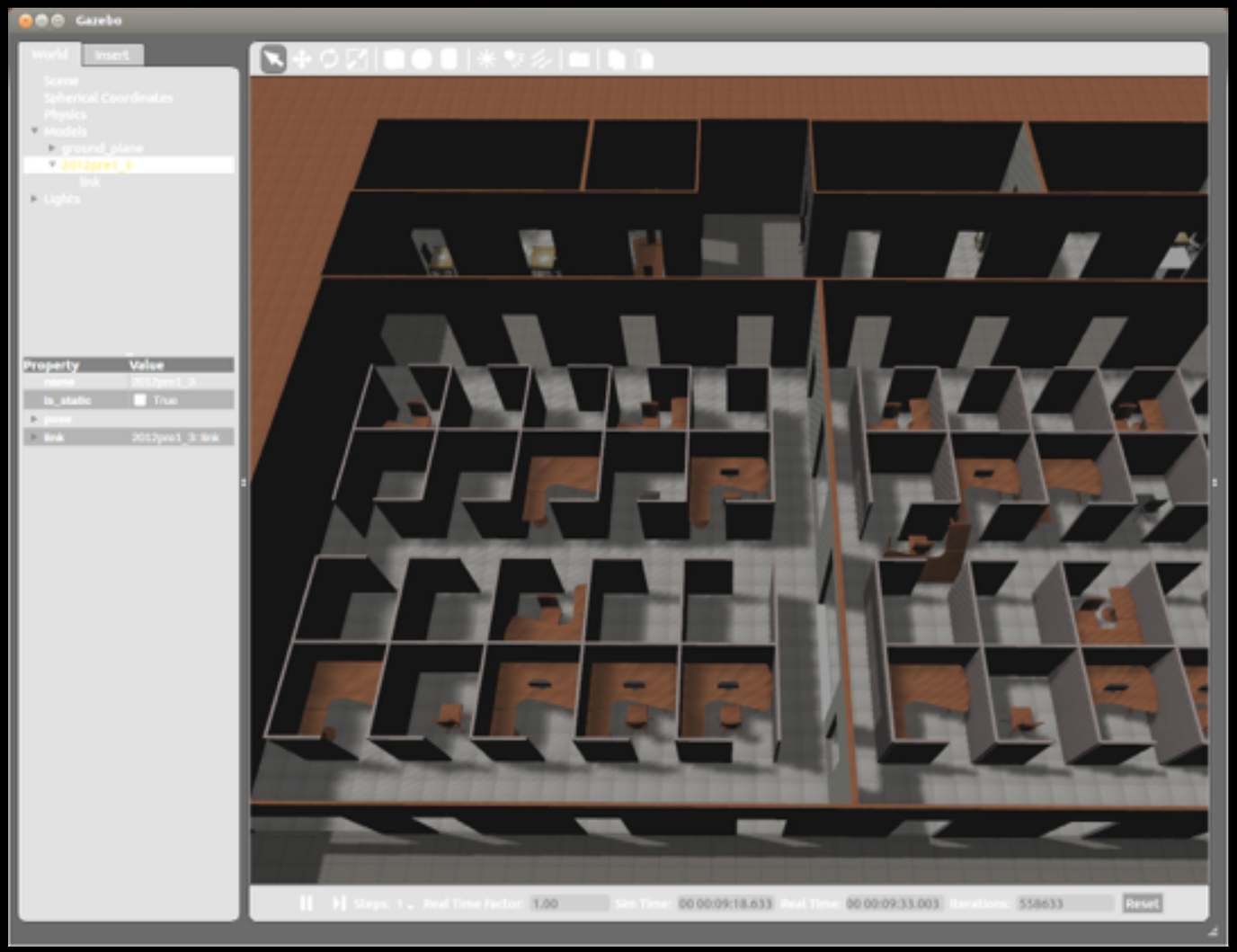
Integration of the simulated sensors with ROS and controlling a mobile robot

- Teams of Participants -



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(2015~2017)

Hands-on 1 : JVRC_R4 with SLAM mapping.

- Using usarsim_inf, ROS, Hector_SLAM
- Pushing an movable object with making a map

- This hands-on have 2 parts.
  - Part 1
    - Run Gazebo with the JVRC_R4 model.
  - Part 2
    - Run ROS with usarsim_inf , Hector_SLAM , rviz , teleop_twist_keyboard

Hands-on 1 : JVRC_R4 with SLAM mapping.

- Edit USARGazebo.world for selecting JVRC_R4.
  - open ~/RobocupRescuePackage/USARGazebo.world with an editor
  - Search “SIMPLE BLOCK WORLD”
  - Remove “- ->” at the end of the line.
  - Search “JVRC Task R4”
  - Add “- ->” after the end of the line.
  - Save and close the file.
- Run Gazebo with the field_model of JVRC_R4.
  - cd ~/RobocupRescuePackage
  - source .bashrc.USARGazebo
  - Run gazebo with USARGazebo.world

Hands-on 1 : JVRC_R4 with SLAM mapping.

- Run ROS with usarsim_inf , Hector_SLAM , rviz , teleop_twist_keyboard
  - install usarsim_inf (https://staff.fnwi.uva.nl/a.visser/activities/FutureOfRescue/day1.php)
  - source ~/catkin_usarsimros_ws/devel/setup.bash
  - cd ~/RobocupRescuePackage
  - roslaunch start_all.launch

Hands-on 2 : How to add a new kind of robot.

- Which robot can you use in this simulator?
  - Every robot which Gazebo has.
  - If USARGazebo does not know the robot, you have to add it. (See next page)
  - You can spawn the robot which you want to use by the following GameBot command :
    - INIT {Classname THE_ROBOT_MODEL_NAME}.....
  - Let's spawn your favorite robot by using USARSim INIT command.

- But, if the robot which you want to use has a sensor which USARGazebo does not take care of, you have to add some codes in USARGazebo to use the sensor. (See Hands-on 3)

Hands-on 2 : How to add a new kind of robot.

- How to add a robot information which you want to use.
  - cd ~/RobocupRescuePackage
  - Open USARGazebo.cc with an editor.
  - Search “Robot_DB”, you can see the list of robot informations.
  - Duplicate a robot information and edit the duplicated robot information for your robot.
  - Save and close the file.
  - cd build
  - make

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- You need to collect some informations about the sensor.
  - TO GET THE SENSOR DATA :
    - Own name of the sensor.
    - Type name of the sensor in Gazebo topics list.
    - Message data type of the sensor's topic.
    - The member of the message data type of the sensor's gazebo topic.
  - TO SEND THE SENSOR DATA :
    - Data format for the after processing which use the sensor data.
      - For an USARSim client : GameBot protocol
      - For a client using ROS : ROS topics

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to know the own name of sensor.
  - Check the robot's SDF file.
    - Search sensors which the robot has.
      - KEY WORD : "<sensor "
    - Find the name of sensor which you wanna use.
      - KEY WORD : "name ="

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to know the type name of the sensor.
  - You can find the type name of the sensor by checking Gazebo topics list.
    - You should check that the sensor output exists in Gazebo topics.
    - Use a gazebo command to get a topics list from Gazebo

      $ gz topic -l

    - You can find the sensor name in the topics list,
      and the last word divided by slashes in the topic name is the type name of the sensor.

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to know the message data type of the sensor's gazebo topic.
  - You can generate the name of the message data type with following 2 steps :
    - Step 1 : Use the gazebo command to get the information of the sensor's topic

      $ gz topic -i THE_TOPIC_NAME

    - Step 2 : Read the type name of topic, and insert it between "Const" and "Ptr".
  - Ex.) If the type name of topic is "LaserScanStamped", the message data type is "ConstLaserScanStampedPtr".

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to know the member of the message data type of the sensor's topic.

  - One of easiest way to get information of a message data type is using Google with following key words :
    - ConstLaserScanStampedPtr
    - ConstGPSPtr
    - ConstINSPtr

  - You will be able to some sample codes including the message data type which you searched.

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to know the data format to output the sensor data in GameBot protocol or in ROS topic.
  - The GameBot protocol information will be found from USARSim manual.
  - The ROS topics information will be found in the ROS wiki web pages.

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to add the new sensor's codes in USARGazebo.
  - Add a call_back function for the new sensor with following 3 steps :
    - Step 1: Add a prototype definition of the sensor's call-back function.
      - The message data type of the sensor's topic is required as a data type of argument of the sensor's call-back function
  - Let's see the source code, ~/RobocupRescuePackage/USARGazebo.cc. Using find with the keyword “callback” , it will take you near the point where you will work.

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to add the new sensor's codes in USARGazebo.
  - Add a call_back function for the new sensor with following 3 steps :

    - Step 2: Copy and paste an already existing another sensors call-back function registering code and edit it for the new sensor.
      - The type name of the sensor is required for registering the sensor's call-back function

- Let's see the source code, ~/RobocupRescuePackage/USARGazebo.cc. Using find with the keyword “callback” , it will take you near the point where you will work.

Hands-on 3 : How to add a sensor on a robot and how to add a new code for a new sensor.

- How to add the new sensor's codes in USARGazebo.
  - Add a call_back function for the new sensor with following 3 steps :

    - Step 3: Copy and paste an already existing another sensor's call-back function and edit it for the new sensor.
      - The message data type of the sensor's topic is required as a data type of argument of the sensor's call-back function.
      - Members of the message data type of the sensor's topic is required for writing codes for the sensor's process of data converting.
  - Let's see the source code, ~/RobocupRescuePackage/USARGazebo.cc. Using find with the keyword "callback" , it will take you near the point where you will work.

Give a subject for following "Forum discussion" : GameBot or Gazebo Topics

- Which Protocol will we use in this league, GameBot or Gazebo Topics ?

Things	Using Gazebo Topics	Using GameBot
Guarantee fair game by the game system (Gazebo topics can control every elements for getting score)	No	Yes
Easy to add new robots and devices	Yes	No
Speedy to share new technologies from each teams	Yes	No
Easy to maintain the game platform	Yes	No

The end of setting up the new simulation platform.

- Question Time

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