CEABOT: Nationalwide Little humanoid robots competition; rules, experiences and new challenges

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Abstract. Ceabot competition, first national competition of humanoid robots for degree and postgraduate courses students, is introduced. It is organized by the robotic part and automation Spanish committee (CEA-IFAC). Three editions already took place. Its aim is to encourage students to start with robotics, programming little humanoid robots that were constructed by themselves or adapted from a commercial kit. In the paper the main aspects of the organization, the rules and the competition are revised.

Keywords: Teaching with robotics, Didactic approaches, Humanoid robots.

1 Introduction

In this document we tried to compile and spread the gained experiences from former CEABOT competitions. The competition is annually presented in "Jornadas de Automática" sponsored by CEA-IFAC. The competition final goal is to encourage the automation and robotics teachers to try new students to participate in new editions of that competition.

2 The competition

The objective of the competition is promoting the participation of degree and postgraduate courses students for their starting at robotics, programming and control of walking robots.

Remote control units are not permitted during the execution of competition tests. The robot of the team must demonstrate its skills through accomplishing the various tests fully autonomously. Any intervention by team members during development of the tests is punished with a penalty, even a single touch with the hand to avoid a collapse or change of position to recover it from a strange movement. All hardware and software control should be included in the robot. The robots are going to inhibit communication with the outside world to avoid tele-operation. The behaviour of the robot must be programmed and based on sensory information available on board. The students should have chosen the sensors according to the test.

It consists of two or three tests, the first one in the past calls was a walking test. Robots must walk forward from the starting line until the finishing one, where they must go back to the starting line walking backwards. The second one a sumo fight.

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This test is in a plane rectangle, levelled out, green, stiff field which measures are 2x2.5m. It is shown in the following draw, figure 1. In figure 2 the sumo court.

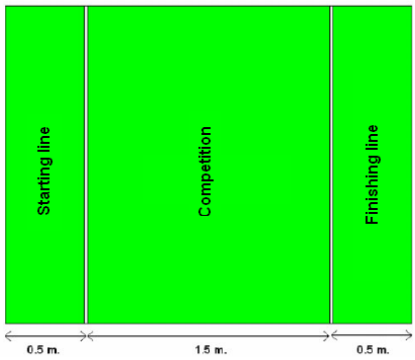

Figure 1. Field for the competition

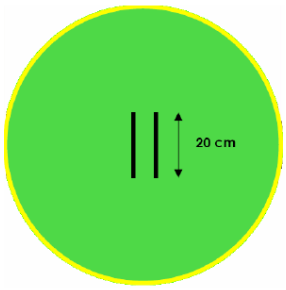

Figure 2. Ring court for the sumo fight

2.1 The rules and teams

The organizing team is the one who writes the rules for the competition. Every year the rules have to be changed, revised and published. For further information on the different tasks the robots must overcome check the competition rules. The rules of this competition are based on the ones from the Federation of International Robot-soccer Association (FIRA), and the competition is based on Humanoid Robot World Cup Soccer Tournament (Hurosoft) with small robots at [1] .

Each team is allowed to have maximum one robot. One team is made up of up to five students. A student cannot be in more than one team. It is recommended having teams of two or three people because there is no limit for number of teams. But if there are too many teams participating, the jury would set up a qualification round to make sure only the best ones are taking part in the tournament.

For score points the robot has to make its opponent fall down or expel it from the court. The one who makes more points wins an assault. There are three of them.

3. Students participation

To be able to participate in the competition, each team has to prepare the robot to afford the heats.
At first, the robot has to be built. After this, the sensors have to be chosen and added. Then the software programming, that is the part where most time is spent, has to be done. It consists of generating trajectories and designing primitives for the movements.
The robot's weight, dimension and anthropomorphic characteristics are described in the rules. How the walls, the marks and colours must be has to be written there as well. The teams, the jury, and everything about the heats and scoring have to be revised every year. A penalty can be defined in case anyone does not play with the rules, even the exclusion of a team from the competition may be declared.

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4. About the organization

The competition is an extra activity in the "Jornadas de Automática" organized every year by the Public Universities of Spain that are at GT-ROB. The Host University organizes the whole event. GT-ROB and the teacher of last year's Winner University support them. The development committee consists of people selected by the last year's winner.
The Host must be in charge of the construction of the courts and the development committee of its verification and examination.
The participant teams always have to be accompanied by a teacher who is responsible for the students. The registration is for free and the sensors, the robot and every material are paid by the respective University. This limits the number of teams per University.
To encourage the participation in the competition it is important to find a technologic company which is interested in sponsoring the prizes.

5. Beyond contest

The robotics as a teaching tool wins over more followers every day, from secondary education to university courses across the degrees, masters, etc. Not only engineering departments are using robotic platforms but it is increasingly used in other fields. This suggests that the potential of robots in education is developing. Advantage should be taken on the variety of robotics and low cost robot kits. (Weinberg et al. 2003).

The robots provide the students a natural way to develop skills in integrating systems, the current functioning of the devices, critical thinking and independent resolution of problems, working in teams and multidisciplinary approach. Many teachers are interested in these low-cost reconfigurable and/or mobile platforms for teaching purposes or research. Universities and high school centres are using these kits as platforms to test ambient intelligence, programming control systems, mechatronics etc. Numerous projects have dealt with the impact of robotics in education ([2], [3]). This demonstrates that the motivation to learn is substantially increased, when it gives students a practical way to implement the theoretical foundations, building and programming robots to solve certain evidence or real problems.
The interaction between the students and real robots provides them with enough experience to understand and solve real problems, developing new capacities to identify and propose viable technical and economical solutions. Compared to other disciplines, robotics is still an emerging area, which combines aspects of mechanical engineering, electronics and programming applied in a particular device. This multidisciplinary approach and the synergies that help them to work in teams of students from different engineering directions make Robots an excellent teaching platform.

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Figure 3., CEABOT07.

Figure 3 shows the competition of 2007. The experience gained by students makes them able to focus on drafting a report about the work done and explaining how the, operating circuits, sensors, etc. work.

6 Conclusions and Future Work

After the experience that has been made by the organizers of the contest in its first three editions, some possible conclusions and initiatives can be drawn. To increase the competitions acceptance and impact among the students, it has taken time to set and readjust the rules. Furthermore, enough time needs to be given to the students to be prepared for the tests. It has to enhance disclosure and advertisements to increase participation. We have to involve teachers who hold seminars about subjects like robotics, programming and its automatic bid to incorporate ending of career projects opportunity to participate. In turn departments must be able to finance the purchase of kits and consumables. This is facilitated through the use of robots built by students themselves and low cost commercial kits.

Thanks

We want to specially thank, for the efforts made to all the UC3M students that collaborate in the last three contest edition on behalf of the team Roboticslab.. Thanks to the CEA-GTRob and CEA_IFAC organizations for supporting the initiative contest each call.

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