The Gazebo - USARSim Interface

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Overview of The Gazebo-USARSim Interface

- Show a short videos
- RoboCup2012 Rescue Virtual Robot League Preliminary1 model and pioneer3 at with sensors making SLAM map
Overview of The Gazebo-USARSim Interface

- Show a short videos
  - Portmessa Nagoya model and pioneer3at_wth_sensors making SLAM map
Overview of The Gazebo-USARSim Interface

- Show a short videos
  - JVRC_R4 model and pioneer3at_wtih_sensors pushing object
Overview of The Gazebo-USARSim Interface

• Show a short videos
  • JVRC_R4 model and pioneer3at_with_sensors making SLAM map
Overview of The Gazebo-USARSim Interface

- A figure of a simple system diagram
Why do we need Gazebo based simulation platform?

- We want to get a physics calculation results which we can use it for research activity.
  - We could not get it from USARSim.

- Now Gazebo is getting be a major tool for robotics researchers by it's many good characteristic points:
  - Gazebo has some changeable high-accuracy physics engine.
  - Gazebo has many robot models which have right physical models.
  - Gazebo has high connectivity with ROS
Why do we need Gazebo based simulation platform?

- For the RoboCup Rescue Virtual Robot League.
- Almost of all teams want to use their own client software which they made.
  
  Then ……

- We need a connectivity between a client software for USARSim and the new Gazebo based platform.
- If someone write a software like a protocol convertor from Gazebo interface into USARSim interface, teams can use their own client software which they made for USARSim.
- A T.C. of this league tried to make a prototype software for it.
- In this presentation, the software is called as “USARGazebo”.
Description of New Simulation Platform [overview]

• Description of new simulation platform is consist of 2 parts.

  • Part 1 shows the new simulation platform with Gazebo.

  • Part 2 shows the new models for robotics researchers the new simulation platform with Gazebo.
Description of New Simulation Platform [Part I]

• What we need to realize new simulation platform with Gazebo?

• We need a protocol converter

  • Gazebo : Topics

    ↑ ↓

    A PROTOCOL CONVERTER

    ↑ ↓

• Each team’s USARSim client software : GameBot Protocol
Description of New Simulation Platform [Part I]

- How can we build the protocol converter?

- **By using a plugin system of Gazebo.**
  - In a Gazebo plugin, we can read and write Gazebo topics naturally.
  - For reading topics from sensors, we can register a call-back function with a Gazebo topic from a sensor.
  - We can construct some functions for input and output GameBot protocol with the ordinary TCP/IP socket API.
  - Writing Gazebo topics can be everywhere.
  - We can write a Gazebo topic, after receiving a USARSim command in GameBot protocol by TCP/IP socket.
Description of New Simulation Platform [Part I]

- What USARSim commands do we have to implement in the new simulation platform?
  - GETSTARTPOSES,
  - INIT
  - DRIVE
  - GETGEO
  - GETCONF
  - SET
Description of New Simulation Platform [Part I]

- What sensors do we have to implement in the new simulation platform?
  - CAMERA
  - LASER SCANNER
  - GROUNDTRUTH
  - ODOMETRY
  - GPS
  - INS
Description of New Simulation Platform [Part2]

- **Reusability**: RoboCup2012 RVRL Preliminary 1
  - Show a demonstration or a short video of using the model.
Description of New Simulation Platform [Part2]

- New models for research use: JVRC task models, Portmessa Nagoya RoboCup WCS 2017 venue model
  - JVRC task models, show a demonstration or a short video of using JVRC_R4 model.
  - Portmessa Nagoya model, show a demonstration or a short video of using the model.
  - Details of these introduced models will be showed tomorrow by Prof. Takahashi.
Description of New Simulation Platform [Part2]

• JVRC_task_R4 from JVRC task models
Description of New Simulation Platform [Part2]

- Portmessa Nagoya RoboCup WCS 2017 venue model
Introducing sample robots included in the new simulation platform.

- And robots included current version of new simulation platform.
  - pioneer3at_with_sensors
  - Crawler_robot
Intermission

• Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?
• Many teams are using ROS.
  • Gazebo : Topics
    A PROTOCOL CONVERTOR
  • Each team’s USARSim client software : GameBot Protocol
Intermission

- Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?
- Many teams are using ROS.
  - Gazebo:
  - Each team’s USARSim: GameBot Protocol
  - A PROTOCOL CONVERTOR

Topics
↑  ↓

GameBot Protocol
Intermission

- Which Protocol will we use in future of this league, GameBot or Gazebo native topics?
- Many teams are using ROS.
  - Gazebo
  - Each team’s USARSim: ROS Topics + GameBot Protocol client software
Intermission

• Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?

• Many teams are using ROS.

  • Gazebo : Gazebo Topics
  
  A PROTOCOL CONVERTOR
  
  • Each team’s USARSim : ROS Topics + GameBot Protocol client software

  • ROS : ROS Topics
Intermission

- Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?
- Many teams are using ROS, then there is another way ……

  - Gazebo
  - Each team’s USARSim: ROS Topics + client software
  - ROS: ROS Topics

A PROTOCOL CONVERTOR

Gazebo Topics

GameBot Protocol
Intermission

• Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?

• Many teams are using ROS, then there is another way !!

• Gazebo : Gazebo Topics

• Each team’s USARSim : ROS Topics + Gazebo Topics
  client software

• ROS : ROS Topics
Intermission

- Which Protocol shall we use in future of this league, GameBot or Gazebo native topics?
- Many teams are using ROS, then there is another way!!

- Gazebo

- Each team’s USARSim: ROS Topics + client software

- ROS

Gazebo Topics

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DIRECT CONNECTION

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ROS Topics

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↓
Intermission

- **GameBot V.S. Gazebo Topics in game.**

<table>
<thead>
<tr>
<th>Things</th>
<th>Using Gazebo Topics</th>
<th>Using GameBot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guarantee fair game by the game system (Gazebo topics can control every elements for getting score)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Easy to add new robots and devices</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Speedy to share new technologies from each teams</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Easy to maintain the game platform</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Intermission

• How do you think?
  • Keeping GameBot?
  • Moving to Gazebo topics?
The end of introducing the new simulation platform.

• Question Time

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