Final task ISS-2021 Bologna: Automated Car-Parking

Automated Car-Parking

A company intends to build an *automating parking service* composed of a set of elements:

- A software system, named ***ParkManagerService***, that implements the required automation functions.
- A **DDR** robot working as a ***transport trolley***, that is intially situated in its ***home*** location. The **transport trolley** has the form of a square of side length ***RD***.
- A ***parking-area*** is an empty room that includes;
  - an ***INDOOR*** to enter the car in the area. Facing the **INDOOR**, there is a ***INDOOR-area*** equipped with a ***weigthsensor*** that measures the ***weigth*** of the car;
  - an ***OUTDOOR*** to exit from the **parking-area**. Just after the **OUTDOOR**, there is ***OUTDOOR-area*** equipped with a ***outsonar***, used to detect the presence of a car. The **OUTDOOR-area**, once engaded by a car, should be freed within a prefixed interval of time ***DTFREE***;
  - a number **N (N=6)** of ***parking-slots***;
  - a ***thermometer*** that measures the temperature ***TA*** of the area;
  - a ***fan*** that should be activated when **TA > TMAX**, where ***TMAX*** is a prefixed value (e.g. **35**)

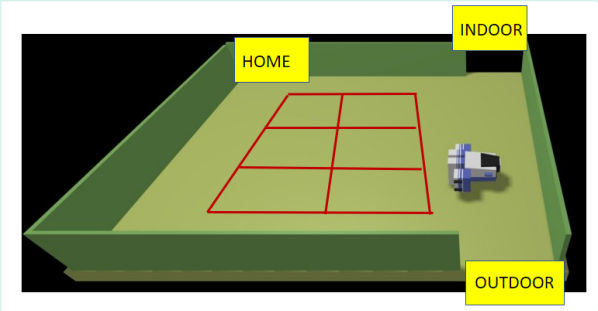
  A ***map*** of the parking area, represented as a grid of squares of side length ***RD***, is available in the file parkingMap.txt:

```
|r, 0, 0, 0, 0, 0, 0, X,
|0, 0, X, X,  0, 0, 0, X,
|0, 0, X, X,  0, 0, 0, X,
|0, 0, X, X,  0, 0, 0, X,
|0, 0, 0, 0, 0, 0, 0, X,
|X, X, X, X, X, X, X, X,
```

The map includes the positions of the **parking-slots** (marked above with the symbol **X**) and of the ***fixed obstacles*** in the area (the walls marked with the symbol **X**).

The area marked with **X** is a sort of 'equipped area' upon which the **transport trolley** cannot walk. Thus, to get the car in the **parking-slot (2,2)**, the **transport trolley** must go in cell **(1,2)**.

The proper scene for the WEnv is reported in: parkingAreaConfig.js



- a *parking-manager* (an human being) which supervises the state of the **parking-area** and handles critical situations.

The job of our company is to design, build and deploy the *ParkManagerService*.

User stories

As a **client - parking phase** :

- I intend to use a *ParkServiceGUI* provided by the **ParkManagerService** to notify my interest in *entering* my auto in the **parking-area** and to receive as answer the number *SLOTNUM* of a free parking-slot (**1<=SLOTNUM<=6**). **SLOTNUM==0** means that no free slot is available.
- If **SLOTNUM >0**, I move my car in front to the **INDOOR**, get out of the car and afterwards press a *CARENTER* button on the *ParkServiceGUI*. Afterwards, the **transport trolley** takes over my car and moves it from the **INDOOR** to the selected **parking-slot**. The **ParkServiceGUI** will show to me a receipt that includes a (unique) *TOKENID*, to be used in the *car pick up* phase.

As a **client - car pick up phase** :

- I intend to use the **ParkServiceGUI** to submit the request to pick up my car, by sending the **TOKENID** previously received.
- Afterwards, the **transport trolley** takes over my car and moves it from its **parking-slot** to the **OUTDOOR-area**.
- I move the car, so to free the **OUTDOOR-area**.

As a **parking-manager**:

- I intend to use the *ParkServiceStatusGUI* provided by the **ParkManagerService** to observe the *current state* of the **parking area**, including the value **TA** of the temperature, the state of the **fan** and the state of the **transport trolley** (**idle, working or stopped**).
- I intend to *stop* the **transport trolley** when **TA > TMAX**, activate the **fan** and wait until **TA < TMAX**. At this time, I stop the **fan** and resume the behavior of the **transport trolley**. Hopefully, the **start/stop of the fan** could also be automated by the **ParkManagerService**, while the **start/stop of the transport trolley** is always up to me.
- I expect that the **ParkManagerService** sends to me an *alarm* if it detectes that the **OUTDOOR-area** has not been cleaned within the **DTFREE** interval of time.

Requirements

The **ParkManagerService** should create the **ParkServiceGUI** (for the client) and the **ParkServiceStatusGUI** (for the manager) and then perform the following tasks:

- ***acceptIN***: accept the request of a client to park the car if there is at least one **parking-slot** available, select a free slot identified with a unique **SLOTNUM**.
  A request of this type can be elaborated only when the **INDOOR-area is free**, and the **transport trolley** is at **home** or working (**not stopped** by the manager). If the **INDOOR-area** is already engaged by a car, the request is not immediately processed (the client could simply wait or could - optionally - receive a proper notice).
- ***informIN***: inform the client about the value of the **SLOTNUM**.

If **SLOTNUM>0**:

1. ***moveToIn***: move the **transport trolley** from its current localtion to the **INDOOR** ;
2. ***receipt***: send to the client a receipt including the value of the **TOKENID** ;
3. ***moveToSlotIn***: move the **transport trolley** from the **INDOOR** to the selected **parking-slot**;
4. ***backToHome***: if no other request is present, move the **transport trolley** to its **home** location, else ***acceptIN*** or ***acceptOUT***.

If **SLOTNUM==0**:

- ***moveToHome***: if not already at home, move the **transport trolley** to its **home** location.

- ***acceptOUT***: accept the request of a client to get out the car with **TOKENID**. A request of this type can be elaborated only when the **OUTDOOR-area is free** and the **transport trolley** is at **home** or working (**not stopped** by the manager). If the **OUTDOOR-area** is still engaged by a car, the request is not immediately processed (the client could simply wait or could - optionally - receive a proper notice).
  1. ***findSlot***: deduce the number of the parking slot (***CARSLOTNUM***) from the **TOKENID**;
  2. ***moveToSlotOut***: move the **transport trolley** from its current localtion to the **CARSLOTNUM/parking-slot** ;
  3. ***moveToOut***: move the **transport trolley** to the **OUTDOOR** ;
  4. ***moveToHome***: if no other request is present move the **transport trolley** to its **home** location;
     else ***acceptIN*** or ***acceptOUT***

- ***monitor***: update the **ParkServiceStatusGUI** with the required information about the state of the system.

- ***manage***: accept the request of the manager to stop/resume the behavior of the **transport trolley**.

About the devices

All the sensors (**weigthsensor**, **outsonar**, **thermometer**) and the **fan** should be properly simulated by mock-objects or mock-actors.

When using a real robot

No further requirement.

When available a Raspberry and a sonar

The **outsonar** could be a real device. We can simulate the presence/absence of a car.

When using only the virtual robot or no real sonar available

Consider the new requirement:

- **authorize**: allow a manager to use the **ParkServiceStatusGUI** only if she/he owns **proper permissions**.

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. Each **SPRINT** must be associated with its own 'chronicle' (see templateToFill.html) that presents, in concise way, the key-points related to each phases of development. Hopefully, the team could also deploy the system using docker.
5. Each team must publish and maintain a GIT-repository (referred in the templateToFill.html) with the code and the related documents.
6. The team must present (in synthetic, schematic way) the **specific activity of each team-component**.

Guidance

- Oltre al codice sviluppato durante il corso, il progetto it.unibo.qakDemo include codice che potrebbe risultare utile per l'applicazione finale.
- Il numero e le finalità degli SPRINT sono definiti dal Team di sviluppo dopo opportune interazioni con il committente.
- Il committente (e/o il product-owner) è disponibile ONLINE in linea di massima ogni **Giovedi dalle 15 alle 18** fino a fine Luglio, ma è sempre contattabile on-demand via email.
- Lo svolgimento del lavoro è auspicabile avvenga in diverse fasi:

1. *Fase di analisi*, che termina con la definizione di una architettura logica del sistema, di modelli eseguibili e alcuni, significativi piani di testing.

   E' raccomandato che i risultati di questa fase vengano presentati al committente (con opportuno appuntamento) prima della consegna finale del prodotto.

2. *Fase di progetto e realizzazione*, che termina con il deployment del prodotto.
3.
4. *Fase di discussione* del lavoro svolto, che potrebbe (auspicabilmente) svolgersi IN PRESENZA in LAb2. E' opportuno che ogni partecipante sia pronto a discutere anche sugli elaborati che ha prodotto durante il corso.

AL TERMINE DEL LAVORO:

```
1) Porre il sistema in uno stato con
       0 < nfree < 6  slot liberi e 0 < nbusy < 6  slot occupati.
2) Ipotizzare che la temperatura sia e permanga ok, il fan spento,
   INDOOR e OUTDOOR libere
3) Simulare che il sistema riceva, a distanza di 2 sec l'una dall'altra:
        a) una enterrequest
        b) una carenter
        c) una pickup request
4) Definire le variazioni di stato che il SISTEMA REALIZZATO effettua.
Ad esempio:
  Il sistema risponde al client al punto a) e poi inizia una acceptin al punto b).
  In questa fase, il cliente vede ... mentre il manager vede ...
  Quando arriva c) ...

5) Indicare la strategia seguita per poter automatizzare un test di questo tipo
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