Final task ISS-2020 Cesena

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Separate collection of waste

The *supervisor* of a waiting room (*wroom*) of a large train station intends to promote automatic collection of the rubbish, by means of ddr robots. To this end, some specialized robot (*detector*) periodically explores the surface of the *wroom* in order to collect objects made of recyclable material, in particular bottles made of *plastic* .

The room

The *wroom* is equipped with a indoor air quality sensor (for example [CJMCU-811](#)) that makes available data on the [TVOC concentration in ppm](#).

When the indoor air quality sensor detects a level of TVOC higher than a prefixed value, the *wroom* is said to be in **state-TVOCHigh**.

The *wroom* is also equipped with a collector of plastic-objects (*plasticBox*) that can contain a maximum of **NPB** (e.g. NPB=10) bottles.

The *detector* is initially located in a *detectorHome* situated on the (left-up) corner of the *wroom* .

The collector is situated along the border of the *wroom* behind the *detectorHome* and works as a smart device, able to expose and update - via CoAP - its content.

For a possible virtual environment, see [sceneConfig.js](#)
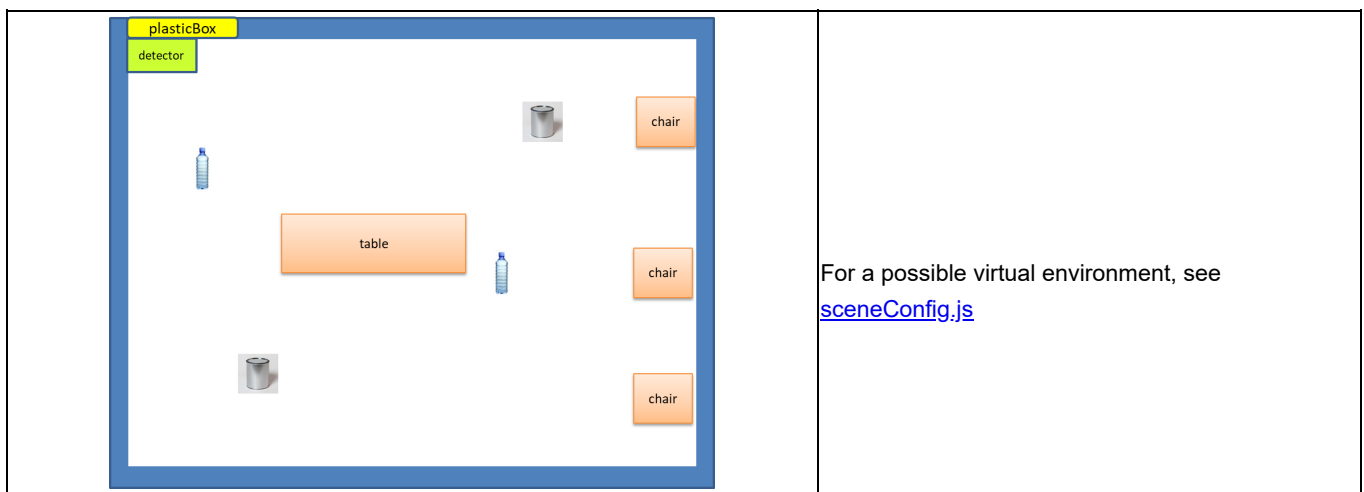
The detector

The *detector* is able to recognize if an object is made of plastic and is equipped with a local container (*detectorBox*) that can contain a maximum of **NDB<NPB** (e.g. NDB=5) bottles.

The behavior of the *detector* is managed by the *supervisor* , which can tell the robot to perform a set of tasks. These tasks are executed when the *wroom* is **closed** to people and include:

1. *Explore the room*. This task performs the following actions:
   - explore the *wroom* in a *systematic way* in order to find static obstacles;
   - if the obstacle is not made made of plastic, keep track of its position in the *wroom* and continue the exploration;
   - if the detected object is made of plastic, put it (if there is space) in the *detectorBox* ; if the *detectorBox* is full or if the room has been completely explored, execute the task *Empty the detectorBox*.

2. *Empty the detectorBox*. This task performs the following actions:
   - if the **detectorBox** is empty, execute the task *Go to home*;
   - check if the **plasticBox** is able to accept the objects contained in the **detectorBox** ; if it cannot accept, send a message to the **supervisor** and wait for a command;
   - otherwise, save the current position of the robot(**beforeEmptyPos**), then move to the **plasticBox** , transfer into it the content of the **detectorBox** and return to the task *Explore the room*, restarting from the saved **beforeEmptyPos** .

3. *Go to home*. This task performs the following actions:
   - return the robot to its **discoveryHome**

4. *Terminate the work*. This task performs the following actions:
   - if the **detectorBox** is empty, return to the **discoveryHome** ; otherwise, execute the task *Empty the detectorBox* and then return to the **discoveryHome**

Requirements

Design and build the software to put on board of the **plasticBox** and of the **detector** . The system must be able to accept the following commands sent by the *smart-phone* of the **supervisor** :

- **explore**: the **detector** must execute the task *Explore the room*.
- **suspend**: the **detector** must execute the task *Go to home*.
- **terminate**: the **detector** must execute the task *Terminate the work*.

Any command sent by the **supervisor** can be executed only if the room is **NOT** in the **state-TVOCHigh**. The system must also include an 'agent' able to detect the **state-TVOCHigh** and to send in automatic way the command **suspend** to the robot.

Moreover, the *smart-phone* of the **supervisor** should be automatically updated with information about:

- the current position of the robot on a map of the **wroom** . The map should also show the position of the detected non-plastic objects;
- the space still available in its **detectorBox** ;
- the space still available in the **plasticBox** .

Non functional requirements

1. The ideal work team is composed of 3 persons. Teams of 1 or 2 persons (**NOT** 4 or more) are also allowed.
2. The team must present a workplan as the result of the requirement/problem analysis, including some significant **TestPlan**.
3. The team must present the sequence of SPRINT performed, with appropriate motivations.
4. The team must present (in synthetic, schematic way) the specific activity of each team-component.