RoboCup@Home
EDUCATION

RoboCup@Home Education

Rules 2024

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RoboCup@Home Education Committee

ABOUT

This is the set of official rules of the RoboCup@Home Education Competition 2024. It is produced and maintained by the RoboCup@Home Education Committee.. It is published at the RoboCup@Home Education website [https://www.robocupathomeedu.org/rules].

Any opinion or inquiry, please refer to oc@robocupathomeedu.org.

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1. INTRODUCTION

1.1 RoboCup@Home Education

RoboCup@Home Education is an educational initiative in RoboCup@Home that promotes educational efforts to boost RoboCup@Home participation and artificial intelligence (AI)-focused service robot development [1].

This initiative currently has four efforts to promote RoboCup@Home competition:

1. **Organizing RoboCup@Home Education Competitions** (local, national, SuperRegional, international)
2. **Providing Open Source Educational Robot Platforms** for RoboCup@Home (service robotics)
3. **Providing OpenCourseWare** for the learning of AI-focused service/partner robot development
4. **Organize Outreach Workshops**

1.2 RoboCup@Home Education Competition

The **RoboCup@Home Education Competition** is a competition focusing on education to cultivate beginner teams for RoboCup@Home competitions. The unique **Workshop+Competition** format for beginner teams effectively boosts novice participants for challenging service/partner robot development and AI learning within a short period of time. @Home Education is hosted internationally and locally, by the community, and for the community.

The purpose of the @Home Education Competition is to open participation in @Home competition for **everyone**, especially novice and non-expert participants. Our communities around the world are hosting @Home Education competitions at various levels, from **regional/local events** within regions, to **SuperRegional events** covering Asia-Pacific, Europe and the Americas, and the **international competition** hosted in the annual international RoboCup events.

1.2.1 Hands-on Workshops

@Home Education committee provides hands-on workshops to guide participants to develop a robot for a competition. **Prior experience in robot development is not required**. However, some basic programming skills are needed.

Our workshops are in two forms - online or in-person. The online workshop materials can be found on @Home Education website: https://www.robocupathomeedu.org/learn/online-classroom

The in-person workshops are organized with the local organizer's request, usually. Before the international competition, @Home Education can provide an opportunity for local teams by organizing a workshop in collaboration with the LOC to promote @Home locally. In addition, to facilitate inexperienced participants to join the event, basic robot building materials or the SPL robots could be shared with qualified beginner teams to work for the robot development in preparation for a competition.

1.2.2 Educational Competition

@Home Education adapts **RoboCup@Home's official rulebook** in order to maintain the standard of the development. However, @Home Education only uses **selected tasks** that are more relevant for novice teams, In addition, it adjusts the assessment scheme for the educational purposes of @Home Education Competition.

1.3 Robot Platforms

There are 2 types of robot platforms in the Education competition: **Open Platform (OP)** and **Standard Platform (SP)**.

Teams in Open Platform use **custom built robots** for the competitions. The competition's development focus is on both **hardware** and **software** designs. Examples of the custom built robots in @Home Education competition can be seen in Fig. 1.

Teams in Standard Platform use **Pepper robots from Aldebaran at the United Robotics Group.** (Fig. 2) [2] in the competitions. The development focus is mainly on software design.

Fig. 1 Custom build robots in Education competition

Fig. 2 Standard robot platform - Pepper robot from SoftBank Robotics

1.4 Participation Categories and Registrations

@Home Education has two categories - **Open Platform (OP)** and **Standard Platform (SP)**.
The competition will be run in two categories.

The registration will be done in two registration categories - Major and Junior registrations. Teams with ALL team members who are 19 year-olds or younger can register as Junior teams. Teams with ALL team members who are older than 19 year-olds must register as Major teams. If the majority of the team members are 19 year-olds or younger, the team can decide to register the older members as mentors. However, the mentor-team member ratio must be 1-3 or more. The youngest team members who can register as Junior members are 14 year-olds.

1.5 Eligibility and Qualification

The purpose of the @Home Education competition is to open @Home competition participation to everyone, especially novice and inexperienced participants. Due to the vast differences in the background and preparations/robot developments among potential participants, @Home Education **qualification procedure** is different from regular RoboCup qualification processes.

In the qualification procedure, teams are required to submit qualification materials (Team Description Paper (TDP) and Team Video) to the committee for review. The Team Description Paper requirements can be found here. The Team Video should show what the team has developed so far using the hardware (if applicable) or simulation, or using diagrams to explain the solution that the team has developed within five minutes. If the video is longer than five minutes, the committee will not review the portion after the 5 minute mark.

Below are some eligibilities and qualifications that we look for in the team application:

- Teams with their own hardware (both Open and SPL):
    - Experience in local @Home Education events - Teams are encouraged to participate in local events first, and advance toward international events.
    - Experienced teams in international events could participate in @Home Education competition as long as the majority of the team members are novice and new to RoboCup competition.
    - Robot hardware costs should be similar to those of the workshop's basic robot platform (<USD 5k).
- Teams without own hardware:
    - Experience in robot development and robot competitions with similar level - i.e. teams from other RoboCup leagues or robotics competitions with some related technical competency.
    - Familiarity with the basic robot platform/SPL - experience in working on related hardware and developing software systems, especially with the RoboCup@Home Education OpenCourseWare/SPL.

1.6 Awards

For each platform there will be Ranking Awards based on the competition performance. There are also some certificate awards, including sponsored Technical Awards and People's Choice Awards.

2. COMPETITION RULES

2.1 Fundamental Concept and General Rules

Fundamentally, the Education competition rules are based on the finalized (previous year) RoboCup@Home's official rulebook. This is to maintain the standard and development along with RoboCup@Home. However, for the educational purpose, several adjustments are made to put more focus on the teams' growth.

2.1.1 Task Selections

We are selecting skill-based tasks from the RoboCup@Home rulebook that are more relevant for novice teams development from the workshop learning. This year, the task selections are as follows:

1. **Carry My Luggage** - Navigation task
2. **Find My Mates** - Vision task
3. **Receptionist** - Speech task

2.1.2 Manipulation Task Adjustment

For Open Platform robots, due the size and height of the robots, the object placement for manipulation tasks is adjusted to be located within the reach of the working envelope of the robot arm (Fig. 3).

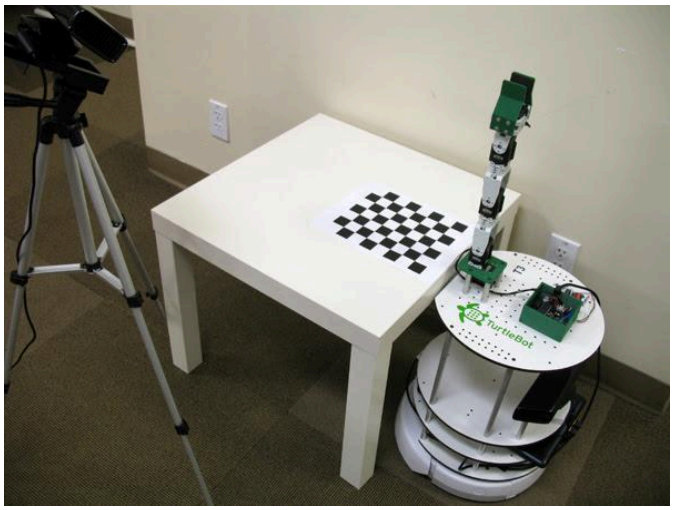

Fig. 3 Object placement and the working envelope of the robot arm [3]

For Standard Platform robots, the manipulation task can be assisted (by human) using the *simplify rule*.

2.2 Team Poster and Presentation

As part of the Finals, all teams are required to prepare a team poster introducing their own team technical development. The A1 size posters are supposed to be posted at the poster area at the beginning of the event.

There will be a team poster presentation session at the end of the workshop sessions, before the start of the competition. All teams will present their poster to introduce their team technical development.

2.3 Educational Assessment Approach

In the Education competition, we are formulating more suitable assessment approaches for the educational purpose.

2.3.1 Incremental Scoring

Compared to the objective based scoring approach in RoboCup@Home, the incremental scoring approach by dividing the task scoring goals into subgoals, can enable partial scoring to assist new teams, who may be challenging for them to produce complete solutions as beginners. The updates are made in red to the task scoresheets. Also, the human assistance mechanism, "Deus ex Machina" is replaced with the above subgoals to cover the task flows.

2.3.2 The “Skip Rule”

The skip rule is a mechanism for the teams to "skip" for difficult parts within a task to proceed to the next subgoal. The purpose is to encourage teams to attempt the tasks even only partially (e.g. only vision task or only speech task if the navigation system is not working).

It is important to note that the skip rule is not a retry mechanism, i.e. the teams cannot retry the same subgoal when applying the skip rule, but have to proceed to the next subgoal.

2.3.3 The “Simplify Rule”

To further motivate teams to attempt difficult challenges instead of calling skip rule, the simplify rule allows teams to run a subgoal of the task under simpler conditions for a reduction of points (i.e. 50%).

For example, in an object recognition task, a team can use their own object, this would be an intermediate score comparing recognizing objects decided by the OC. For people perception or people following, teams may ask to use their own team member (possibly with a predefined colored shirt) instead of a person chosen by OC.

OC can limit the number and the type of such simplifications and teams are required to announce them before the test.

2.4 Competition Tasks

Based on the previous year RoboCup@Home rulebook of 2022, 3 tasks and Finals are selected as follows:

2.4.1 Task 1: Carry My Luggage

The description in section 5.1 Carry My Luggage [Party Host] (pg. 41-43) is referred to.

Score sheet

The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal	
Picking up the correct bag	*100*
• Detect the selected bag	*(50)*
• Take the selected bag [For SPL team - Find a person and communicate with the person to bring the bag for the guest]	*(50)* *300*
Following the person to the car	
• Follow the operator to the outside of the arena	*(150)*
• Follow the operator to the car	*(150)*
• Drop the bag at the car	*50*
Avoid the crowd of people obstructing the path	*50*
Avoid the small object on the ground	*50*
Avoid the hard-to-see object	*50*
Avoid the area blocked with retractable barriers	

Bonus rewards	*100*
Reentering the arena	*(50)*
• Re-enter into inside of the arena	*(50)*
• Back to the starting point	*300*
Joining and staying in the queue on the way to the arena	*(150)*
• Joining the queue	*(150)*
• Staying in the queue	
Regular Penalties	*-50*
Dropping the bag	
Deus Ex Machina Penalties	*-50*
Rediscovering the operator by natural interaction	*-100*
Rediscovering the operator by unnatural interaction	*-200*
Rediscovering the operator by direct contact	
Special Penalties & Bonuses	*-500*
Not attending (see sec. 3.9.1)	*-100*
Using alternative start signal (see sec. 3.4.4)	
Total Score (excluding special penalties & standard bonuses)	*600 (Max 1000)*

2.4.2 Task 2: Find My Mates

The description in section 5.4 Find My Mates [Party Host] (pg. 48-49) is referred to.

Score sheet

The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal	
Report a guest location	*2 x 100*
• Detect a guest	*(2 x 40)*
• Move to the front of a guest	*(2 x 10)*
• Back to the front of the operator	*(2 x 10)*
• Provide the guest location	*(2 x 40)*
Provide location unique feature	*2 x 50*
Provide description of a guest	*2 x 150*
• Provide the correct guest's name	*(2 x 50)*
• Provide the correct guest's description 1	*(2 x 50)*
• Provide the correct guest's description 2	*(2 x 50)*
Bonus rewards	
Report the 3rd guest location	*150*
• Detect the 3rd guest	*(50)*
• Move to the front of a guest	*(25)*
• Back to the front of the operator	*(25)*
• Provide the 3rd guest location	*(50)*
Provide description of a 3rd guest	*250*

• Provide the correct 3rd guest's name	*(50)*
• Provide the correct 3rd guest's description 1	*(100)*
• Provide the correct 3rd guest's description 2	*(100)*
Deus Ex Machina Penalties	
Person has to wave the robot in order to be found	*2 x -75*
Person has to tell the robot where he/she is sitting/standing	*2 x -75*
Person has to approach to the robot (e.g. walk and stand in front of it)	*2 x -150*
Special Penalties & Bonuses	
Not attending (see sec. 3.9.1)	*-500*
Using alternative start button (see sec. 3.4.4)	*-100*
Total Score (excluding special penalties & standard bonuses)	*600 (Max 1000)*

2.4.3 Task 3: Receptionist

The description in section 5.6 Receptionist [Party Host] (pg. 52-53) is referred to.

Score sheet

The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal	
Introduce a new guest to every other guest and offer a seat	*2 x 250*
• Introduce the guest's name	*(2 x 50)*
• Introduce the guest's favorite drink	*(2 x 50)*
• Detect an empty seat	*(2 x 100)*
• Pointing/Facing at the empty seat while offering it	*(2 x 50)*
Look at the person talking	*50*
Look at the person being described	*50*
Look in the direction of navigation	*50*
Continue with wrong name or drink	*2 x -50*
Persistent inappropriate gaze - away from conversational partner	*2 x -50*
Persistent gaze not in the direction of the navigation while moving	*-50*
Bonus rewards	
Open the entrance door for a guest [For SPL team - Find a person and communicate with the person to open the door for the guest]	*2 x 100* *150*
Describe the first guest to the second guest	
Deus Ex Machina Penalties	*2 x -75*
Alternative HRI	*2 x -200*
Not recognizing people	
Special Penalties & Bonuses	*-500*
Not attending (see sec. 3.9.1)	
Total Score (excluding special penalties & standard bonuses)	*650 (Max 1000)*

2.5 Finals: Presentation and Demonstration

The description in Chapter 7 Finals (pg. 85-86) is referred to.

All teams compete in Finals.

2.5.1 Task

The objectives of this year are:

- The robot helps a person that has had a small accident in their home.
- The robot monitors a person while they are going about their day and reacts appropriately if it notices any unusual events.

The procedure for the demonstration and the timing of slots is as follows:

1. **Setup and demonstration:** The team has a maximum of *10 minutes* for setup, presentation and demonstration.
2. **Interview and cleanup:** After the demonstration, there is another *5 minutes* where the team answers questions by the jury members. During the interview time, the team has to undo its changes to the environment.

REFERENCES

[1] J. T. C. Tan, L. Iocchi, A. Eguchi, H. Okada, “Bridging Robotics Education between High School and University: RoboCup@Home Education,” *Int. Conf. of IEEE AFRICON 2019*, Sep. 2019.

[2] Aldebaran’s Pepper robot, https://unitedrobotics.group/en/robots/pepper

[3] ROS Wiki, http://wiki.ros.org/turtlebot_kinect_arm_calibration/Tutorials/CalibratingKinectToTurtleBotArm