7th LATIN AMERICAN IEEE STUDENT ROBOTICS COMPETITION

Joint with JRI'2008 (Brazilian Intelligent Robotic Journey) and SBIA'2008 (19th Brazilian Symposium on Artificial Intelligence)

Rules for the IEEE Educational Kits Competition

Version 1.5

The Backup Restore Challenge

Objective

Two robots must cooperate to restore the spaceship main computer.

Story

Not so long ago, two spaceships were exploring Mars when one of them had technical problems and crashed. The crew was transported by robots from the Mars surface to the other spaceship in a suspended animation state in order to fly back to Earth. Inside the ship, the only two remaining robots assisted the injured crew preparing medicines and cleaning up the place by throwing the medical trash in proper places. Not lucky enough, they have run out of food and fuel. Fortunately, they were close to a space station and food and fuel were successfully brought to the spaceship by the robots, and the spaceship restarted its journey safely back to Earth.

Surprisingly, the safe trip of the robotic crew stopped when the spaceship flew across a nebulous. The spaceship was involved by an electromagnetic space storm, which caused a general failure on the spaceship computers that erased all data in computers hard disks. The ship is now flying without control, and the current ship direction will cause itself to collide with a planet in less than 5 minutes at present velocity.

Fortunately, robots have a highly pragmatic backup policy and lots and lots of backup tapes are available, and the last backup tape can be used to restore the spaceship main computer. The last backup is stored jointly with older backups into cabinets in the spaceship backup room. However, for security reasons, data cannot be restored in the main computer without appropriate password. This password is recorded into a special security card stored upstairs, in the second floor of the spaceship.

In order to reestablish the spaceship computational system, robots must bring the security card and the last backup tape to the main computer and introduce both in the appropriate inputs. A final restriction to accomplish the system restore, however, is that both data (the security card and the system backup) must be introduced in the main

computer inputs at the same time, each one by a robot with a delay not superior to 5 seconds between then, configuring the cooperative task!

Challenge Overview

Both robots will start the challenge at the same time in front of the data input areas of the main computer. Once the challenge starts, one of the robots must go to the backup room in order to look for the last backup tape, and the other robot must go to the password room in order to take the password card. Both (backup tape and password) will be represented in the game by a black wood cube. In the backup room, there will be a number of tape storage cabinets, that will store a number of old backup tapes, represented by blue wood cubes. Tapes in a cabinet will be positioned vertically one above other. In all backup rooms it will exist only one black wood cube, in an unknown and randomly chosen position. The robot must search for the last tape remaining in the backup room. In front of each cabinet there will be a black tape on the ground. The blue tapes in front of the main computer inputs accomplish the landmark. The second robot must look for the black wood cube in the upstairs. Both cubes must be introduced in the main computer inputs at the same time, each one by a robot, configuring the cooperative task.

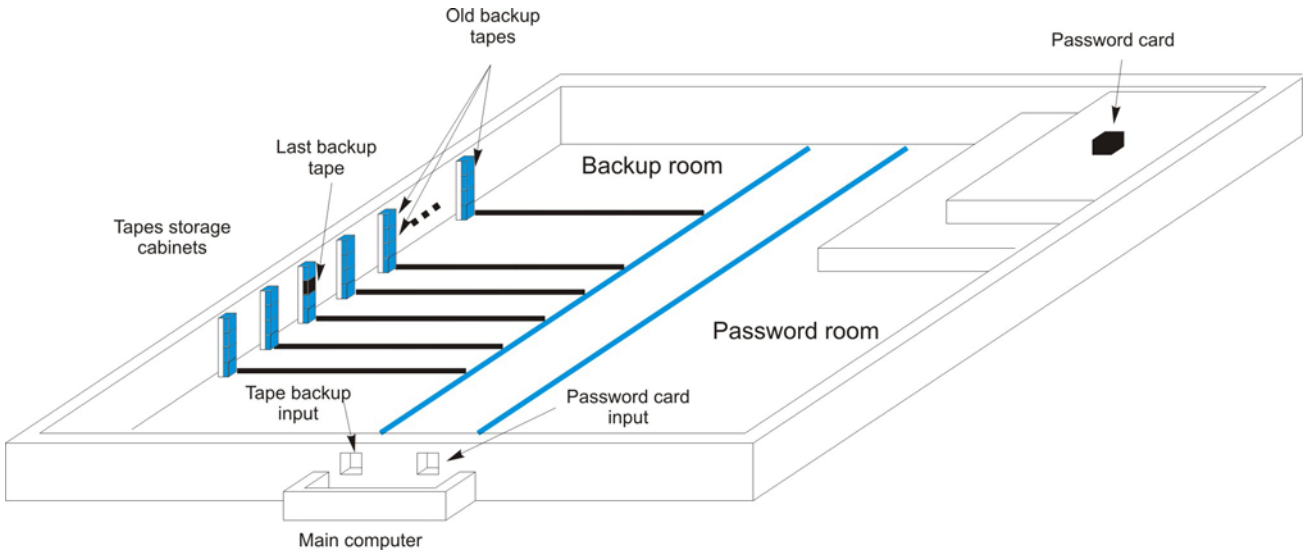


Figure 1 – Arena overview (out of scale, details in appendix 1).

Preparation for the Challenge

- **Robots**: each robot will begin the game in the start position of the arena, at the beginning of the blue tapes in front of the main computer.

- **Password**: the password will be positioned somewhere on the top floor of the spaceship.

- **Correct backup tape**: the correct backup tape will be positioned in a random cabinet, as well as in a random position in the cabinet. The judge will be responsible for this random selection. Every available place in the cabinets will be filled.

- **Calibration:** teams must be prepared to calibrate their robots to the environment conditions in the maximum of 2 minutes before the beginning of the game. No calibration or reprogramming will be allowed after the start of the game.

Rules Summary

- All robots are to act autonomously, that is to say, robots must operate without human control during contest;

- The maximum time for completing the challenge is 5 minutes;

- As a tentative for next years, only LEGO (NXT e RCX), PNCA, MECCANO and RoboExp educational kits are allowed;

- The teams will have two chances of restarting by challenge, placing the robots in their initial positions with the current time counting;

- The game is over:

    - When the 5 minutes are gone;

    - When the 2 restarts have been used;

    - When the team informs the judge that they have finished the challenge, with the gained points until the moment.

About the Robots

- **Type of material:** only official Standard Kits pieces and sensors are allowed, i.e., only temperature, rotation, light, and touch sensors can be used. Micro or regular motors are allowed. Any other object non-Standard Kits component or object, such as rubber bands,

rope, adhesive tape, insulating tape, to name a few, will cause the disqualification of the team. It will not be allowed the use of remote control inside of the arena environment;

- **Number of components**: each robot will have the limitation of 6 sensors, 6 actuators (motors) and any number of sound generators;
- **Maximum dimensions:** at all time in a match, each robot must fit into a 25cm cube, even when its parts are completely extended or opened. An antenna is not allowed, except if inside these limits;
- **Weight limit:** there is no weight limit for this challenge.

Colors and Marks

- **Floor:** The floor will be of a light not textured color (white, or close to white);
- **Walls:** The walls will be of a light not textured color (white, or close to white);
- **Tapes:** 3M® black tapes will be used to indicate the path to the backup tapes cabinets and 3M® blue tapes will be used to indicate the path to the main computer.
- **Password:** Black wood cube, as shown in appendix 2.
- **Correct backup tape:** Black wood cube, as shown in appendix 2.
- **Old backup tapes:** Blue wood cubes, as shown in appendix 2.
- **Main computer holes:** See the appendix 1 for layout details.
- **Cabinets:** See the appendix 2 for layout details.

Classification criteria:

The following criteria will be successively adopted in order to classify teams:

1. **Number of points:** the team with more points will be declared the winner;
2. **Time spent:** the team that accomplished the task in the shorter time will be declared the winner.

Punctuation Summary

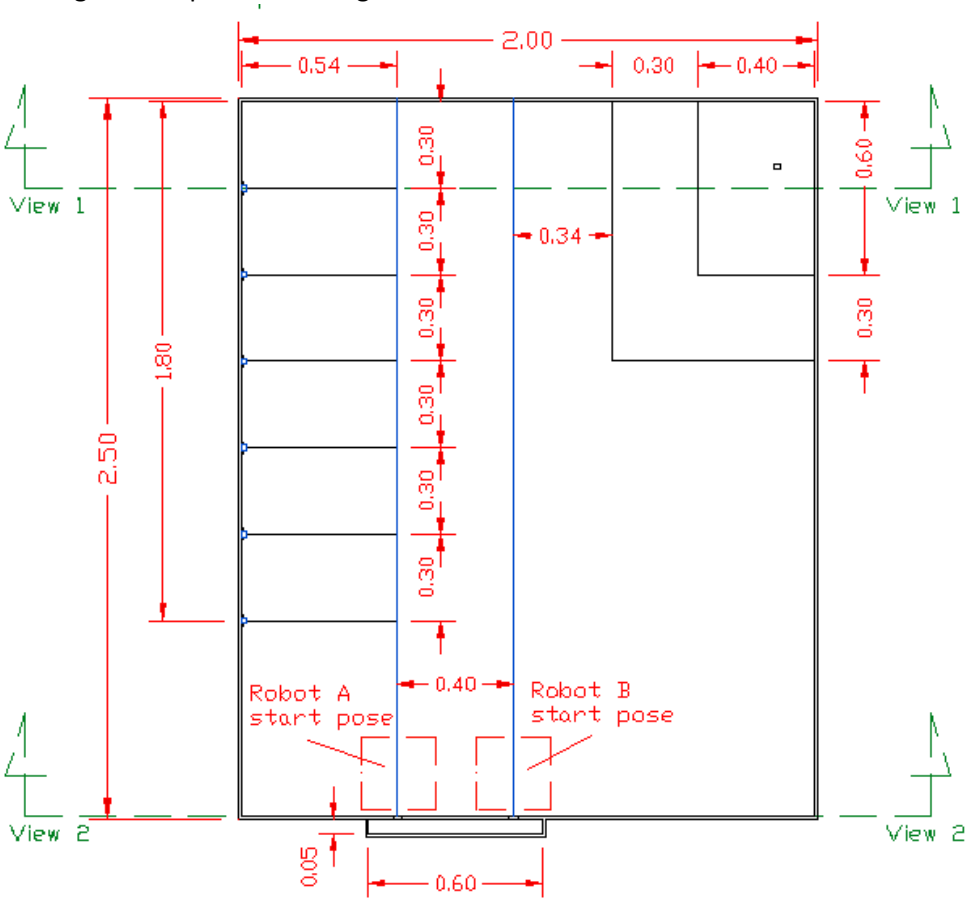
- Task punctuation:

- Accomplished task (correct cubes dropped in correct holes with a time delay not superior to 5 seconds): + 1.000 points
- Accomplished task with time delay (correct cubes dropped in correct holes with a time delay superior to 5 seconds): +500 points
- Each robot with black cube positioned in main computer input: + 100 points

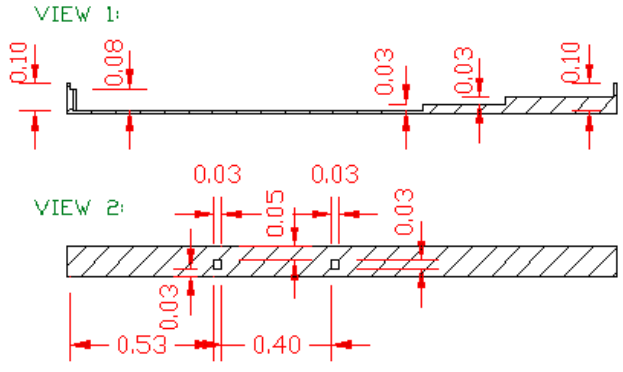
- Backup room punctuation:
  - Each blue cube accidentally dropped outside of the cabinet or carried by robot: - 50 points
  - Each blue cube intentionally left outside of its place in the cabinet: - 2.000 points
  - Id the right backup tape with triple beep sound: +100 points
  - Catch without dropping the right backup tape: +100 points
- Password room punctuation:
  - Each step up (robot must be completely above the step): +50 points
  - Each step down (robot must be completely bellow the step): +50 points
  - Password catch:+100 points
- Restarting:
  - Each restart: -50 points.

Appendix 1: Arena constructive details

Official arena will be constructed in wood (ground, walls, stairs and tapes cabinet) with dimensions shown in figure 2a. The two red squares indicate initial positions of both robots. Figure 2b details stairs, main computer inputs and walls. Walls are 10cm high and stairs are 3cm high. As a cheaper alternative for tests, we recommend constructing an arena using a white plastic on the ground.



(a)



(b)

Figure 2. Arena construction details and dimensions.

Appendix 2: Accessories and objects construction details

Backup tapes detail

Old and last backup tapes and password card will be constructed in wood as shown in figure 3.

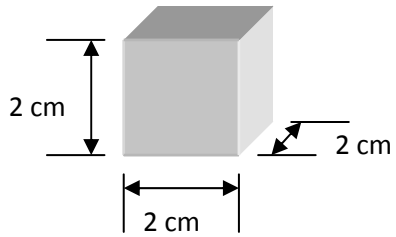


Figure 3. Backup tapes construction details.

Colors:

- Old backups in blue (0,0,255);
- Last backup and password card in black (0,0,0);

Tapes cabinet detail

Four backup tapes will be stacked in each backup cabinet. Two wood lateral structures will be used in order to support these four wood cubes. These lateral structures will be of the same size of the cubes (8cm) and must be glued on the ground and wall of the arena. Lateral structures will be in white (or close to white).

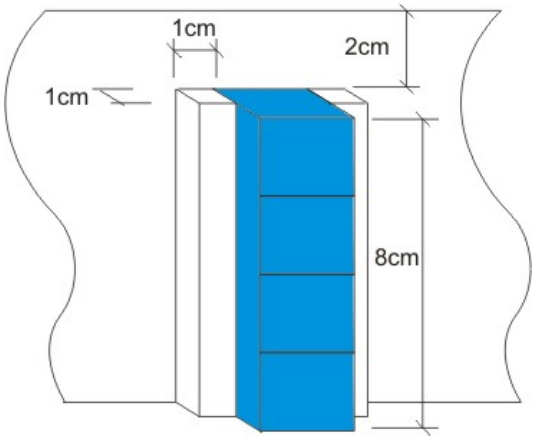


Figure 4. Tapes cabinet construction details.