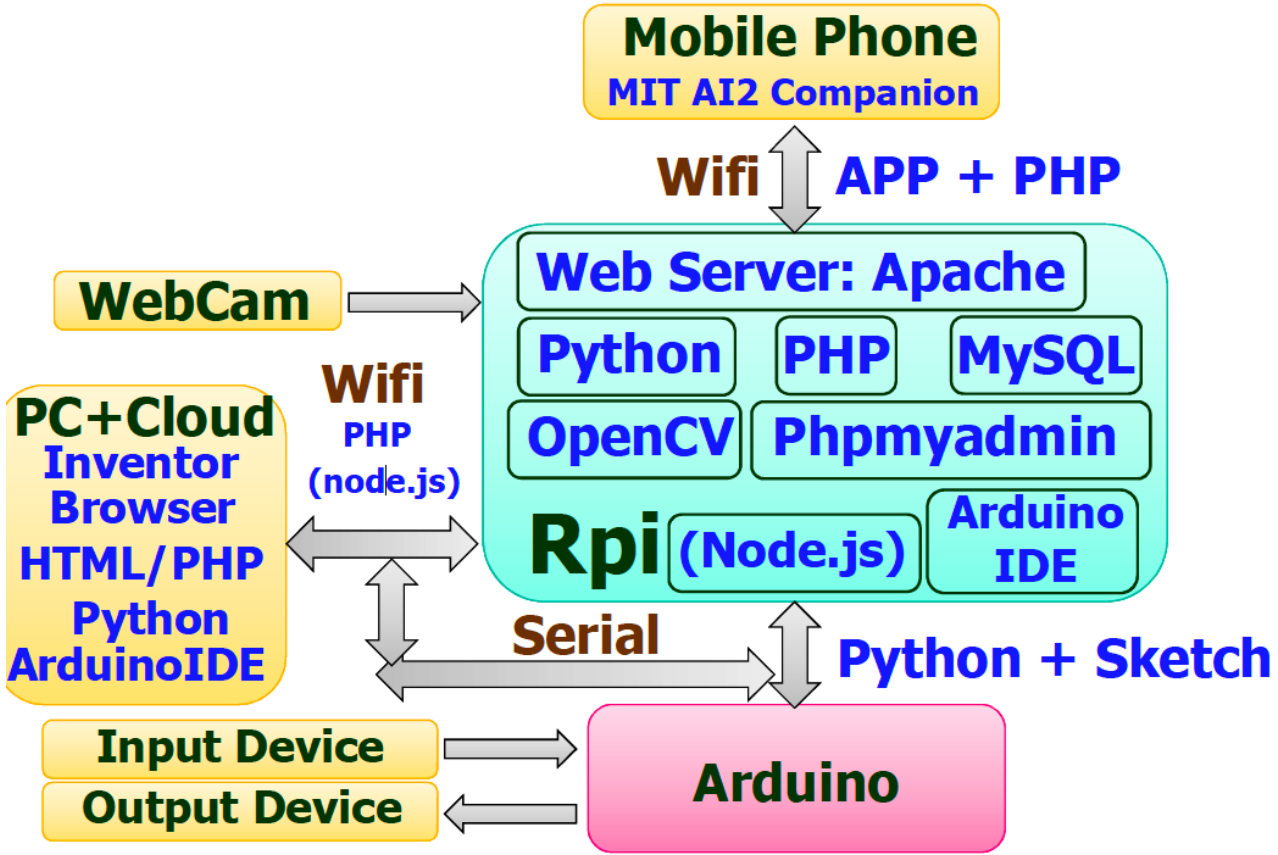
Actuators

Servo motors, Electromagnetic device

Mechanical parts

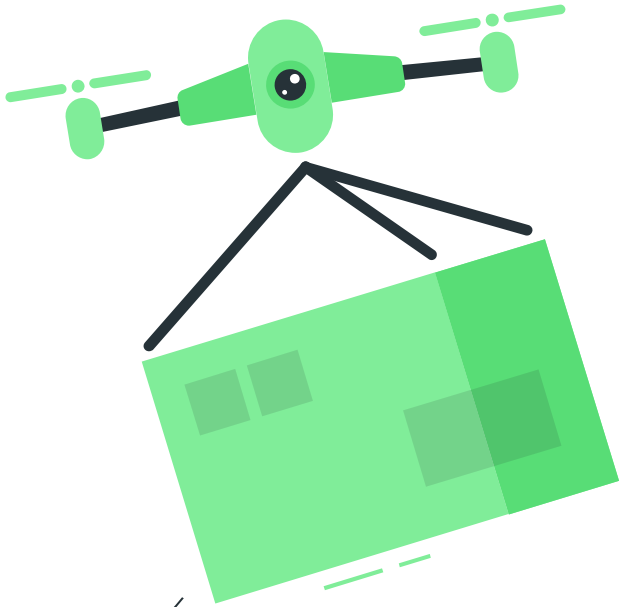
Purchase or Maker

Tools (for your reference)



Grade and Schedule

Contest rules and important dates



Contest Rules for Final Project

- Remotely control your logistics vehicle based on the live video sent from the video camera in your vehicle to deliver the ball with specified color to a designated client household indicated by color.
- If the logistics vehicle crashes during the race, you can reset it, but you cannot change the location and orientation of the vehicle.
- The color of balls and households may be red, or blue.
- Obstacles (bottles) are covered with black paper.
- The fence is black.
- The scores are calculated based on functions.
- 10 minutes maximum per round. Faster can get more points.

Contest Rules for Final Project

- The logistics vehicle has functions such as moving, grabbing, image transmission, remotely controlled and APP of mobile phones (60 pts).
  Basic motions and route:
  Go through the entrance -> Pick up the specified color ball -> Control the car to the designated region -> Exit through exit 1
- Bonus points are given based on the following motions.
  Advanced motions and route:
  Go through the entrance -> Pick up the specified color ball -> Judge the complementary color by coding (10 pts) -> Control the car to the designated region -> Go nearby the obstacles and give buzzle warning sounds (5 pts) -> Exit through exit 2 -> Measure and show the temperature at the assigned position (5 pts)

Contest Rules for Final Project

- 1 points will be deducted for each intervention until reaching maximum deduction (5 pts).
- If no intervention occurs, 5 points bonus will be given.
- Points are given for surface integrity (5 pts), vehicle aesthetic integration (5 pts) and smooth operation (5 pts).

- Addition to contest score, oral, written report and DEMO for the final project are mandatory.
- Please select the members who are responsible for the coding, electrical circuits, and mechanical parts, respectively.

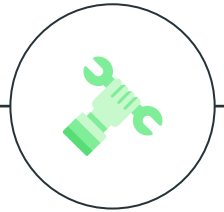
Project Timeline

10/28

Submit the project proposal

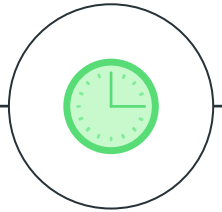
12/2

TA times for the final project



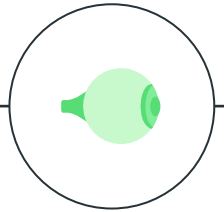
12/5-12/9

Practice your vehicle at 生機館 R503



12/9

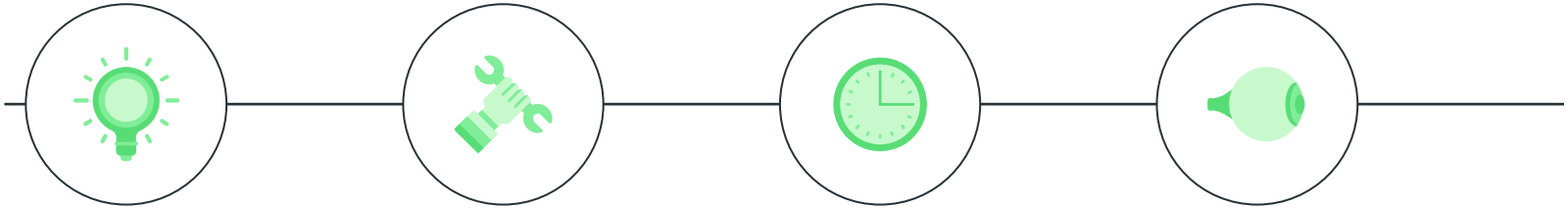
Contest!!!
At 生機館 R101



Project Timeline (cont.)

12/9

Contest!!!
At 生機館 R101



12/16

Final presentation
(10 mins + 2 mins Q&A)

12/23

Final Exam
Please return all your parts to TAs

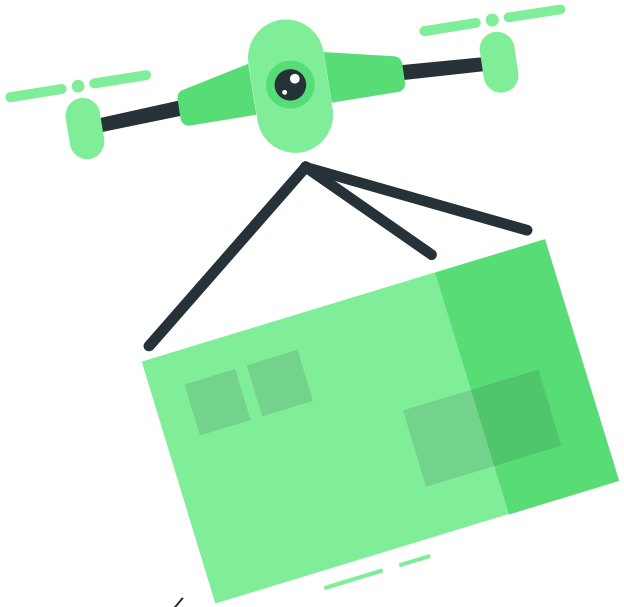
12/25

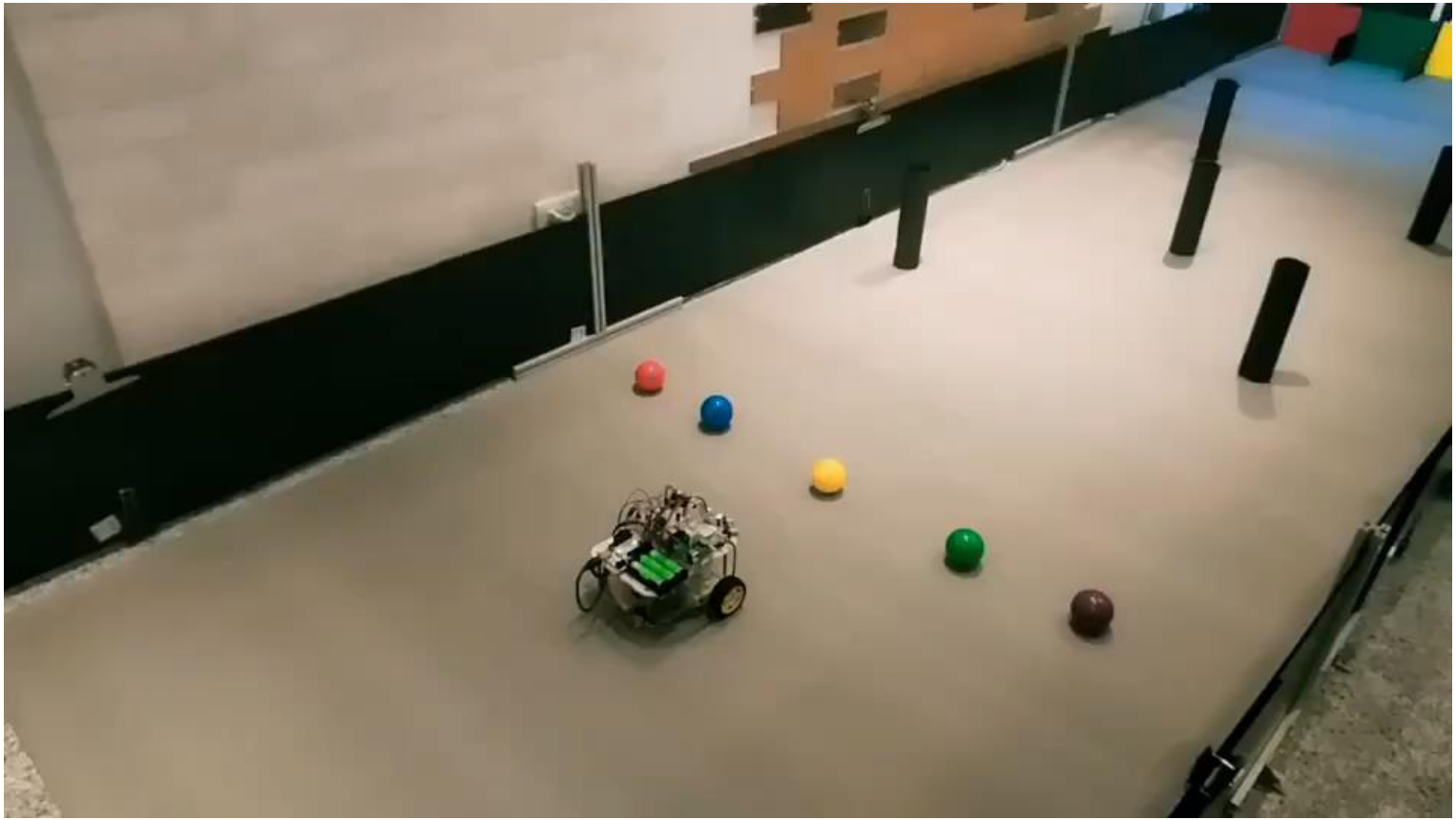
Happy holiday~~

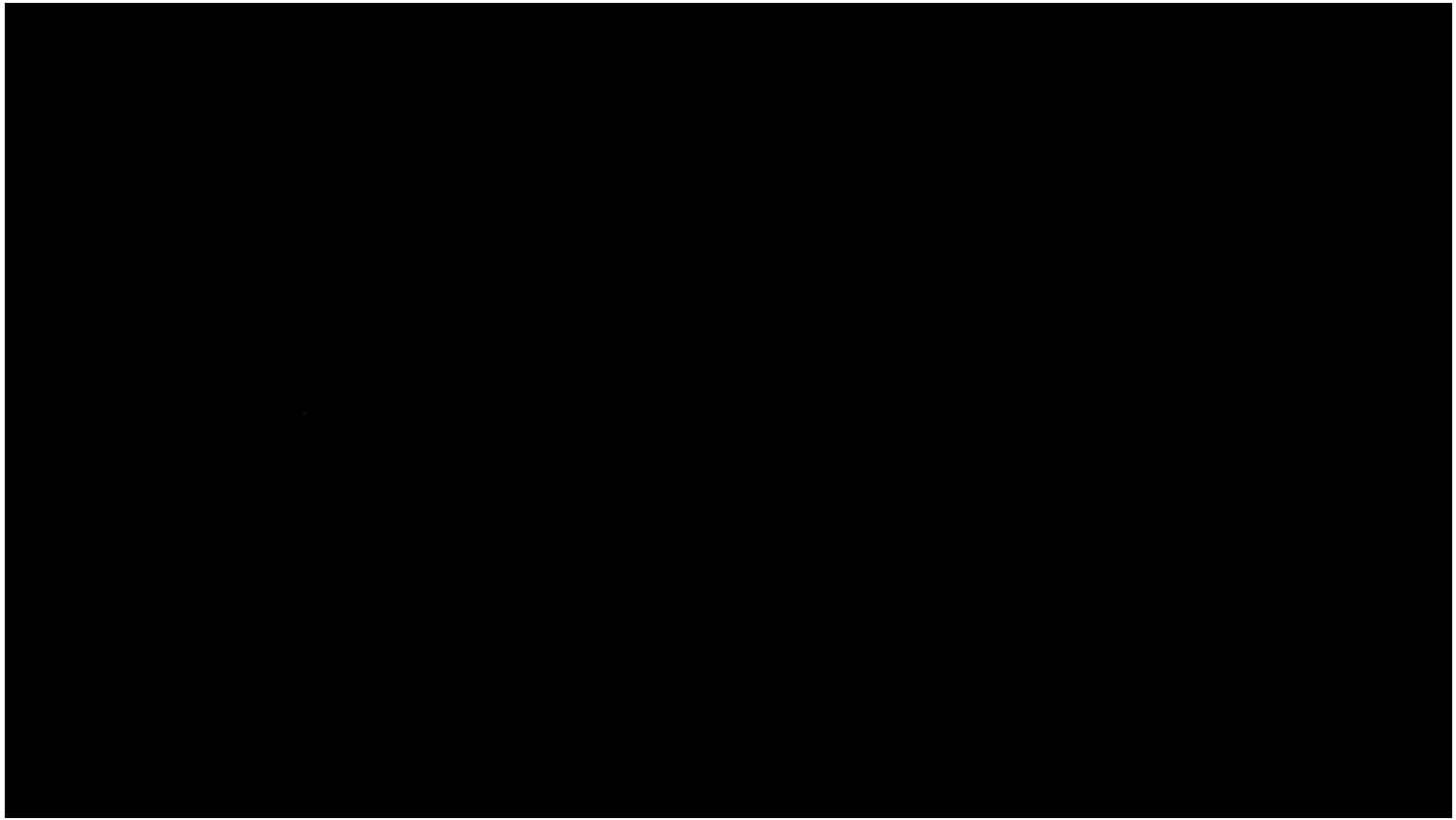
Grading Policy of the Course

- Attendance and performance in class (15%)
- Lab and homework (35%)
- Final project (30%)
- Final exam (20%)

Videos from last year








Have fun &
enjoy the
course!!