Final Workshop

Towards Smart Autonomous Cyber-Physical Systems:
*Unmanned Aerial/Ground Vehicles and Robots*

Logistics Demo

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Demo summary

- Within a warehouse, items are unloaded at a certain area and need to be moved to dedicated positions in another area.
- The human workers call the independently operating swarm for help on demand in order to place the carts according to their needs
- In order to operate the swarm, the human can start the mission, send the robots back to a start position or abort the mission.
  - These functions are treated as blocks, such as the ones generated by the code generator.
- Human safety is addressed: The Turtlebots evade (human) obstacles or stop in distance
  - In case an obstacle is not detected early enough, bumpers and slow speed avoid any harm
- Dynamicity of the environment:
  - No static plan → if a robot is removed, the system will continue unloading every cart
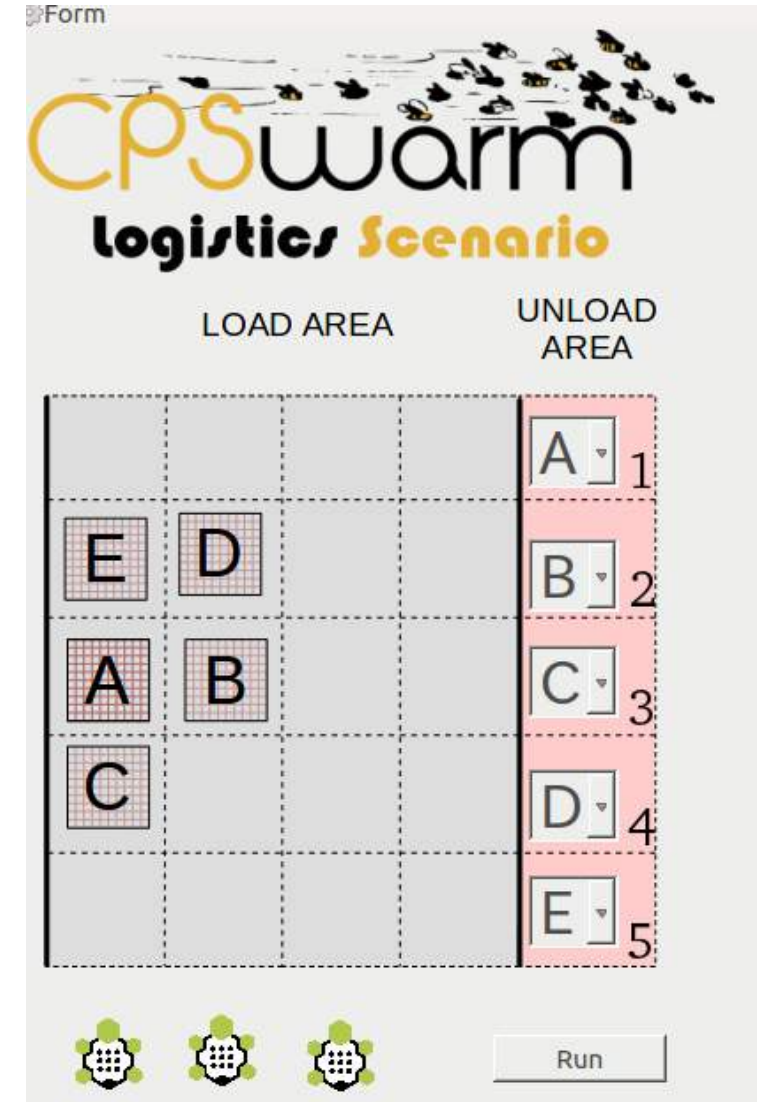
Hardware used

- There will be 2 types of turtlebots, two with camera and without elevator, and 5 with elevator but without camera.
- The carts will have different QR codes and the id of the QR code will be assigned to some target location.
- So, all robots will know the assignment between id_code and location
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Camera

Elevator

🔵 CPS_scout   CPS_carrier ⬡
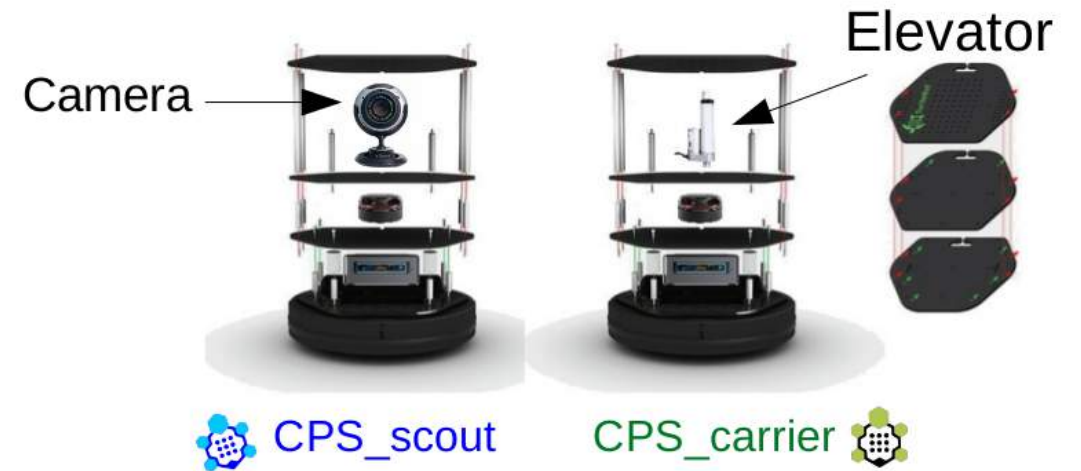
Requirements

QR_Id	Final_pos
A	1
B	2
C	3
D	4
E	5

Hardware used

- The CPS_carrier robots will keep the elevator installed between the two last wood stacks of the top on the robot.

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- The CPS_scout robots do not need to lift carts so the elevator has been removed. The new scenario they have to identify QR codes from the carts.

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- The camera model choosen is FLIR Chameleon CM3. Resolution of 2048x1536 pixels, a rate frame of 55 fps and an interface USB 3.0. To integrate it with Ubuntu Operating System was necessary to increase the bandwidth of the USB ports in order to get the images at the rate of 55 fps.

- The laser Hokuyo UST-10LX is installed in all the robots. This laser has a range of 10m, a wide detection angle of 270°, an angular resolution of 0.25° and a precision of 40mm

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Hardware used

- There will be a fixed camera in a tripod checking all the time that there is no person close to the scenario.
- For this mission the camera Rubedos VIPER has been selected. This camera is a stereo camera with a depth range from 1 m to over 30m and a diagonal field of view up to 92 degrees. It also incorporates an NVIDIA® Jetson™ TX2 Module to process on-board image processing. This device will be part of the scenario as another CPS that will notify the robots if it detects one person around.

Hardware used

- Control box used:
  - Wireless pushbuttons: Schneider ZBRRC and ZBRT buttons
  - Remote I/O card - This module is receiving wireless signals from no-battery pushbuttons, resulting in a clean and easy infrastructure deployment.
    - Advantech ADAM 6060 I/O module:
    - 6-ch DI, 6-ch RL, Ethernet-based smart I/O. Multiple protocol support: Modbus/TCP, TCP/IP, UDP, HTTP, DHCP, SNMP, MQTT
  - AC-DC converters and wiring: Small converters will be powering the devices with 12V and 24V DC.
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