RoboCup@Home Education

Natural Human Robot Instruction Challenge

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.

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 locally prior to 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. For the ICRA @Home Education, there are further modifications made to test new tasks, which are explained in the following sections.

The competition schedule will be as follows:

Workshop – May 13 -14, 2024
Team set-up – May 14, 2024 (teams that do not need workshop, can come to set-up on those two days or just on May 14)
Competition – May 15-16, 2024

1.3 Task Selections

The following are the tasks for this competition to test:

1. ***Find Mates and Make New Mates (party)*** - Vision and Speech tasks
2. ***Receptionist (restaurants)*** - Vision and Speech tasks
3. ***Farewell (restaurants)*** - Speech task

Teams should try at least one task and/or the open demonstration.

1.4 Competition Task Details:

1.4.1 Task 1: Find Mates and Make New Mates (party):
The robot collects some information about various party-guests for the operator, who only knows the names of the guests. While asking questions through communication, it makes new friends.

Main goal: Report to the operator the description of at least two party-guests and the description of at least two new guests.

Technical Judging Score sheet
The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal	
Report the information about a guest	*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 information	*(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 information (new friend)	*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 (i.e. next to who, second from the right, etc.)	*2 x -75*
Person has to approach to the robot (e.g. stand in front of it)	*2 x -150*
Special Penalties & Bonuses	*-500*
Not attending	*-100*
Using alternative start button	
Total Score (excluding special penalties & standard bonuses)	*1000*

1.4.2 Task 2: Receptionist (restaurants):

The robot welcomes the guests in naturalistic ways. It asks the guests if they would like to have a drink at the bar or dinner. Depending on their response, the robot checks with the human receptionist what seats/tables are available including the features of the available locations/tables. Communicate the information with the guest(s) and have them decide which location they prefer. Communicate their decision with an available server and send them to the location of the guest's choice.

Technical Judging Score sheet

The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal Find out what the new guests prefer and offer seats/table while communicating with the human receptionist and servers.	
Introduce the guest's name	*2 x 250*
● Introduce the guest's favorite drink	*(2 x 50)*
● Communicate potential seats/chairs	*(2 x 50)*
● Carry out a conversation naturally to gather guest's preference	*(2 x 50)*
● Communicate the preference of the guest with the human receptionist	*(2 x 100)*
Look at the person talking	
Look at the person being described	*50*
Look in the direction of navigation/available server	*50*
Continue with wrong name, drink, or choice of seat/table	*50*
Persistent inappropriate gaze - away from conversational partner	*2 x -50*
Persistent gaze not in the direction of the navigation while moving	*2 x -50*
Bonus rewards	*-50*
Open the entrance door for a guest	
Describe the first guest to the second guest	*2 x 100*
Deus Ex Machina Penalties	*150*
Alternative HRI	
Not recognizing people	*2 x -75*
Special Penalties & Bonuses	*2 x -200*
Not attending	*-500*
Total Score (excluding special penalties & standard bonuses)	*1000*

1.4.3 Task 3: Farewell (restaurants):

The robot receives the guests, asks how their experience was, and carries out a casual conversation that suits the guests' responses. It checks with the human receptionist to provide the bill to the guests. After the payment, it communicates with the guests, encouraging them to come back in the near future and stating its farewell suited to the guests *in naturalistic ways.*

Technical Judging Score sheet

The maximum time for this test is 5 minutes.

Action	**Score**
Main Goal Receive a guest location	*2 x 100*

● Detect a guest ● Move to the front of a guest ● Back to the front of the human receptionist ● Carries out a natural conversation with the guest about their experience Provide description of a guest ● Provide the correct guest's name ● Provide the correct guest's description 1 ● Provide the correct guest's description 2 Communicate with the guest about the bill (amount and preferred payment method), report it back to the human receptionist ***Bonus rewards*** Report the 3rd guest's information ● Detect the 3rd guest ● Move to the front of a guest ● Back to the front of the operator ● Provide the 3rd guest location Provide description of a 3rd guest ● Provide the correct 3rd guest's name ● Provide the correct 3rd guest's description 1 ● Provide the correct 3rd guest's description 2 ● Communicate with the guest about the bill (amount and preferred payment method), report it back to the human receptionist ***Deus Ex Machina Penalties*** Person has to wave the robot in order to be found Person has to tell the robot where he/she is sitting/standing Person has to approach to the robot (e.g. walk and stand in front of it) ***Special Penalties & Bonuses*** Not attending Using alternative start button	*(2 x 40)* *(2 x 10)* *(2 x 10)* *(2 x 40)* *2 x 150* *(2 x 50)* *(2 x 50)* *(2 x 50)* *2 x 50* *150* *(50)* *(25)* *(25)* *(50)* *250* *(50)* *(100)* *(100)* *(50)* *2 x -75* *2 x -75* *2 x -150* *-500* *-100*
Total Score (excluding special penalties & standard bonuses)	*1000*

1.5 Final: Presentation and Demonstration

All teams compete in Final which is the open demonstration. Teams prepare the open demonstration using the themes explained below.

1.5.1 Theme of the Tasks:

The objectives of this year are:

- The robot helps a person with issues that person faces (difficulty with work, relationships, health etc.) *in naturalistic ways*.
- The robot monitors a person while they are going about their day and helps support them through communications and suggestions *in naturalistic ways*.

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.

1.6 Non-Technical Judging Future User Assessment

All tasks will be judged by ordinary people (non-technical judging). The assessment tool which focuses on natural HRI evaluated by non-technical people is in development.

1.7 Team Presentation:

As part of the Finals, all teams are required to prepare team presentation slides introducing their team's technical development.

All teams will present their presentation slides to introduce their team's technical development.

1.8 Approaches of @Home Education ICRA competition

1.8.1 Educational Assessment Approach:

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

1.8.2 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.

1.8.3 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.

1.8.4 The "Simplify Rule":

To further motivate teams to attempt difficult challenges instead of calling the 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 a conversational task, a team can use their own scripted conversation. This would be an intermediate score comparing the flow of the conversation decided by the human counterparts' more natural conversation. For people's 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 the committee.

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

Date/Time	05/13	05/14	05/15	05/16
9 am		Team set up	Task Demo 1	Final Demo
10 am			Task Demo 1	Final Demo
11 am			Task Demo 1	Final Demo
12 pm			Task Demo 1	Final Demo
1 pm				
2 pm			Task Demo 2	
3 pm			Task Demo 2	Award Ceremony
4 pm			Task Demo 2	
5 pm			Task Demo 2	

Awards (draft):

The list of awards are considered to be given at the award ceremony:

- Best team for each task (three)
- Best open demonstration
- Best innovation
- Best HRI
- Best overall team performance