Hacker Package

The Winter Olympics is a global sporting event happening right now that brings together athletes from around the world to compete in a diverse range of snow and ice–based disciplines. Events such as biathlon, skiing, snowboarding, and skating highlight not only physical strength and endurance but also precision, strategy, and control. One of the most unique winter events is the biathlon, which combines cross-country skiing with target shooting, requiring athletes to balance speed with accuracy under pressure.

In this Hackathon, you will explore how engineering and robotics principles relate to the challenges faced by Olympic athletes. In this context, teams might design a robot inspired by Winter Olympic events, specifically one capable of navigating an obstacle course and shooting at designated targets, similar to the biathlon. Such a robot would need to integrate advanced mobility, sensor systems, and targeting mechanisms. The hackathon provides an opportunity for participants to apply mechanical design, programming, and control systems to build a robot that demonstrates agility, accuracy, and reliability, echoing the skill and precision seen in Winter Olympic competition.

Challenge Description

Your task is to build a robot that can navigate a Winter-Olympics style course while demonstrating the three core aspects of robotics: perception, reasoning, and actuation. Your robot must complete tasks, make decisions, and interact with the environment. The challenge begins with the robot picking up a battery from the start area and placing it in a designated white zone. Depending on where the battery is placed, one of two sections of the course will open.

What's included in the hacker kit
- 1 medium sized breadboard
- 4 9V batteries
- 2 9V battery holders
- 10 Screws
- 1 Ultrasonic Sensor
- 1 Arduino Uno (USB-C)
- 1 Arduino wire
- 4 Wheels
- 2 DC motors
- 2 DC motor holders
- 1 Screwdriver
- 2 Servo Motor
- 1 Motor Drive
- 1 Color sensor
- 2 IR Sensors
- 20 M-M, M-F, F-F Wires (20 of each type)
- 1 Laser Cut Base
- 6 joint and connector pieces for the arm and claw

Note that other materials such as clear tape, masking tape, vinyl electrical tape will be provided at stations. There will also be a hot glue gun station and spare parts station (additional screws, wires, and other small parts).

To take out a kit, have a member from your group bring their student/government ID. The ID will be returned once the kit is returned at the end of the hackathon.

*Teams are only allowed to use the materials in the kit with the exception of markers, pencils, rulers, erasers

Challenge Description

To begin the course, the robot will need to pick up a box located beside the blue circles on the track. The robot will then need to carry the box to the blue circle on either the red or green path to unlock that path and begin that section. After completing the section, the robot can then pick up another box on its way back to the black path, and use the box to unlock another section or simply complete the course.

Section 1: Target Shooting

The robot climbs either a straight ramp or a curved ramp (the **curved ramp is worth more points**). At the top, the robot will be stopped and randomly placed somewhere on the target, from which the robot must then use color cues to navigate toward the center of the target area (black) where there is a ball waiting for them. The team may reupload code after reacing this black section. See Figure 2 for specific dimensions and colors.
 At the center (the black zone), there is a ball. The robot must shoot or launch this ball forward.

- The team will gain maximum points if the ball is in the blue zone without touching the walls, with points decreasing the further it is from the blue zone
- If the ball touches or bounces off the wall, the team will lose points

After shooting, the robot returns down a ramp and may collect the second battery to unlock the other section if desired. The robots ability to navigate to the center and shoot the bar as far as possible will all count for points.

Section 2: Obstacle Course

 The robot navigates a winding path filled with sharp turns and obstacles. The goal is to complete the course as quickly and smoothly as possible. The path leads back to the main area, where the robot can attempt the other section or finish the run. The faster the robot can complete the obstacle course, the more points awarded.

To complete the challenge, the robot must return to its original starting position. Teams may choose to attempt either section, both, or neither, points are awarded based on difficulty and performance.

Track

Raised Platform

ball
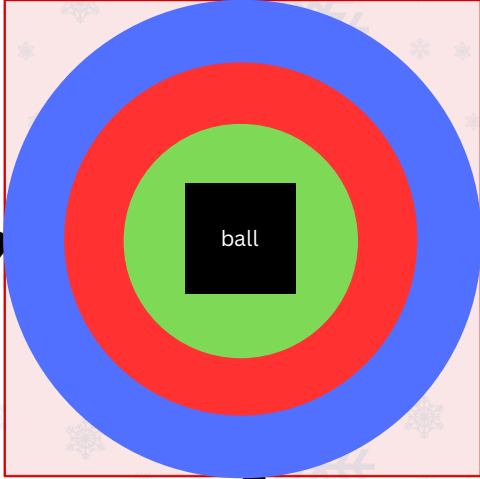
Curved
Ramp

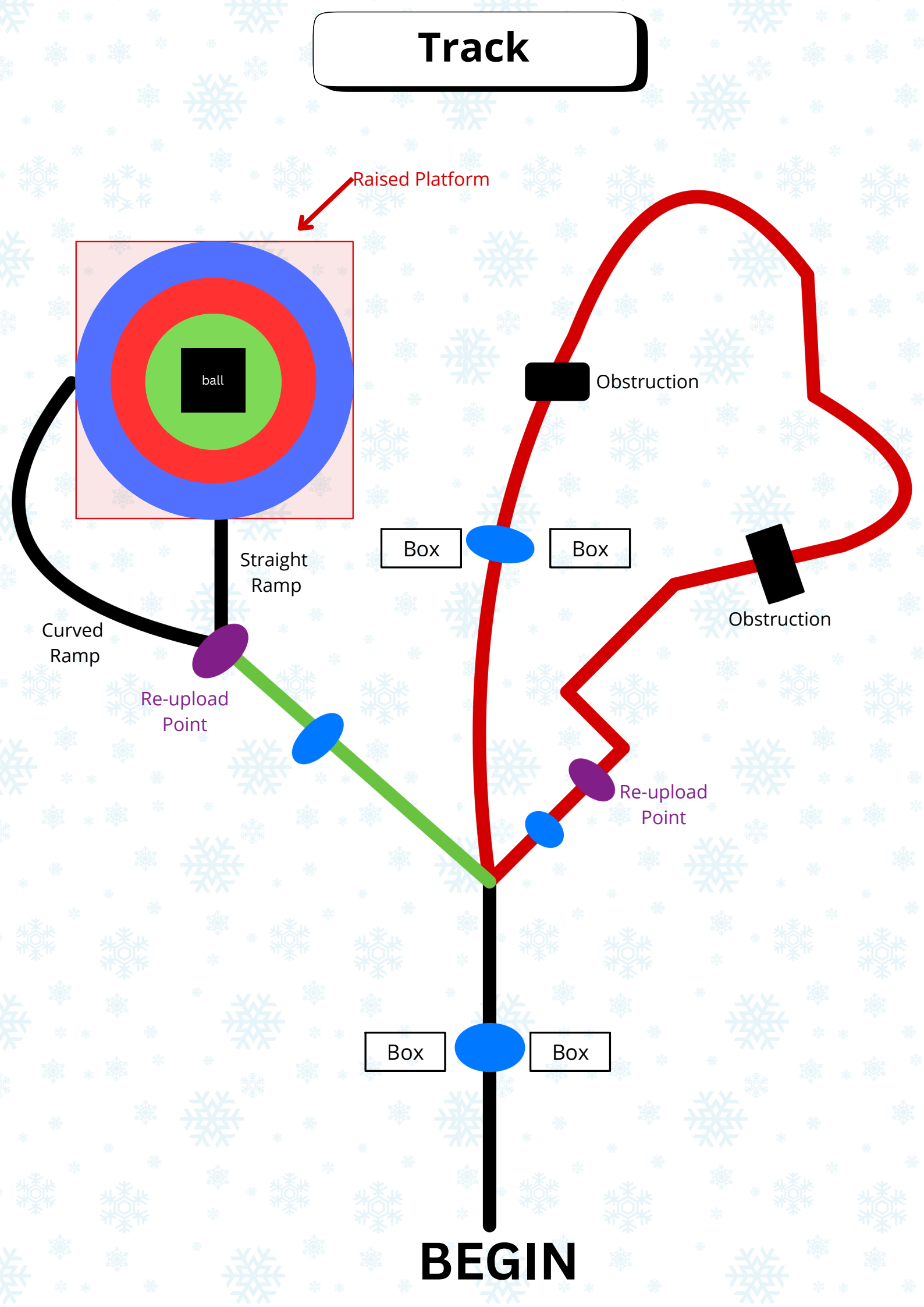Straight
Ramp

Re-upload
Point

Box

Box

Obstruction

Obstruction

Re-upload
Point

Box

Box

BEGIN

Specifics

As shown in the diagram, the following colors will correspond to the following points

- Purple - reupload point
- Blue - battery drop and pickup
- The red path corresponds to the obstacle course (part 2) with black-colored obstructions the robots must avoid
- The green path corresponds to shooting the target with a reupload point where participants can reconfigure their robot to follow the black path and navigate the target colors to the ball
- Once the center of the target is reached, participants will have a chance to reupload code for shooting
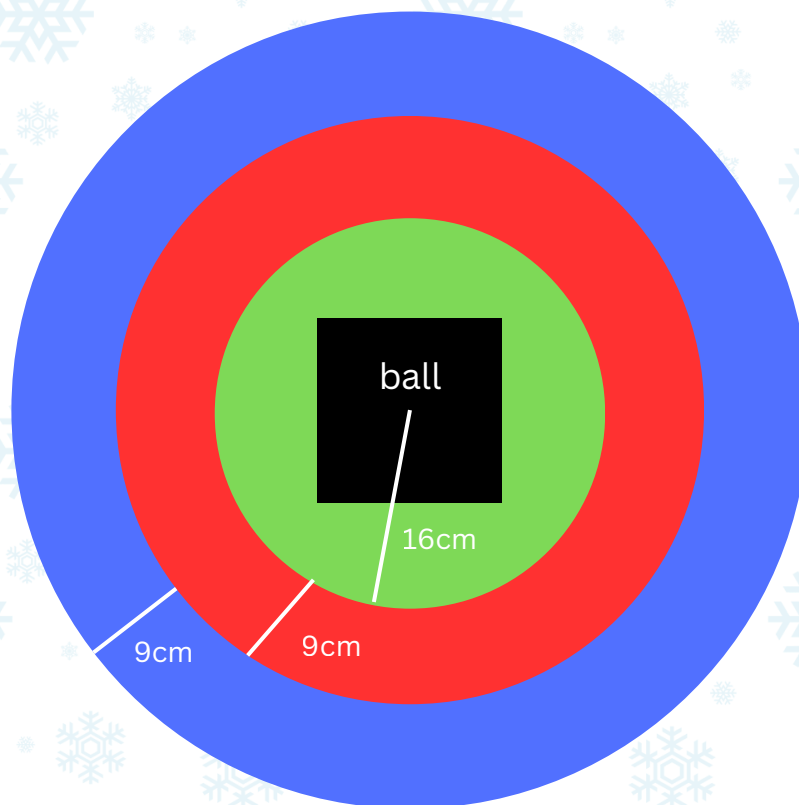

Figure 2. Target Dimensions

Rubric - Track
General Section

Color Detection

Criteria	Point Distribution
Picks up box (If box is still touching the ground, max 3 points)	5
Detects path split (Green/Red)	1
	Total: 6

Path Following

Criteria	Point Distribution
Going Up Ramp (straight: 2 pts, curved: 4 pts)	4
Going Down Ramp (straight: 2 pts, curved: 4 pts)	4
	Total: 8

Point Deduction

Criteria	Point Distribution
# of resets used (-5 points per reset up to 20 points)	-20
Reuploads used (-1 point for each reupload point used)	-5
	Total: -25

Rubric - Track

Section #1: Target Shooting

Criteria	Point Distribution
Drops off box • 5 points if the box is fully in the designated area • 4 points if part of the box is touching the edge but not outside the area • 2 points if less than half the box is outside the area • 1 point if most of the box is outside the area	5
Gets past ring 1 (blue) *	5
Gets past ring 2 (red) *	5
Gets to centre *	5
Shoots the ball • 1 point in the green • 2 points in the red • 3 points in the blue • 5 points in between blue and the wall • 3 points if touching the wall	5
	Total: 25

all wheels must no longer touch the previous ring for full points, else max 3 points

Section #2: Obstacle Course

Criteria	Point Distribution
Drops off box • 5 points if the box is fully in the designated area • 4 points if part of the box is touching the edge but not outside the area • 2 points if less than half the box is outside the area • 1 point if most of the box is outside the area	5
Avoid all obstacles (One point is deducted each time a wheel touches the obstacle)	5
Completed under 60 seconds (inclusive)	5
Picks up box • If box is still touching the ground, max 3 points	5
	Total: 20

All track sections add up to 63 points.

Teams will have 5 minutes to complete the entire course.

Teams will be stopped at the 5 minute, their score will be the number of points they earned up to that point.

Goodluck :)

Rubric - Presentation

Section #1: Quality of Build

Criteria	Point Distribution
Build sturdiness and safety • Robot is solid and safe. • All parts and electrical • components are firmly • attached. Nothing came • loose during operation.	7
Visual presentation • Robot looks clean and • polished. Wires are • organized. Joints and • surfaces are tidy. Design • clearly reflects the theme.	3
	Total: 10

Section #2: Presentation

Criteria	Point Distribution
Clarity of Explanation • Clear, structured explanation covering motivation, design, and function.	8
Organization & Time Management • Mostly organized but pacing or structure needs improvement.	2
	Total: 10

Rubric - Presentation

Section #3: Technicality

Criteria	Point Distribution
Functionality & Reliability. • Robot completes all intended functions reliably throughout the demo.	7
Technical Complexity • Demonstrates multiple interacting components (sensors, logic, actuators) working together	3
	Total: 10

Section #4: Presentation

Criteria	Point Distribution
Material & Resource Awareness • Uses some reused, recycled, or minimal materials intentionally	3
Energy & Environmental Considerations • Mostly organized but pacing or structure needs improvement.	2
	Total: 5

Rubric - Presentation
Section #5: Q&A

Criteria	Point Distribution
Understandingof Their Own System5 • Answers most questions clearly and correctly.	3
Problem-Solving & Reflection • Can identify challenges and suggest reasonable improvements.	2
	Total: 5

All presentation sections add up 40 points.

Teams will have 3 minutes to present their final prototype, immediately followed up a 2 minute QnA period.

Goodluck :)