


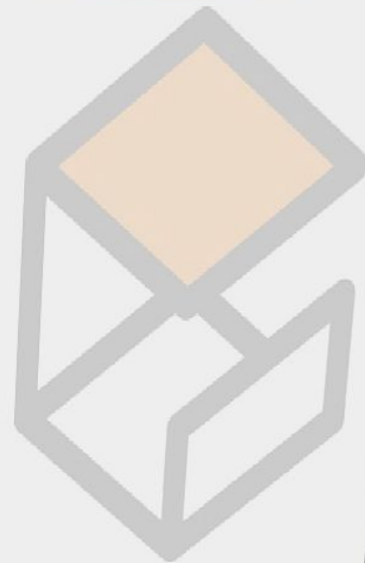
What's new in Gazebo?

Upgrading your simulation user experience!

Louise Poubel & Steffi Paepcke

October 8, 2016

 @chapulinaBR @Steffibot



Open Source
Robotics Foundation

What is Gazebo?

A dynamics simulator, useful for:

Simulating robots in complex indoor
and outdoor environments

Plays nicely with ROS

Prototyping, continuous integration, faster integration
on new algorithms, competitions, education, etc.



Open Source Robotics Foundation

This collage illustrates various applications of computer vision and robotics. The images include:

- A soccer robot on a field.
- A robotic arm.
- A red robotic arm.
- A person using a VR headset.
- A soccer robot.
- A car with a sensor.
- A robotic arm.
- A person using a VR headset.
- A soccer robot.
- A car with a sensor.
- A robotic arm.
- A person using a VR headset.
- A soccer robot.
- A car with a sensor.
- A robotic arm.

Gazebo 7 Dependencies



Gazebo Design Goals

Accessible to novice and advanced users

Increased GUI capabilities

Improved C++ API

More comprehensive documentation

Improved usability

User-centered, iterative design process

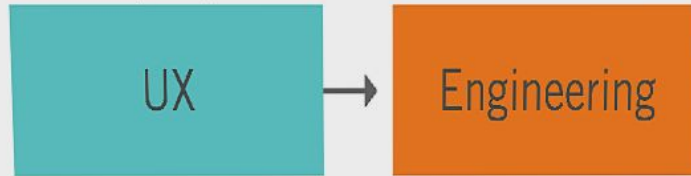
Usability testing



Open Source Robotics Foundation

User-centered, Iterative Design Process

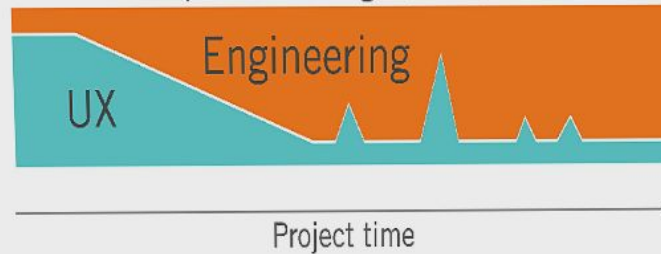
Waterfall (Bad!)



Slap-it-on-at-the-end (Worse!)



User-centered, iterative design (Good!)



New Features

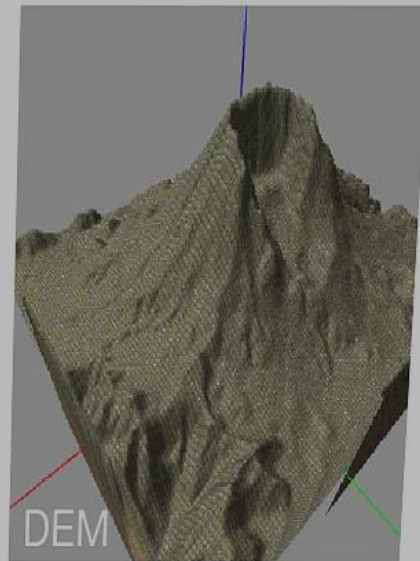


Open Source Robotics Foundation

Better worlds

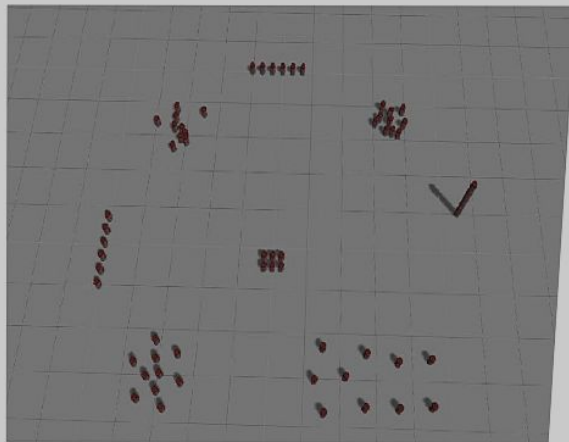
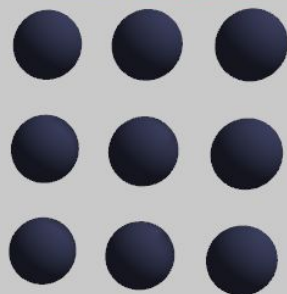


- Scripted trajectories (actors)
- Heightmap Digital Elevation Models (DEM)
- Roads



Better worlds

- Nested models
- Populations of models in specified configurations



Better control

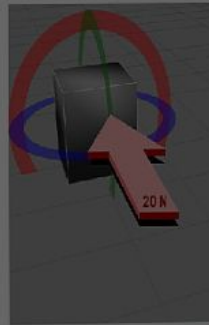
- Graphically apply force/torque
- Undo
- Orthographic view
- View angles

Force & Torque Application: v2 (1.29.15)

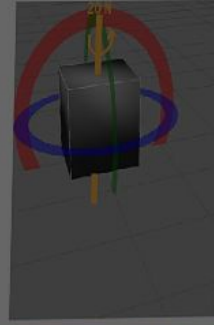
3D Markers and Arrow Control

Manipulating the rotate markers repositions the arrow/line. Scrolling mouse wheel changes magnitude.

Force



Torque

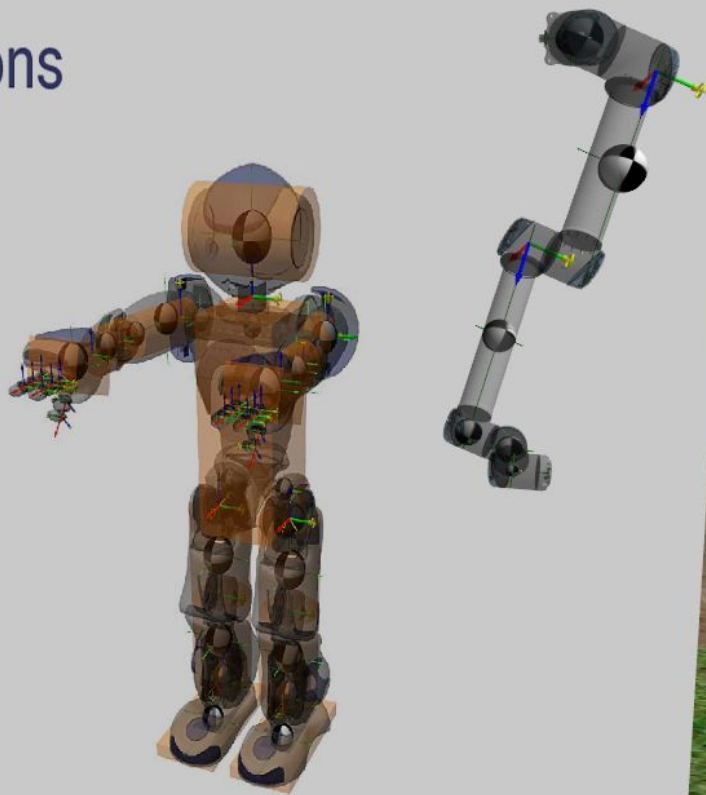


We select a default magnitude and direction. Magnitude readout changes as dialog is edited or as mouse scroll wheel is scrolled.

Let's see how orange looks for the Force arrow, and yellow for Torque.

Introspection visualizations

- Links Frames
- Joints
- Collisions
- Center of Mass
- Inertia
- Wireframe
- Contacts



Building Editor:

- Import floorplans
- Walls, windows, doors, stairs
- Colors, textures
- 2D view

Building the Scene
Users may create a space from scratch, or they may load an image as a template to their view. This image can be, for example, a 2D screenshot of a building. The image can be imported from the HoloLens, or by gluing it into the 2D View. Walls are created by clicking dragging a rectangle onto the 2D View from the Palette, or by drawing a window or door. As the view is shown, it is rendered in the 3D view below. Doors, windows and stairs are designed into the 3D view from the palette. Dragging a texture or color swatch into the 2D View will highlight a wall and floor. Releasing the swatch will apply to the highlighted portion. Holding Ctrl while dragging allows the user to copy/paste the new swatch here.

Scale: Undo/Redo: Turn wall dimensions on/off

Clicking to add square room to 2D View. Adjustments can be made on the 2D View.

• Changes cursor to draw mode
• Single click to start wall, double click to complete final wall

Double-click to open 2D View. Windows/doors snap to walls

Two new wall types will appear in 2D View. Walls/Floors
• Highlight on view. Assigned to a wall, or floor, can be edited. Ctrl to select only final result to view cursor when dragging

Same interaction as textures. While default. See Page 2

2D View supports:
• room floor creation
• color/texture/door/window modification

3D view supports:
• Adding partitions

• Add level
• Double-click level name opens Level Inspector
• Right-clicking shape opens a menu with Open Level Inspector option
• Clicking 2D will display on 3D view level name editable

Views are re-sizable

Users may add surface textures to the walls and floor

When room is created, floor is filled with background color swatch

While outline on floor allows the highlighting floors

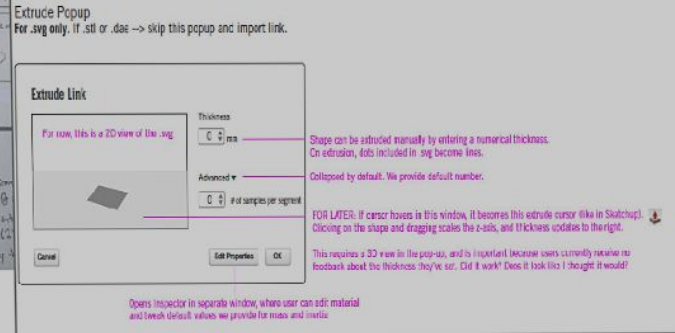
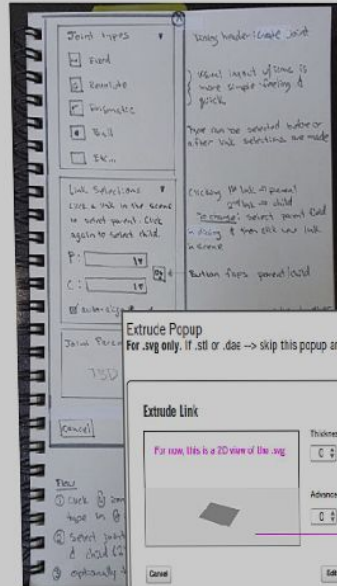
Inserting Color/Texture into 2D View (not allowed)
If the user attempts to drag color or texture into the 2D View, the following tool to access attached to the cursor. It is designed to prevent the cursor from entering the 2D View.

Drag Color and texture can only be added to the 3D view

Closest Pop-up (EC)
Done Pop-up (DC)
Save Pop-up (SC)
Hold mouse over Save and Done Pop-up

Model Editor:

- Schematic view
- Simple shapes
- Inspectors
- Align tool
- Nested models
- Joint creation
- Meshes
- Add plugins
- Extrude SVG



Attach model here

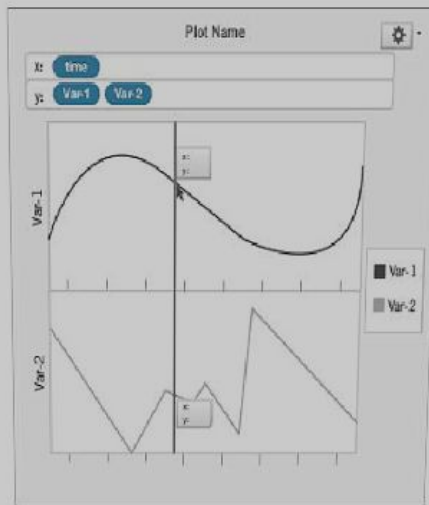
Plotting

Graphically plot variables

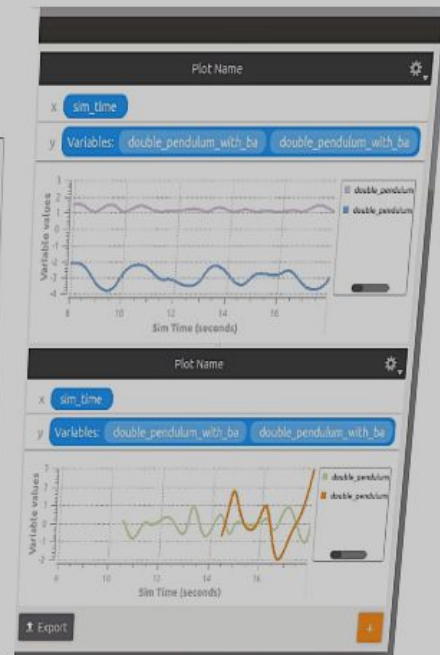
- Gazebo topics
- Physics data

Plotting v5 (1.26.16)

Interactions (2 of 3)



Low-fidelity prototype



Final design

Sensor support

- Camera

- multi
- wide angle
- depth

- GPS

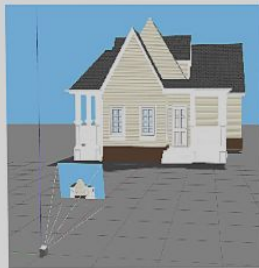
- Altimeter

- Magnetometer

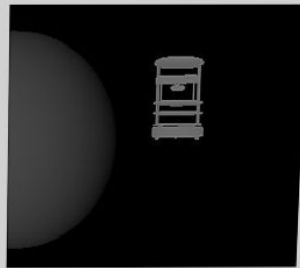
- Sonar

- Logical sensors

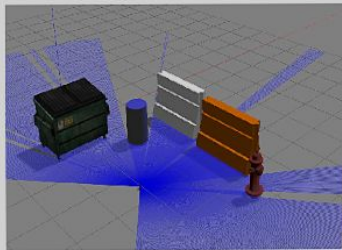
- Sensor noise



RGB camera



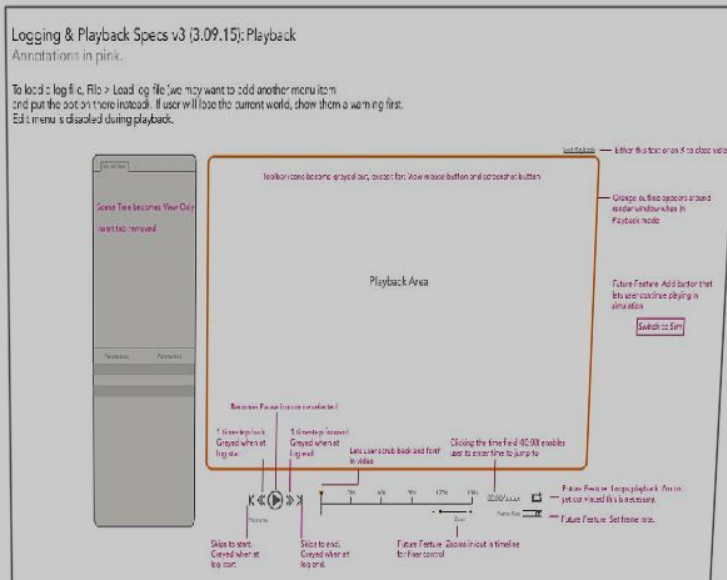
Depth camera



Ray sensor

Logging and Playback

- Create log files within GUI
- Play log files back



New plugins

- ArduCopter
- Arrange
- BlinkVisual
- FiducialCamera
- Harness
- KeyboardGUI
- LinearBattery
- Wind

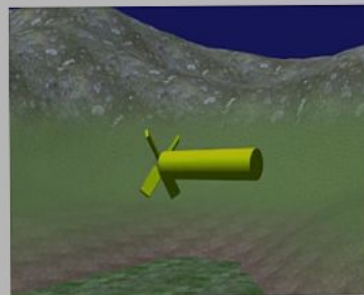
... and more!



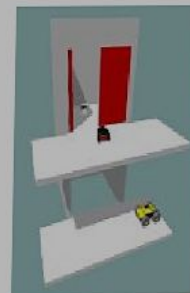
Lift / Drag



GUI overlay



Buoyancy



Elevator

Hardware Integration

- Oculus, OpenVR
- Razer Hydra
- OptiTrack
- SpaceNav
- 3D glasses
- Polhemus



What's next?

GUI-specific

Terrain Editor

Visual redesign (Material Design)

GUI Console


Graphical inertia resizing

Graphical tools for physics valid.

..and more!

Other

PropShop integration 

CloudSim + gzweb 

Improve SDF/URDF support

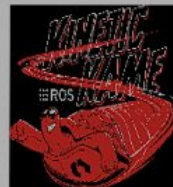
Support for deformable shapes

...and more!

Now what? Using Gazebo with ROS

- Default Gazebo-ROS combos

ROS version



Gazebo version

2.2

5.0

7.0

- Also possible to **make your own combination**

http://gazebosim.org/tutorials?tut=ros_wrapper_versions

- From Gazebo 7, releases are synced with ROS!

Gazebo Resources & Documentation

<http://gazebo.org>

<http://gazebo.org/tutorials>

<http://answers.gazebo.org>



Thank you. 고맙습니다