RoboCup@Home Education

Online Challenge

Rules 2020

ABOUT

This is the set of official rules of the RoboCup@Home Education Challenge 2020. It is produced and maintained by the RoboCup@Home Education OC (Organizing Committee). It is published at the RoboCup@Home Education website [http://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].

Under this initiative, currently there are 4 efforts in active operation:

1. **RoboCup@Home Education Challenge** events (national, regional, international)
2. **Open Source Educational Robot Platforms** for RoboCup@Home (service robotics)
3. **OpenCourseWare** for the learning of AI-focused service robot development
4. **Outreach Programs** (local workshops, international academic exchanges, etc.)

1.2 RoboCup@Home Education Online Challenge

The **RoboCup@Home Education Online Challenge** is an online competition platform to cultivate beginner teams for RoboCup@Home challenges. The unique **Workshop+Competition** format effectively boosts novice participants for challenging service robot development and AI learning within an event time. Hosted locally and internationally, by the community, and for the community.

The purpose of the Online Challenge is to open the participation for **everyone**, especially novice and non-expert participants with no past experience. Our communities around the world are hosting Education Challenges at various levels, from **national events** within countries, to **regional events** covering Asia-Pacific, Europe and Americas, and **international events** usually hosted in the annual international RoboCup events.

1.2.1 Hands-on Workshops

We conduct hands-on workshops to guide the participants to build the robot for the competition. **Prior experience in robot building is not required**. However, some basic programming skills are needed.

To facilitate totally inexperienced participants to join the event, we are providing (in sharing manner) basic robot building materials for qualified beginner teams to work for the workshop development and competition.

1.2.2 Educational Competition

We are running the competition and adapting similar rules from **RoboCup@Home's official rulebook**, in order to maintain the standard of the development. However, we are also **selecting tasks** that are more

relevant for novice teams development, and formulating more suitable **assessment approach** for the educational purpose.

1.3 Robot Platforms

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

Teams in Open Platform use **custom build robots** for the challenge events. The challenge's development focus is on both **hardware** and **software** designs. Example of the custom build robots in Education Challenge can be seen in Fig. 1.

Teams in Standard Platform use **a standardized robot platform - Pepper robot from SoftBank Robotics** (Fig. 2) [2] in the challenge events. The development focus is mainly on software design.

Fig. 1 Custom build robots in Education Challenge

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

1.4 Participation Categories

Under each robot platform, it is further divided into **Open category** for any age level of participants, and **Junior category** for teams with all members under 19 years old.

- Open Platform
  - Open category
  - Junior category
- Standard Platform
  - Open category

○ Junior category

It is important to note that the same registration requirements of RoboCup Major leagues are applied to Open category teams, and RoboCup Junior leagues registration requirements for Junior category.

1.5 Eligibility and Qualification

The purpose of the Education Challenge is to open the participation for everyone, especially novice and non-expert participants with no past experience. However, due to the vast background differences of all potential participants, in some cases, it may jeopardize the balance of the competition. Similar conditions may also happen to the Open Platform teams' custom build robot hardware, where the basic robot platforms provided during the workshop may not be as superior as the custom build robots. On the other hand, teams without robot hardware and wish to apply for hardware support during the event also need to prove their own preparation and readiness for the challenges. Hence, we have a **qualification procedure** during team application to review the teams and hardware conditions.

In the qualification procedure, teams are required to submit qualification materials (i.e. Team Description Paper (TDP) and team video) to the OC for reviews. Some guidelines for the OC to review for team qualifications are as belows:

- Teams with own hardware:
  - Experience in local Education Challenge events - Teams are encouraged to attempt local events first, and advance toward international events.
  - Majority new members for experienced teams in international events.
  - Similar robot hardware costs as compared to the provided workshop basic robot platform (<USD 5k).
- Teams without own hardware:
  - Experience in related development and competition events - Teams from other RoboCup leagues or robotics competitions are proven to have some related technical competency.
  - Familiarity with the workshop basic robot platform - Experience in working on related hardware and software systems, tutorials, especially the RoboCup@Home Education OpenCourseWare.

1.6 Awards

For each platform and each category, there will be a 1st and 2nd place awards.

The sponsored Special Awards are given based on the criteria as follows:

- **MathWorks Award** - Best use of MATLAB tools
- **SoftBank Robotics Award** - Best use of Pepper robot software development tools
- **Jupiter Robot Award** - Best robot design

2. COMPETITION RULES

2.1 Fundamental Concept and General Rules

Fundamentally, the Education Challenge 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).
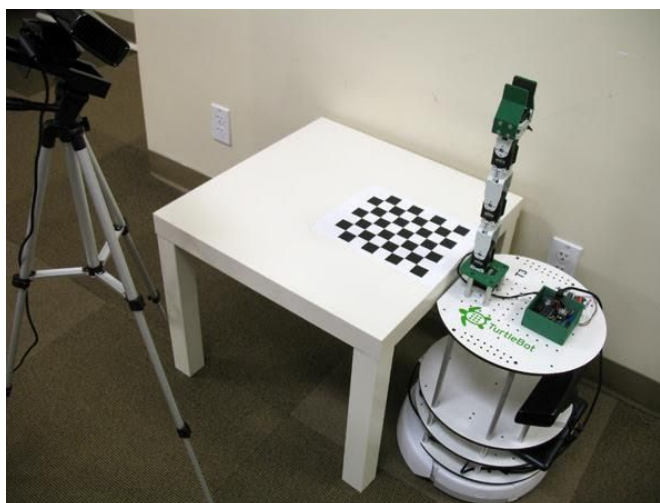

Fig. 3 Object placement and the working envelope of the robot arm [3]

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 Challenge, 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 partially 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 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 2019, 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. 47-48) is referred to.

Score sheet

The maximum time for this test is 5 minutes.

Action	Score
Main Goal	
Take the bag to the car	*500*
● Detect the selected bag	*(100)*
● Take the selected bag	*(200)*
● Follow the operator to the outside of the arena	*(100)*
● Follow the operator to the car	*(100)*
~~Hand-over the bag~~	~~-200~~
~~Regain operator's track by natural interaction~~	~~5 x -100~~
~~Regain operator's track by non-natural interaction~~	~~5 x -200~~
~~Regain operator's track by direct contact~~	~~5 x -400~~
Bonus rewards	
Reentering the arena	*100*
● Re-enter into inside of the arena	*(50)*
● Back to the starting point	*(50)*
Avoid the crowd obstructing path	*100*
Avoid the small object on the ground	*100*
Avoid the hard-to-see 3D object	*100*
Avoid the area blocked with retractable barriers	*100*
Special penalties & standard bonuses	
Not attending (see sec. 3.9.1)	*-500*
Using start button (see sec. 3.4.4)	*-100*
Outstanding performance (see sec. 3.9.3)	*100*
Total score (excluding penalties and standard bonuses)	*1000*

2.4.2 Task 2: Find My Mates

The description in section 5.4 Find My Mates [Party Host] (pg. 53-54) 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 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)*
~~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*~~
Bonus rewards	
Report the 3rd guest location	*200*
● Detect the 3rd guest	*(80)*
● Move to the front of a guest	*(20)*
● Back to the front of the operator	*(20)*
● Provide the 3rd guest location	*(80)*
Provide description of a 3rd guest	*300*
● Provide the correct 3rd guest's name	*(100)*
● Provide the correct 3rd guest's description 1	*(100)*
● Provide the correct 3rd guest's description 2	*(100)*
Special penalties & standard bonuses	
Not attending (see sec. 3.9.1)	*-500*
Using start button (see sec. 3.4.4)	*-100*
Outstanding performance (see sec. 3.9.3)	*100*
Total score (excluding penalties and standard bonuses)	*1000*

2.4.3 Task 3: Receptionist

The description in section 5.6 Receptionist [Party Host] (pg. 57-58) is referred to.

Score sheet

The maximum time for this test is 5 minutes.

Action	Score
Main Goal	
Introduce the 1st guest to John	*100*
● Introduce the 1st guest's name	*(30)*
● Introduce the 1st guest's favorite drink	*(30)*
● Pointing/Facing at the 1st guest while introduction	*(40)*
Offer an empty seat to the 1st guest	*150*
● Detect an empty seat	*(75)*
● Pointing/Facing at the empty seat while offering it	*(75)*
Introduce the 2nd guest to John and 1st guest	*100*
● Introduce the 2nd guest's name	*(30)*
● Introduce the 2nd guest's favorite drink	*(30)*
● Pointing/Facing at the 2nd guest while introduction	*(40)*
Offer an empty seat to the 2nd guest	*150*
● Detect an empty seat	*(75)*
● Pointing/Facing at the empty seat while offering it	*(75)*
~~Misunderstanding the name of a guest~~	~~*2 x -50*~~
Bonus rewards	
Opening the entrance door to a guest	*2 x 200*
Sitting the oldest person on a sofa	*100*
Special penalties & standard bonuses	
Not attending (see sec. 3.9.1)	*-500*
Using start button (see sec. 3.4.4)	*-100*
Outstanding performance (see sec. 3.9.3)	*100*
Total score (excluding penalties and standard bonuses)	*1000*

2.5 Finals: Presentation and Demonstration

The description in Chapter 7 Finals (pg. 89-90) is referred to.

All teams compete in Finals.

2.5.1 Task

The objectives of this year are:
- The robot serves food to a user.
- The robot interacts with a non-expert user naturally.

The procedure for the demonstration and the timing of slots is as follows:
1. **Setup and demonstration:** The team has a maximum of 7 minutes for setup, presentation and demonstration.
2. **Interview and cleanup:** After the demonstration, there is another 3 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

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[2] SoftBank Robotics Pepper robot, https://www.softbank.jp/en/robot/

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