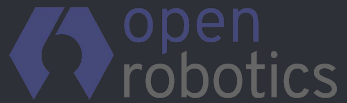
How to Achieve Realistic Visuals in Ignition Gazebo

Cole Biesemeyer



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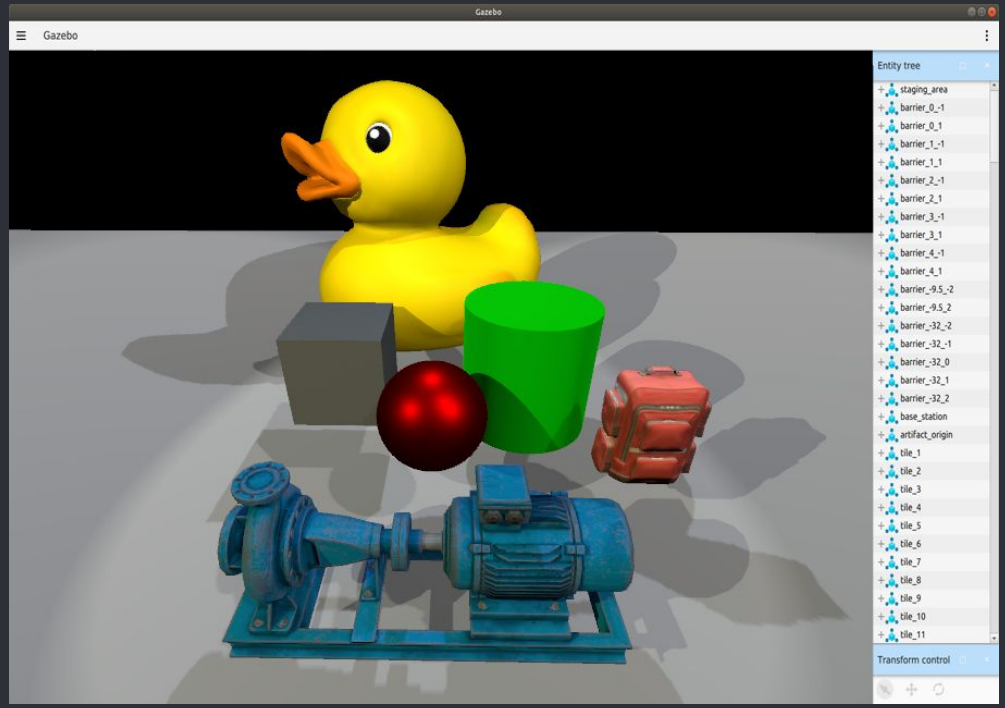
Ignition Gazebo



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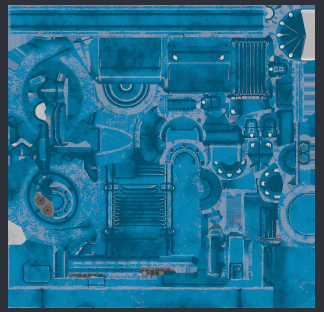
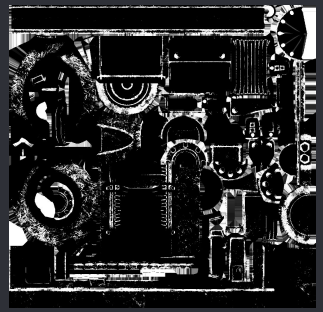


Albedo

+



Metalness

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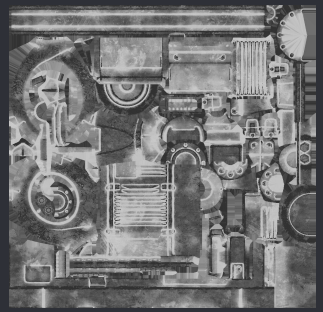
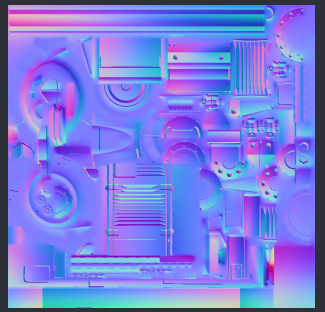


Roughness

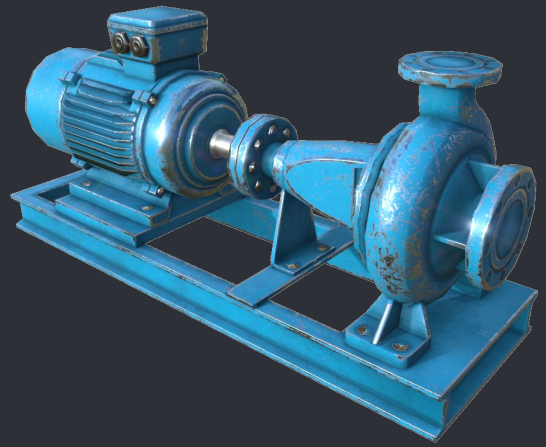
+



Normal

+

=



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What is Physically Based Rendering? (PBR)

Gazebo Classic

- Single color map
- No reflections
- Single surface type

Ignition Gazebo

- Multiple maps to control lighting
- Surface accurately reflects light
- Multiple surface types on a single model

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High Resolution Source Models

- Standard workflow for creation of 3d assets.
- Allows for optimization at any level.
- Realistic, detailed assets.

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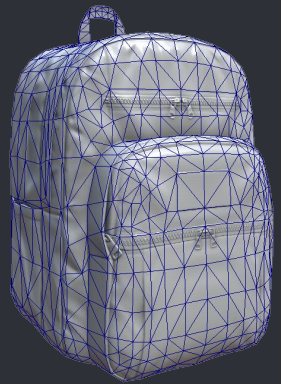
Procedural texturing

- Change resolution without quality loss
- Change look of models quickly
- Consistent look across models using presets and material libraries

PBR Workflow

High Polygon Count



Low Polygon Count

Final Textured Model

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Why is PBR important for robotics simulators?

- Improvements over Gazebo Classic.
- Better for computer vision systems.
- Brings Ignition Gazebo closer to the visual fidelity and workflow of modern game engines.

What PBR is not,

- Lighting/shadows
- Image effects

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Using PBR for the DARPA Subterranean Challenge

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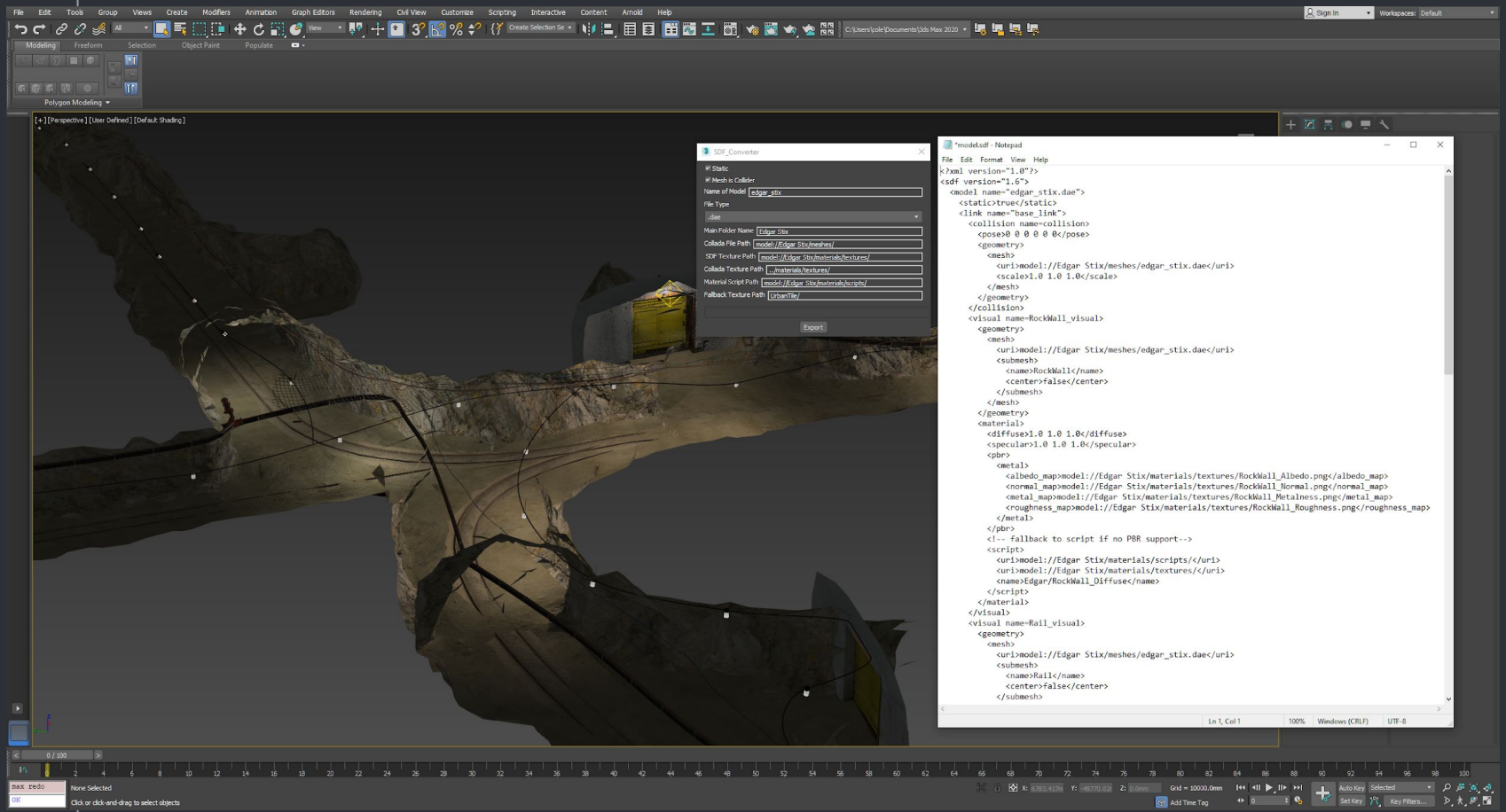
SDF_Converter
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Mesh is Collider
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edgar_stix
File Type
.dae
Main Folder Name
Edgar Stix
Collada File Path
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SDF Texture Path
model://Edgar Stix/materials/textures/
Collada Texture Path
../materials/textures/
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Fallback Texture Path
UrbanTile/
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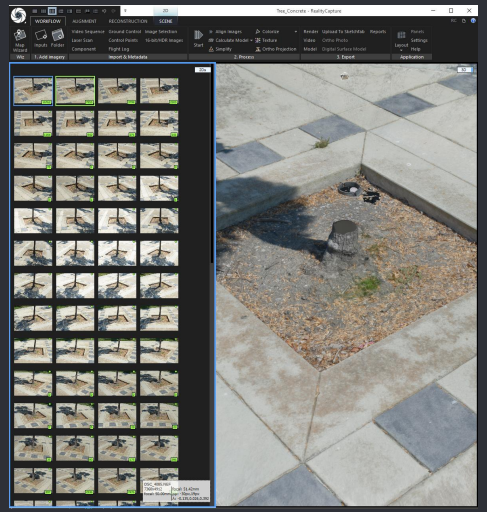
How to create better content, faster

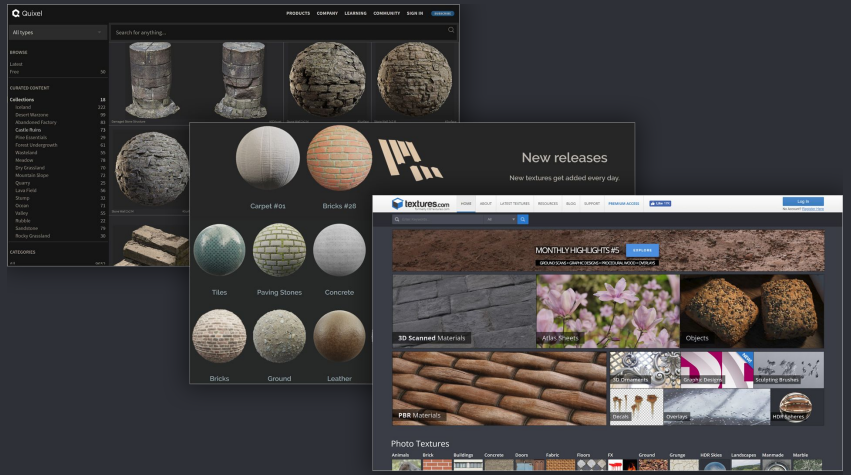
Photogrammetry

The process of using 2d images to create 3d models of real life objects.



Asset libraries

Online collections of various textures and models that can be used as a starting point for quickly creating 3d environments.



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- Photogrammetry

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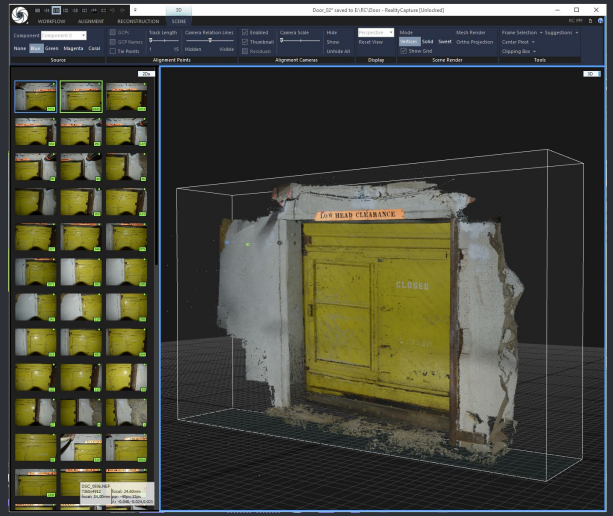
PHOTOGRAMMETRY STEPS

Take Photos

Process Photos



Optimize Model

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ADVANTAGES OF PHOTOGRAMMETRY

- 1:1 accuracy of real objects
- Faster than traditional methods
- Ultra high detail
- Cost
- Versatility

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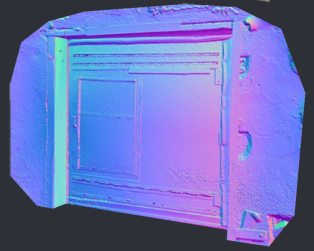
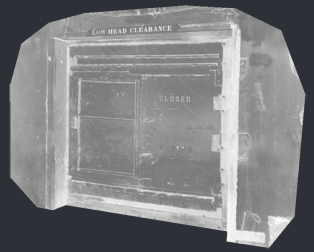
How photogrammetry works with PBR

Albedo map
from scan



Normal map
from scan



Roughness created
By tweaking Albedo

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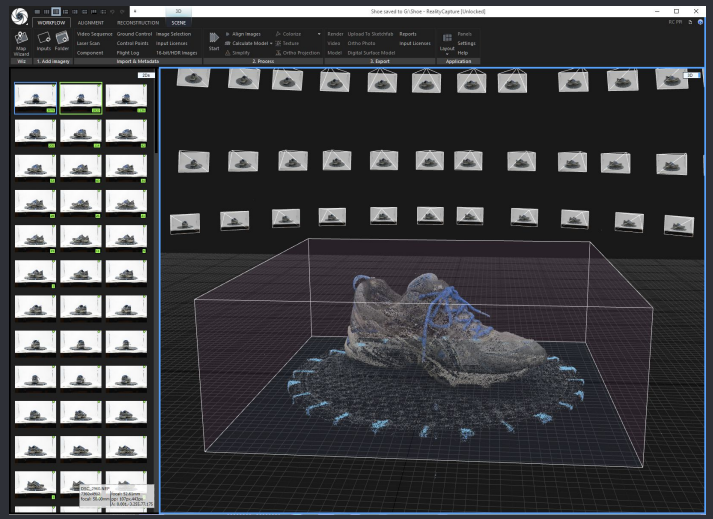
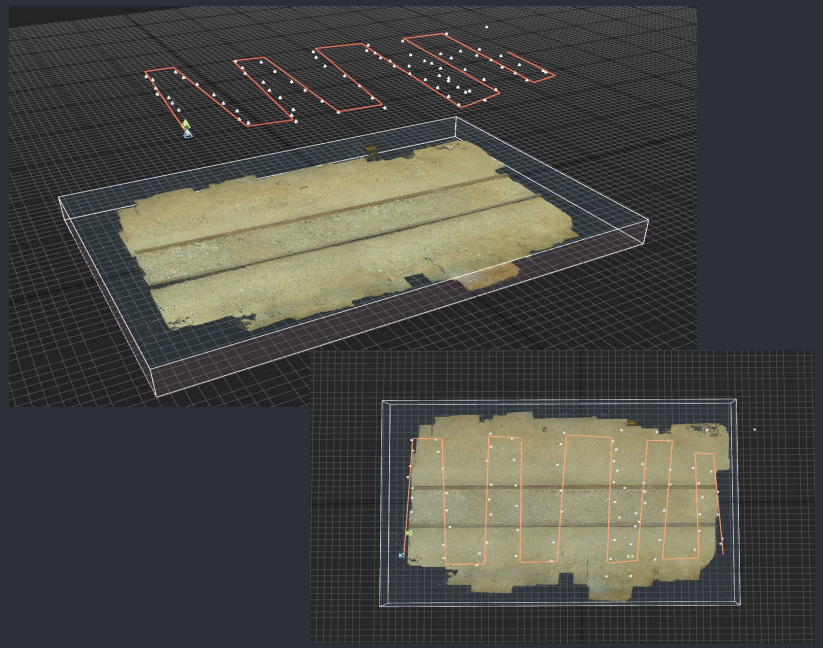
Taking photos for photogrammetry

Freestanding objects



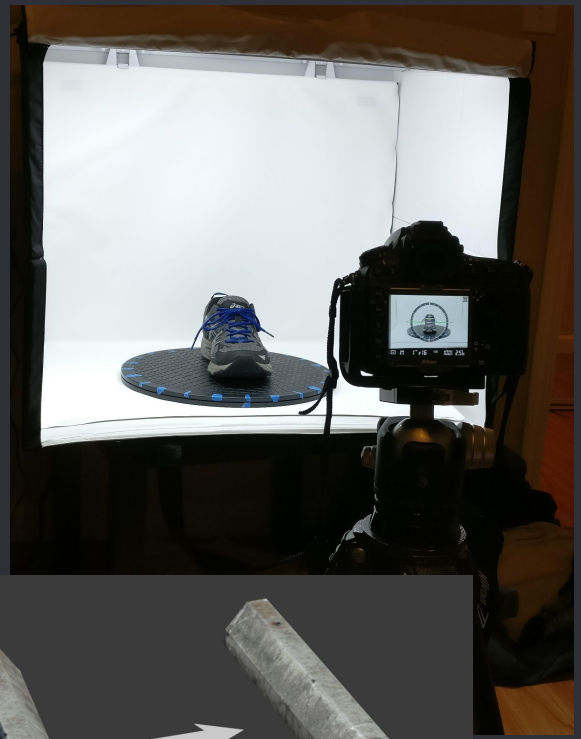
Flat surfaces



Taking photos for photogrammetry

Achieve neutral lighting

- Use a lightbox or studio setup
- Take photos on an overcast day
- Use delighting techniques



Delighting Techniques

- Sometimes direct light is unavoidable
- Software to remove highlights and shadows
- Mix of software and manual input

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DEFENSE INNOVATION UNIT

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Taking photos for photogrammetry

Hardware

- Nikon D800
- Tripod
- Remote Shutter

Small object setup

- Lightbox
- Turntable

Software

- Reality Capture

RealityCapture

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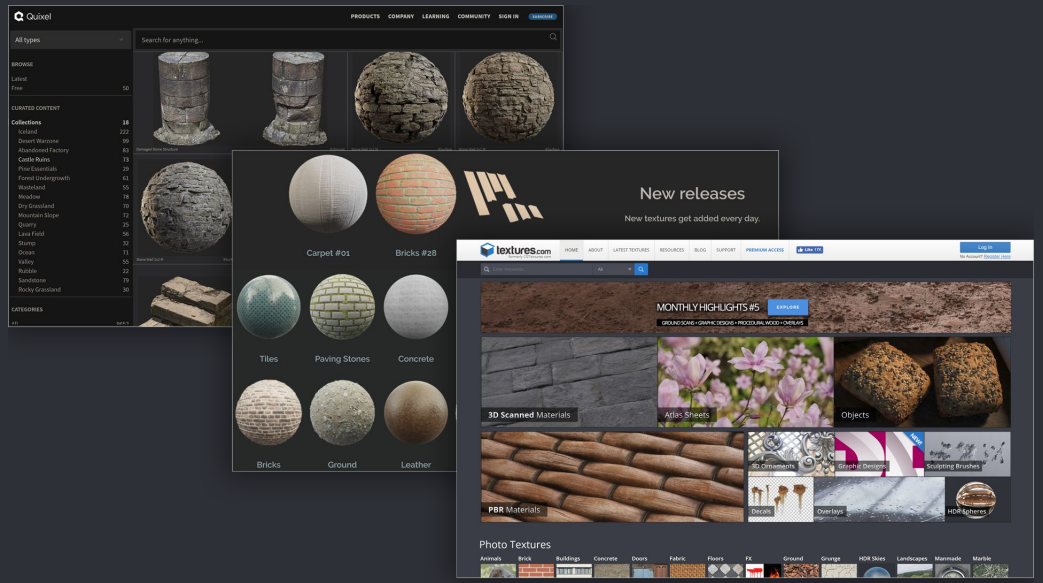
Asset Libraries

A resource for finding finished assets

- Textures
- Models
- Animated characters
- UI Elements
- Audio



What to look for when choosing models from a asset library

- Curated assets
- Assets from the same artist
- Real time engine marketplaces
- Level of Detail
- Licensing restrictions

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What they aren’t good for

- Projects that have a very large scope.
- Projects with very specific needs.
- Projects that require accuracy of an exact real life location.

Looking outside the robotics community for 3D content creators

How a dedicated content creator can increase the visual fidelity of your projects.

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CONTENT CREATORS FOR ROBOTICS PROJECTS

What a content creator offers

- Knowledge of 3D rendering.
- How to get the most out of all assets.
- A creative perspective on virtual projects.
- Ensure projects are well optimized for real time performance.
- Faster Development.
- Create high fidelity objects for robots to interact with.
- Create and manage large scale 3d environments.

Where to look:

- Video Game industry
- VFX industry
- Architectural industry
- Studios for hire
- Universities

Thank you!

Contact: Cole@OpenRobotics.org

Resources

- https://ignitionrobotics.org/home
- https://www.darpa.mil/program/darpa-subterranean-challenge
- https://unity3d.com/files/solutions/photogrammetry/Unity-Photogrammetry-Workflow_2017-07_v2.pdf

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