



Fira Smart Home

Competition Rules 2024

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Abstract

The Robotic Vacuum Cleaner Simulation League operates under the umbrella of the Smart Home Robotics League, a dynamic platform that encourages participation from enthusiasts of all ages and backgrounds. As part of this larger ecosystem, the league offers a diverse array of challenges tailored to different skill levels and age groups. From the First Steps League, designed for newcomers and young enthusiasts, to the U19 Section, which pushes the boundaries of innovation and technical excellence, the league caters to a wide spectrum of participants, each with their own unique aspirations and capabilities.

League Purpose:

At its core, the Robotic Vacuum Cleaner Simulation League serves a twofold purpose: to educate and to inspire. By providing participants with access to a sophisticated simulation platform, the league empowers them to explore the intricacies of robotics and programming in a safe and controlled environment. Through hands-on experience with coding algorithms for robotic vacuum cleaners, participants not only enhance their technical skills but also cultivate a deeper appreciation for the potential of intelligent robotic solutions in real-world scenarios.

Programming Languages:

Within the league, participants have the freedom to unleash their creativity using Python, a versatile and widely adopted programming language. Python's simplicity and readability make it an ideal choice for developing algorithms for robotic vacuum cleaners, enabling participants to express their ideas and solutions with clarity and precision. Additionally, participants in the U19 Section may have the opportunity to explore more advanced programming languages, further expanding their programming repertoire and technical expertise.



Age Sections:

The league is divided into distinct age sections, each tailored to accommodate participants at different stages of their robotics journey:

1. First Step:

Geared towards individuals under the age of 13, the First Step section provides a gentle introduction to the world of robotics and programming. With no minimum age requirement, this section offers a welcoming environment where young enthusiasts can take their first steps towards mastering the art of robotics.

2. U14 Section:

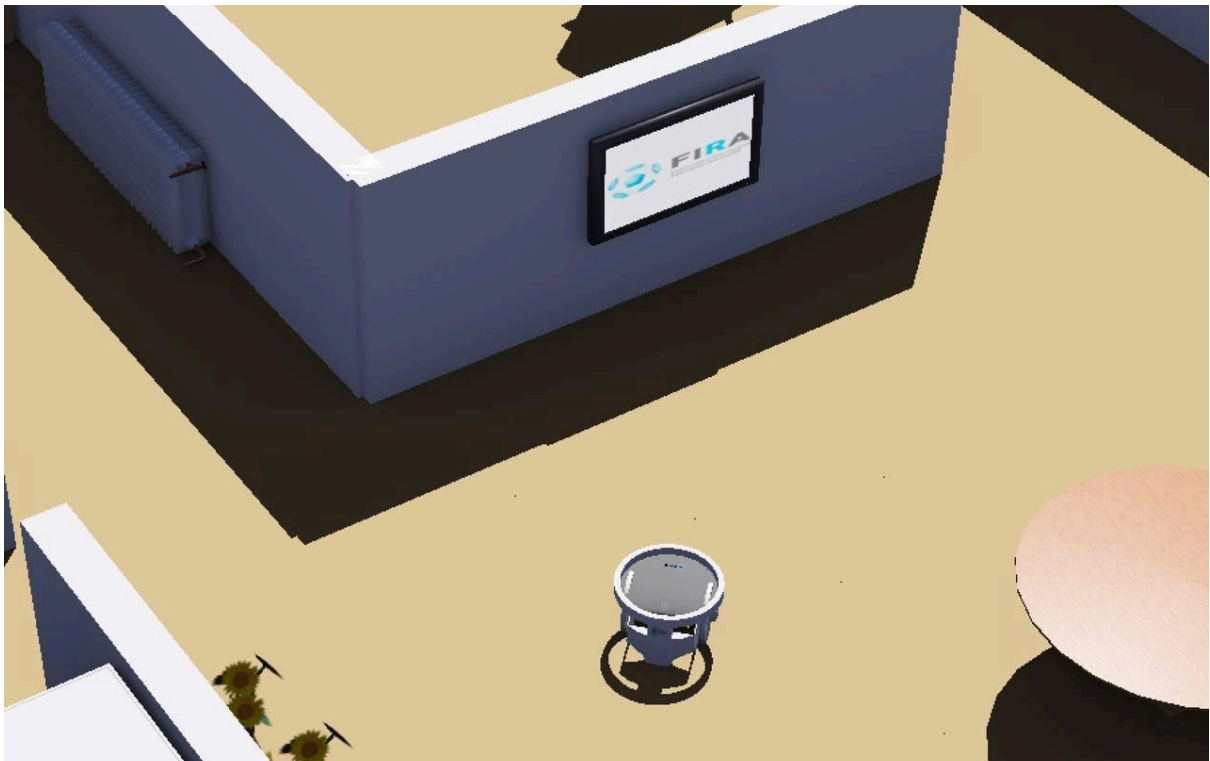
Open to individuals under the age of 14, the U14 Section offers a more structured and challenging platform for budding roboticists. Participants in this section are encouraged to delve deeper into coding and problem-solving, laying the foundation for future success in robotics competitions and beyond.

3. U19 Section:

Reserved for participants aged 14 and above, the U19 Section represents the pinnacle of the league, where advanced skills and innovative thinking take center stage. With additional sections of the rules specifically tailored to teams in this age bracket, the U19 Section provides a competitive yet nurturing environment for aspiring engineers and tech visionaries.

Robot:

The robotic vacuum cleaners are created from a different number of components and electronic sensors, and teams can use them to implement their ideas and different algorithms. Below, we highlight some of these components and sensors :



Sensors:

Distance Sensors

In the First Steps and U14 sections, eight distance sensors are strategically arranged to precisely determine the distance between the robot and obstacles, aiding in obstacle detection and collision prevention. However, in the U19 section, the arrangement of these sensors may differ, yet their fundamental purpose remains unchanged: facilitating obstacle detection and collision avoidance for enhanced robot navigation.

Inertial Measurement Unit (IMU)

An Inertial Measurement Unit (IMU) serves as a versatile device capable of measuring and conveying specific gravity, angular rate, and the orientation of an object to which it is affixed. Primarily utilized as a compass, the IMU

assists in determining the heading of the robot, offering crucial navigation guidance during its operations.

Global Positioning System (GPS) (U19)

The GPS sensor determines the precise location of the robot in environments and gains more accurate access to different areas within the perimeter.

Platform

1. **Webots Robot Simulator Version 2023.a:** This powerful tool serves as the backbone of our simulation environment, providing a robust platform for testing and refining our robotic algorithms. [Download for macOS](#) / [Download for Windows](#)
2. **Smart Home Competition Supervisor:** As the name suggests, the Competition Supervisor oversees the proceedings of the competition, implementing the rules and scoring criteria to ensure fair play and accurate assessment. [GitHub](#)
3. **Python Version 3.8 or higher:** To bring our robots to life, we'll need to write controllers using Python. [Download](#)

Game Structure

In each round, based on a unique map provided to the teams and executable within the simulation environment, the game consists of various sections of a house that have become cluttered and polluted by everyday challenges (Note: In the U19 section, maps have a fixed format and only objects on the maps are changed). The game's structure requires teams to develop their programs in a way that showcases the best possible performance in all the different environments and conditions that may arise during the competition.

This means that the teams' robots must be capable of managing various tasks and solving various challenges, including cleaning the floor tiles, addressing environmental pollution issues, robot exploration within the house, avoiding physical obstacles and checking the charging system (U19). Achieving effective performance in different environments and at different times is essential, and the teams must excel at these tasks to earn points.

All these issues and challenges provide opportunities for the teams to demonstrate their abilities in the face of real-world tasks and challenges, allowing them to improve their performance.

Obstacles

In each environment, obstacles and challenges can obstruct the robot's path. Teams must use the available sensors to identify obstacles and navigate around them to avoid causing damage to the items in the robot's path.

These obstacles can encompass a wide array of elements that individuals typically find in their daily lives, such as furniture, office equipment, or household items.



Charging System (U19)

Power for the robot is supplied through a battery. During the competition, there may be a need to recharge the battery. Wireless charging stations are designated by green areas in the environment, and these stations may be placed in one or more locations in the environment. When the robot stands on a charging station and sends a message to the server, it begins the recharging process.

Scoring

The scoring system in the Robotic Vacuum Cleaner Simulation League is pivotal in assessing the performance of participating teams. It operates by evaluating the cleanliness achieved by each robot during the competition, taking into account factors such as the coverage of cleaned floor tiles and the overall cleanliness level attained. Teams are awarded scores based on their efficiency in completing the designated tasks within the specified time frame. This scoring mechanism encourages teams to optimize their algorithms and strategies to maximize their cleaning capabilities while efficiently navigating through the simulated environments. Ultimately, the scoring system serves as a metric for gauging the effectiveness and

ingenuity of each team's robotic solutions, fostering healthy competition and innovation within the league.

Fair Play

In the Robotic Vacuum Cleaner Simulation League, fair play is a fundamental principle that underpins the integrity and spirit of the competition. Participants are expected to conduct themselves with honesty, integrity, and respect towards their fellow competitors and the rules of the league. This entails refraining from any form of cheating, exploitation of loopholes, or unsportsmanlike behavior that may compromise the fairness and integrity of the competition. Any attempt to manipulate or exploit loopholes in the rules will be met with strict penalties, including potential disqualification from the competition. By upholding the principles of fair play, participants contribute to the positive atmosphere of the league and ensure a level playing field for all teams.

Code of Conduct

The Robotic Vacuum Cleaner Simulation League places a strong emphasis on the originality and authenticity of code submitted by participants. All code must be original work, authored by the individual or team submitting it. Plagiarism, including the unauthorized use of external code libraries or the submission of code copied from other sources, is strictly prohibited and constitutes a violation of the competition's code of conduct. Participants are expected to uphold the highest standards of academic integrity and intellectual honesty in their coding practices. By adhering to these principles, participants contribute to the integrity and credibility of the competition, fostering an environment where innovation and creativity thrive.

Organizer Discretion

While the rules of the Robotic Vacuum Cleaner Simulation League provide a framework for fair and orderly competition, the organizers retain the discretion to interpret and enforce these rules as they see fit. In cases where ambiguity arises or disputes occur, the organizers will exercise their judgment to ensure a fair and equitable resolution. Decisions made by the organizers regarding rule violations or disputes are final and binding. Participants are encouraged to communicate any concerns or issues to the organizers in a respectful and constructive manner, recognizing the organizers' commitment to upholding the integrity and spirit of the competition. Through their discretion, the organizers uphold the principles of fairness, transparency, and accountability, ensuring the overall success and credibility of the league.

Ways to Contact the Technical Committee

For the most recent updates and assistance, we invite you to connect with the competition through:

- [Discord](#)
- [Telegram](#)
- [Webstie](#)