GLOBAL ROBOTICS CHALLENGE

F1

Racing Challenge

Rulebook

F1 Racing Challenge Rules

1. Introduction:

1.1 Purpose:

The F1 Racing challenge is a head-to-head robotics event inspired by Formula 1 racing, designed to encourage students in STEM. Teams will race their robots on a designated track, simulating the competitive and strategic aspects of racing with a focus on speed.

1.2 Key Features:

- Rounds: Three rounds, each consisting of three laps per team.

- Head-to-Head Racing: Two robots compete on the same track simultaneously.

- Manual Control: Robots are controlled manually to encourage real-time team coordination.

2.Team Composition:

-Team Size : 3 : 5 people guided by a Coach (Discover Category).

-Team Size : 3 : 8 people guided by a Coach (Junior & Senior Category).

-Teams will be divided into Three age categories:

- **Discover: Ages 8 - 11 years (LEGO KITS) .**

- **Junior: Ages 12- 17 years (NON-LEGO) .**

- **Senior: Ages 18 - 23 years (NON-LEGO) .**

3. Competition Format:

Rounds :

1. Round 1 - Qualifiers:

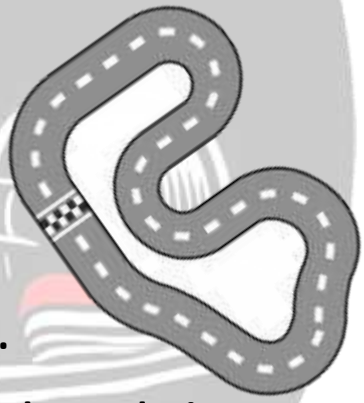
- Objective: Complete three laps as quickly as possible.
- Structure: Two robots compete per race on a forward track.
- Advancement: Top half of the fastest robots proceed to the next round.

2. Round 2 - Semi-Finals:

- Objective: Complete three laps with the fastest average lap time possible.
- Structure: Head-to-head racing with new pairings based on Round 1 times.
- Advancement: The fastest robots qualify for the final round.

3. Round 3 - Finals:

- Objective: Complete three laps to determine the overall winner.
- Structure: Finalists race head-to-head.
- Winning Criteria: The robot with the fastest average lap time across all rounds wins.



4. Track Specifications:

4.1 Track Layout

- Dimensions: Width of 100 cm for side-by-side racing.
- Surface: From Wood, non-reflective surface for stability.
- Lane Markings: Start lines are marked, robots may share lanes during races.

4.2 Start/Finish Lines

- Clearly marked with sensors or visual cues for accurate lap timing.

4.3 Pit Stop Zone

- Fixed Area: A designated area along the track serves as the pit stop zone for all teams.
- Exit: Robots must re-enter the track safely after any pit stop.

5. Robot Specifications:

5.1 Size and Weight

- **Dimensions**: Maximum size of 30 cm (width) x 40 cm (Length).

- **Weight Limit**: 4 kg maximum weight.

5.2 Control System

- **Manual Control Only**: Teams operate robots using approved controllers.

- **Kill Switch**: Each robot must have an easily accessible kill switch for emergency power-down.

6. Race Rules:

6.1 General Race Procedure

1. **Start**: Both robots start simultaneously at the referee's signal.

2. **Lap Completion**: Each race consists of three laps per team.

3. **Pit Stops**: Teams may use the fixed pit stop area as needed but must comply with exit rules.

6.2 Head-to-Head Competition

- **Collision**: Any collision with other robots or the track walls is discouraged. Intentional collisions are strictly prohibited and will result in penalties. Minor unintentional contact with other robots or walls is permitted, but repeated or severe collisions may lead to warnings or additional penalties at the judges' discretion.

- **Overtaking**: Robots are free to overtake within the track width.

- **Blocking**: Prolonged blocking (**over 5 seconds**) is discouraged and results in penalties.

7. Penalties:

7.1 Types of Penalties

1. **Collision**: 5 second penalty.
2. **Blocking Opponent**: 5 second penalty if blocking exceeds 5 seconds.
3. **False Start**: 5 second penalty for starting before the signal.
4. **Improper Action Outside Pit Stop**: A 5-second penalty will be applied for any unsanctioned actions taken outside the pit stop area.

7.2 Penalty Deduction

Penalties are added to the total race time of the robot.

8. Scoring System and Score Sheet:

Scoring Components

1. **Average Lap Time**: Based on the average time taken to complete three laps.
2. **Penalty Deduction**: Time added to the total time for each infraction.

Score Sheet Template for Fastest Robots

Team	Lab 1	Lab2	Lab3	Avg	Penalties	Final Score
A	25.0	23.5	24.0	24.2	+5	29.2
B	26.0	24.5	23.0	24.5	+0	24.5
C	22.5	23.0	24.5	23.3	+10	33.3
D	25.0	25.5	26.0	25.5	+0	25.5
E	23.0	24.0	22.5	23.2	+5	28.2

9. Challenge Phases :

9.1 Pre-Competition Submissions:

Teams are required to submit specific documents before the competition day to ensure preparedness and adherence to safety and design standards:

- **Cost Analysis: A detailed financial report assessing the costs associated with the robot's design and construction. Points: 20**

- **Technical Report: A comprehensive document detailing the robot's design, components, and functionalities, including a description of the electrical system (SID). Points: 50**

- **Safety Document: Documentation verifying that the robot meets competition safety standards, including fuse calculations for electrical safety. Points: 15**

- **Total Pre-Competition Submission Score: 85 points**

9.2 Challenge Day:

On Challenge Day, teams will participate in the following events:

9.2.1 Safety Check:

1. **Each team's robot will undergo a mandatory safety check prior to racing.**
2. **Robots that do not pass the safety check will be disqualified from competing.**
3. **Safety Check Score: 15 points**

Safety Standards:

1. **Fuse Requirement: A fuse must be used.**
2. **No Sharp Edges: Robots should not have any exposed sharp edges.**
3. **Covered Wiring: All wiring should be safely covered, with no exposed elements.**
4. **Organized Wiring: Wiring should be neatly arranged to avoid any risks.**
5. **Secured Parts: All parts should be tightly secured, with no loose screws or unsecured components.**

9.2.2 Mission (Race):

Teams will compete in a series of races, aiming to complete the track in the shortest time possible.

- Round Structure:

- **Each round will be 20 minutes in total.**
- **Each lap is allocated 5 minutes for teams to complete the track.**
- **5 minutes are provided at the beginning for setup and at the end for exiting the track.**

- Objective: Achieve the lowest time on the track across three rounds.

- Race Mission Scoring:

The robot with the fastest total time after three rounds will receive the maximum score of 200 points.

Scores for other teams will be calculated relative to the fastest robot's time, using the following formula:

$$\text{Score} = (\text{Fastest Robot Time} / \text{Competitor's Time}) \times 200$$

Example: If the fastest robot completes the course in 50 seconds, and another robot completes it in 60 seconds, the second robot's score will be:

$$\text{Score} = (50 / 60) \times 200 = 166.67$$

- Total Mission Score : 200 points, with each team's score proportional to their lap time relative to the fastest team.

9.2.3 Presentation

Teams will present their project, explaining the design, engineering, and decision-making processes.

- Format:

- Duration: 15-minute presentation followed by a 5-minute Q&A with judges.

- Content: Teams should cover their robot's design, engineering decisions, and safety considerations.

- Scoring:

- Presentation & Delivery: 50 points

- Design & Engineering Evaluation: 50 points

- Total Presentation Score: 100 points

9.3 Scoring Summary

Phase	Criteria	Points
Pre-Competition (Submissions)	Cost Analysis	20
	Technical Report	50
	Safety Document	15
Challenge Day	Safety Check	15
	Race Mission (Relative Scoring)	Up to 200
	Presentation (Delivery)	50
	Presentation (Engineering)	50

10. Safety and Technical Regulations:

10.1 Pre-Race Checks

All robots must undergo a safety and technical inspection before each race to confirm compliance with size, weight, and safety regulations.

10.2 Emergency Protocols

- Emergency Stop: Referees can halt a race for safety reasons.

- Repair Area: Designated for teams to fix robots between rounds without affecting race proceedings.

11. Design Guidelines:

To help teams build high-performance robots for the competition, the following design recommendations are provided. This guidance covers essential aspects of mechanical and electrical design, with an emphasis on safety, efficiency, and race performance.

11.1 Mechanical Design Helper

The following tips are offered to help teams create a strong, efficient chassis for optimal handling and speed on the track:

- **Chassis Design: Use lightweight, durable materials such as aluminum or carbon fiber to construct the chassis. Ensure that the chassis is structurally sound and capable of withstanding forces from acceleration, braking, and cornering.**

-**The steering system: for the front wheels is crucial for effective vehicle control, stability, and safety. Unlike fixed wheels, which would significantly limit maneuverability.**

Therefore, it is most likely that a steering system with a servo motor will be used to control the car's direction.

- **Aerodynamics: Design the robot's body to reduce air resistance, using smooth, streamlined shapes to lower drag and improve speed.**

- **Suspension: Ensure the suspension system absorbs shocks effectively, keeping the tires in contact with the track to enhance handling and stability.**

- **Weight Distribution: Position heavy components, like batteries and motors, strategically for balanced weight distribution, which helps prevent instability during sharp turns.**

- **Ground Clearance: Maintain sufficient ground clearance to avoid scraping the track, while keeping it low enough to ensure stability and prevent tipping.**

11.2 Electrical Design Helper

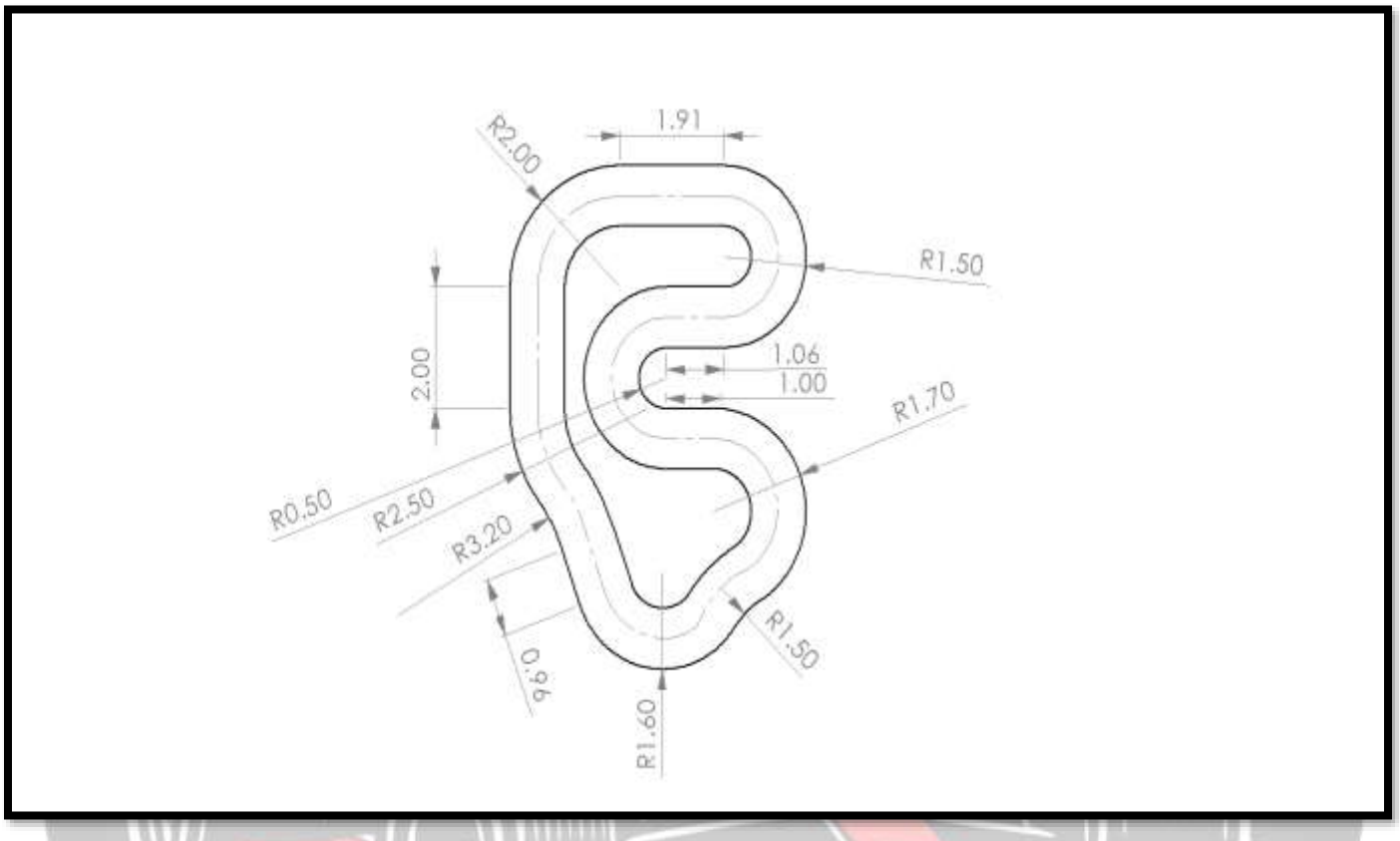
This section provides essential guidelines for selecting, configuring, and maintaining the electrical systems of your car:

- **Battery Configuration: Select a battery type and configuration (series or parallel) that matches the car's power requirements. The batteries should provide ampere power for both acceleration and endurance.**
- **Wiring and Safety: Secure all wiring and ensure insulation to prevent shorts. Install a fuse after the battery to protect the circuit from overcurrent.**
- **Motor and Control: Choose motors that balance speed and torque for optimal performance. Pair the motors with suitable motor controllers to achieve smooth, reliable operation.**
- **Power Management: Design the power system to maximize energy efficiency, minimizing power losses to maintain performance throughout the race.**
- **Testing and Calibration: Conduct thorough testing of the electrical systems in race conditions and adjust as necessary to ensure reliability and optimal performance.**

Note:

To download the Track click this link:

https://drive.google.com/drive/folders/1qKm61SZ58x9ddEqQVfE9lJCtawyUuIRh?usp=sharing



Note: Knowing that all dimensions in the pervious figure are in meters.

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Good Luck