



## Problem Statement: Robotic Billiards Challenge

### Background Story

In a futuristic world where robots have revolutionized sports, a new challenge has emerged—**Robotic Billiards**. Players must design and program intelligent robots to skillfully control and pocket power balls into designated zones, mimicking the precision and strategy of real-world billiards. Your mission is to develop one manual robot (Striker) to work together to complete the task within the given time limit.

### Mission

Your team must **design, build, and program a robot** to play robotic billiards.

- **Striker (Manual Robot):** This robot will be manually controlled to hit balls towards scoring zones.

To win the challenge, robots must **strategically work** to pocket all the balls within the time limit.

The competition consists of 3 stages, each with distinct objectives:

1. **Mentoring Round (Optional):** A paid mentoring session is held during summer vacations for interested participants to refine their projects with expert guidance.
2. **Zonal Round:** A knockout round where participants showcase their innovation and creativity.
3. **Finale:** The top 20% team from each zone will advance to compete in the finale.

## Robot Criteria for Robotic Billiards Game:

In the **Robotic Billiards Challenge**, each team must design and operate a **single manually controlled robot** known as the **Striker Robot**. This robot will be responsible for striking or repositioning balls into scoring pockets. To ensure fair play and adherence to competition standards, the Striker Robot must meet the following specifications:

### 1. Control & Navigation

- The **Striker Robot must be wirelessly controlled** using the **RoboQuest controller**.
- **Only mobile phones can be used for controlling the robot—RC remotes are not allowed.**
- The robot must be **manually navigated** by the operator without any autonomous features.
- Only **1 RoboQuest Controller** is allowed for programming and control.
- **Wireless Communication Integration:** Only a maximum of one Bluetooth is allowed for this purpose.

### 2. Motion & Mobility

- The robot must use **BO DC motors** with a **maximum speed of 150 RPM** (tested on a tachometer).
- It must **efficiently strike or reposition balls** toward scoring pockets.
- The robot **must not cause damage** to the arena, props, or other objects.

### 3. Size, Weight & Electrical Constraints

- The robot must **adhere to all size, weight, and electrical specifications.**
- Any violation of weight, size, or power limits may result in **disqualification.**
- The main part of the robot's dimensions must not exceed **25 cm x 25 cm x 20 cm (LxWxH)** during the initial inspection, **excluding the hitting part** but including the wheels. However, the bot can extend its size once the run begins. A tolerance of  $\pm 5\%$  is allowed.
- AC power supply will not be provided or allowed during the competition.
- The battery used for the bot should not exceed 12V.
- **Wheel Specifications and Restrictions:**
  - Maximum overall diameter: 8 cm and Maximum width: 2.5 cm

- o Omni-directional wheels are not allowed

#### 4. Game-Specific Constraints

- The **Striker Robot must start from the designated Start Zone** and return to the same zone after completing its task.
- If a ball **does not completely enter a scoring pocket**, no points will be awarded for that ball.
- The **robot must not interfere with any arena elements or props** beyond repositioning the balls.
- To be eligible for bonus points, the **robot must complete all tasks within the 5-minute time limit.**

#### Arena Details



- The game will take place on a **240 cm × 340 cm** billiards-style arena.
- The **Striker Robot** starts from the **Manual Control Zone** and must **strike or push power balls** from the storage zone into play.
- Each power ball must be completely inside the **scoring pocket** to earn points.

## Game Rules

1. **Time Limit:** The entire match lasts **6 minutes**.
2. **Manual Robot Rules:**
  - o Must start from the **Manual Control Zone**.
  - o Can hit balls towards the scoring pockets.
3. **Scoring System:**
  - o Each power ball successfully placed into a **scoring pocket** earns points.
  - o Bonus points will be awarded for completing the task **before time runs out**.
4. The sharing of robots is strictly prohibited. Any violation will result in immediate disqualification without consent.

## Winning Criteria

- The team that scores the **most points** by accurately **placing balls** into the scoring pockets within the time limit **wins the challenge**.
- Teams must optimize their robots' design, strategy, and programming to maximize efficiency.

## Scoring and Penalties

Step	Challenge	Points to Win
1	Race against Time!	Finish in under 2 minutes: 100 points! Finish in under 3 minutes: 80 points! Finish in under 4 minutes: 60 points! Finish in under 5 minutes: 50 points!
2	Place your blocks!	Perfect goal: 20 points Missed the goal: 0 point
3	Watch Out for Mistakes!	Any blocks that are intentionally ejected from the arena will result in a deduction of 2 points! Any intentional contact between your

		robot and an opponent's robot will result in a deduction of 5 points!
4	Special Bonus Fun!	Teams that complete all challenges without incurring any penalties will receive a special bonus of 5 points

### Skills Involved

- **Inculcating STE(A)M and Computational Thinking Skills:** Robotics engineering, coding (for autonomous navigation), and mechanical design.
- **Cultivating Problem Solving and Critical Thinking Skills:** Planning efficient paths and strategies.
- **Collaboration and Teamwork Skills**

Are you ready to take on the **Robotic Billiards Challenge** and prove your engineering and programming skills?

