

Image Based Localization with Simulated Egocentric Navigations

Santi Andrea Orlando^{1,2}, Antonino Furnari¹, Sebastiano Battiato¹ and Giovanni Maria Farinella¹

¹Department of Mathematics and Computer Science, University of Catania, Catania, Italy

DWORD – Xenia Progetti s.r.l., Acicastello, Catania, Italy

SEN Tool Documentation

The Tool described in this work:

<http://iplab.dmi.unict.it/SimulatedEgocentricNavigations/index.html> , has been used to generate the dataset described in this link:

<http://iplab.dmi.unict.it/SimulatedEgocentricNavigations/dataset.html>

and available to download it.

TOOL DESCRIPTION

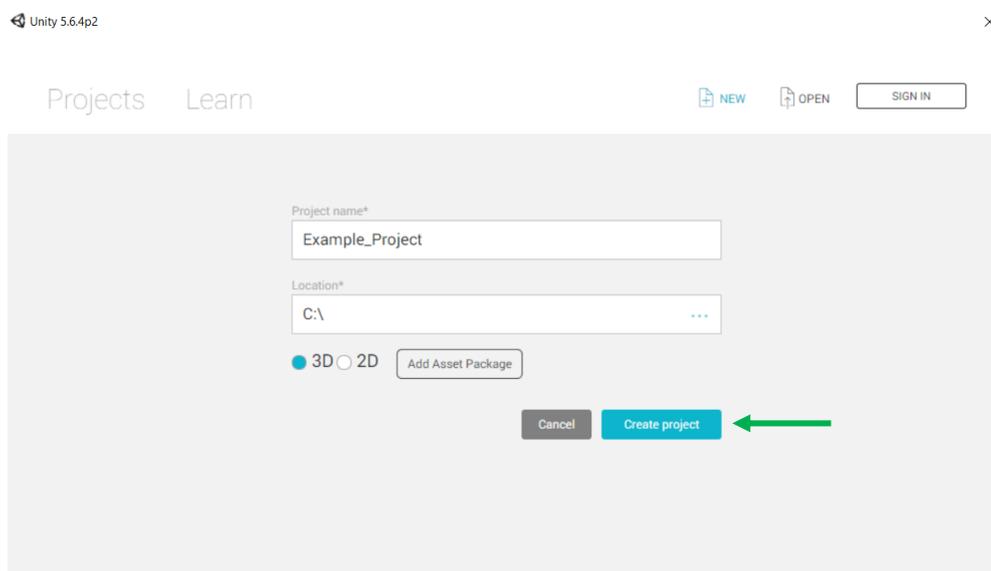
This tool can be used to generate Dataset of Egocentric Navigation useful to study **Indoor Image Based Localization**.

The tool is made for Unity 3D 5.6.4p2 or recent version, it has been tested with Windows 10.

1) Getting Started

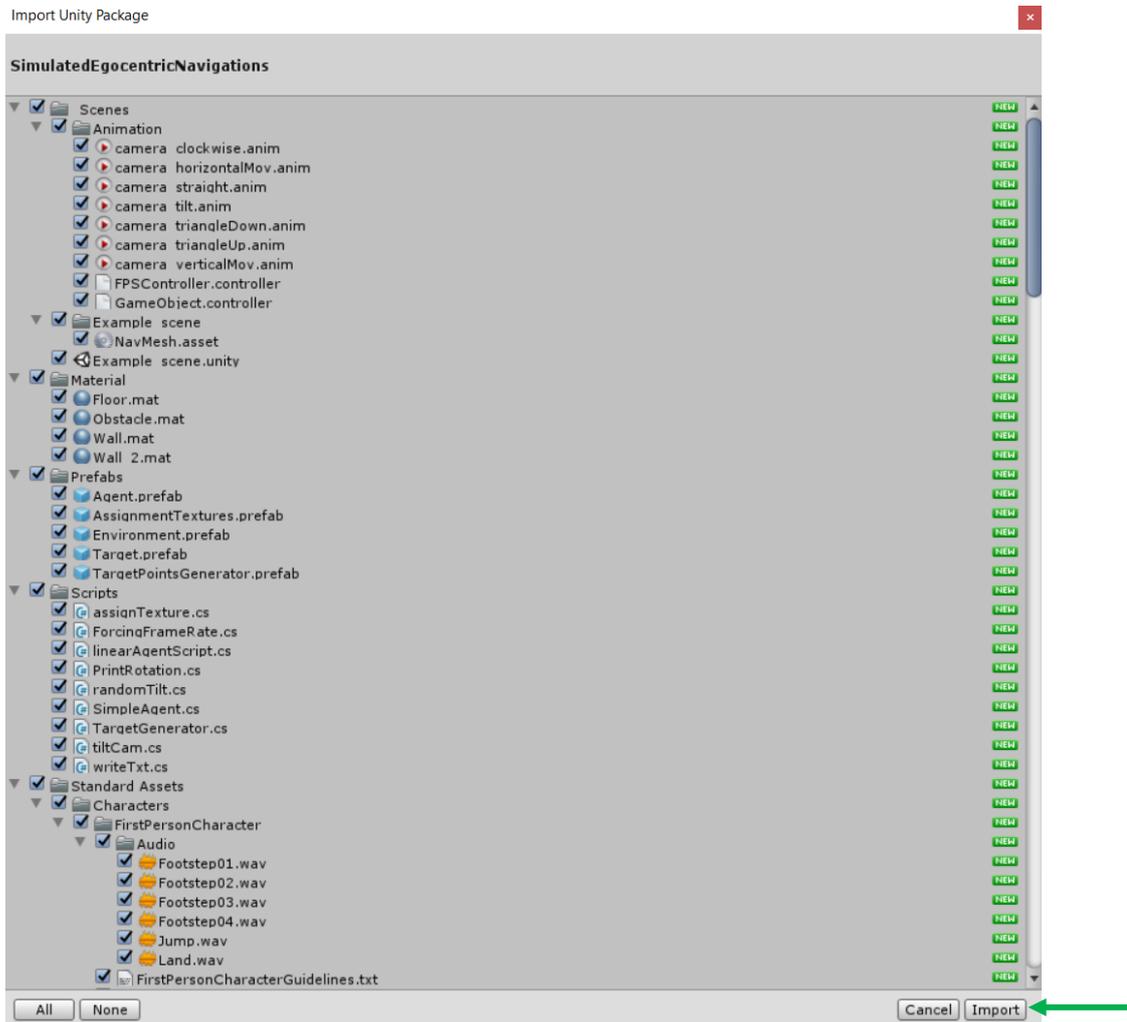
1) Create a New Project

To start to use this tool you need to create a “New Project” from Unity 3D as shown below:



2) Import Package

In the project Choose **Assets > Import Package > Custom Packages...** and select the package: “SimulatedEgoentricNavigations.unitypackage”. From dialog box, **Import Package** (See Figure below), click on **Import** button.



Wait the importing process...

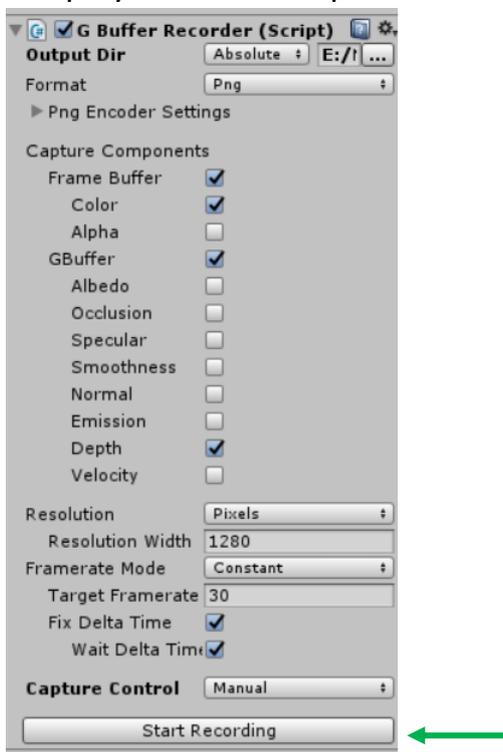
3) Run the Example navigations

From **Project** window open “_Scene” folder and open the scene “Example_Scene”. By clicking on play button, you can test the Simulation of the Egocentric Navigations.

To acquire the frames to generate the dataset, from **G Buffer Recorder** component set the folder where you want to save the frames (GameObject Agent > Image > G Buffer Component > Output Dir)

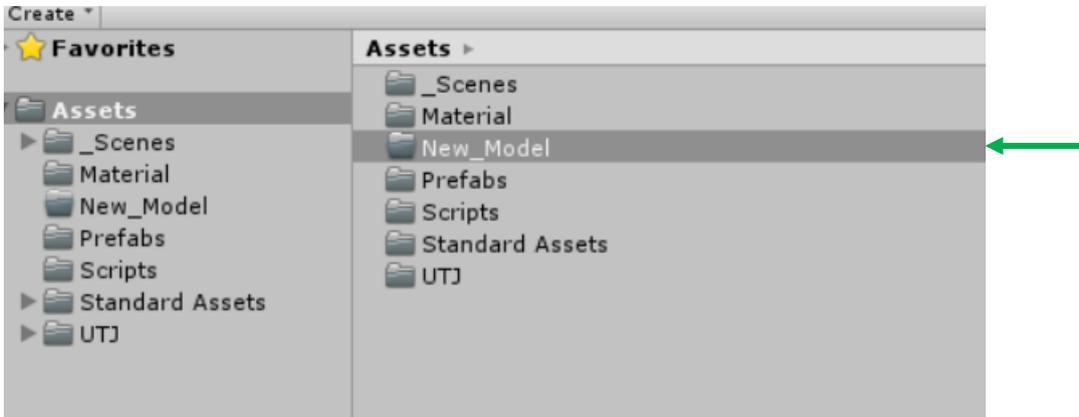
PS: Make sure to create inside the desired output folder, the folder “FrameBuffer”. If you want to capture also the Depth create also a folder “Depth”.

You can click on **Start Recording** to start to generate the Dataset, the generation will stop automatically when all the paths will be done. To stop it manually you can click the play button on top.



2) How to import a Matterport 3D Model

Create a new folder. On **Project** window right click on **Assets > Create > Folder**.

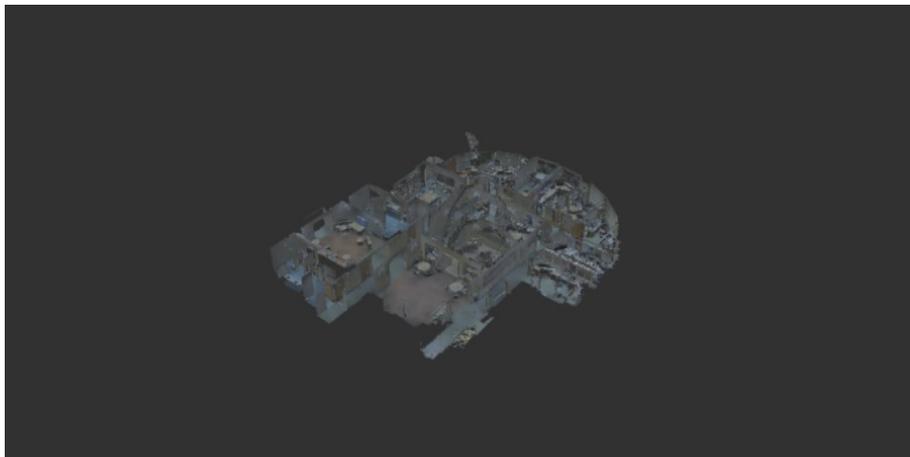


Follow these steps:

- 1) Create a folder **Textures** in the new folder;
- 2) **Drag** in it the textures of the model;

rgb_textures	25/03/2015 17:51	Cartella di file	
.gitkeep	08/02/2017 23:08	File GITKEEP	0 KB
camera_to_room.json	05/02/2017 10:12	File JSON	5 KB
pointcloud.mat	09/02/2017 04:12	Microsoft Access Table ...	485.157 KB
rgb.mtl	09/02/2017 06:03	File MTL	30 KB
rgb.obj	09/02/2017 06:03	Object File	19.480 KB
semantic.mtl	09/02/2017 03:50	File MTL	149 KB
semantic.obj	23/11/2017 16:29	Object File	19.467 KB

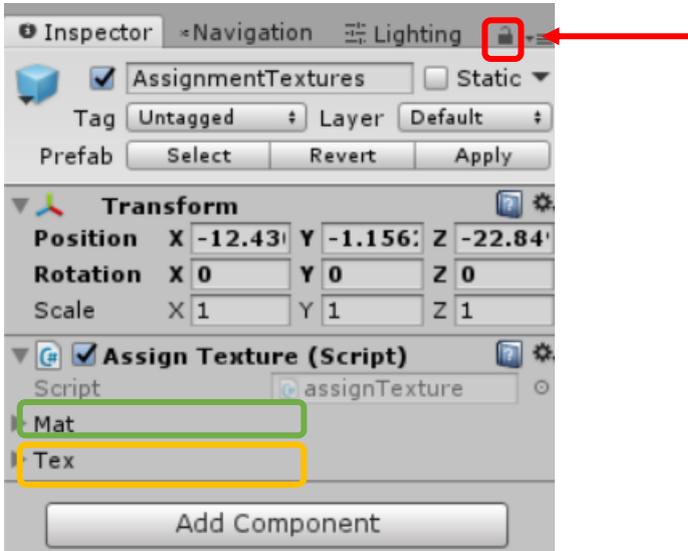
- 3) **Drag** in the folder of the model the files **.obj** and **.mtl** respectively the 3d model and its materials;
- 4) You should have the model already textured as below:



- 5) if you don't have the same results of the figure above follow the next optionally procedure:

Optionally

- 1) Create a new empty scene **File > New Scene**
- 2) Drag in it the prefabs **“AssignmentTextures”** (Project window > Assets > Prefabs)
- 3) Click on the GameObject in **Hierarchy** window and in **Inspector** window lock it by clicking in:



- 4) Select all the materials of the new model and drag it on **“Mat”** parameter
- 5) Select all the textures of the new model and drag it on **“Tex”** parameter
- 6) Click play to attach the textures to the materials

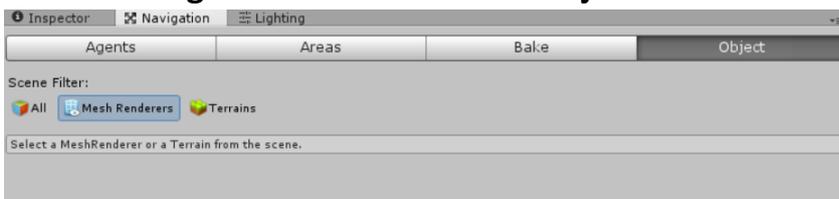
3) Create a Navigation system by your own

To start to simulate the Navigations you need to follow this steps:

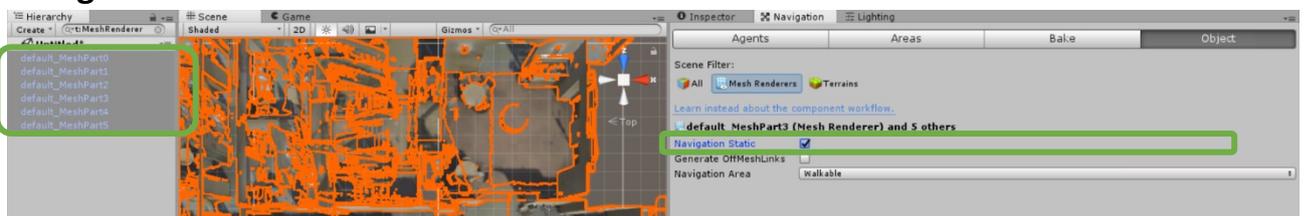
- 1) Create the Walkable Area
- 2) Create the reachable target points
- 3) Setting the Agent

3.1 Create the Walkable Area

- 1) Create a new empty scene **File > New Scene**
- 2) Delete the **Main Camera** from the **Hierarchy**, and set the **Direction Light** rotation to (90, 0, 0) with a white colour
- 3) Drag the 3D model on the **Hierarchy**
- 4) Drag the prefab "Agent" on the **Hierarchy**
- 5) Select the model from the **Hierarchy**
- 6) Go to **Windows > Navigation** to open the navigation window
- 7) On the **Navigations** window select **Object** tab and select Mesh Renderers Icon



- 8) In **Hierarchy** will be shown just the part of the 3D Mesh, Select it all and check **Navigation Static**



- 9) On the **Navigations** window select **Bake**, set the **Agent Radius** to 0.2 and click on **Bake Button**. You can see in blue the walkable area

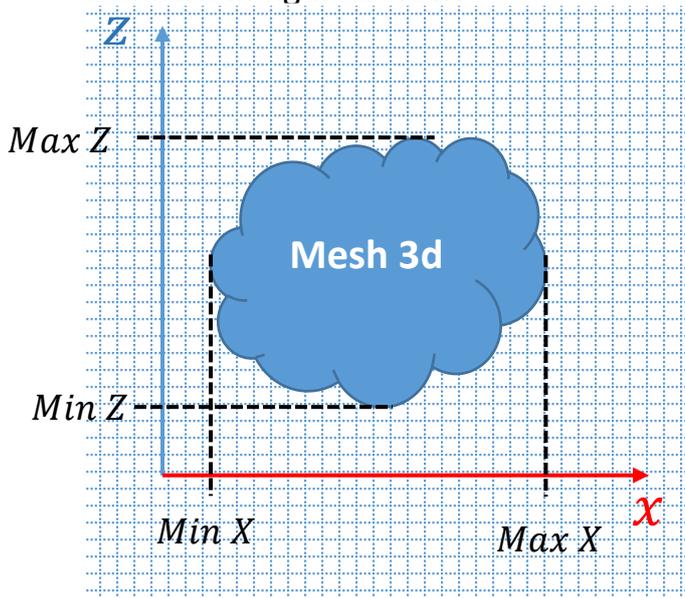


3.2 Create the reachable target points

After that you created the Walkable Area you have to create the reachable target points.

- 1) Put into the **Scene** the prefab "TargetPointsGenerator" and sets its Position to $X = 0; Y = 1; Z = 0$
- 2) In its **Inspector** window go to the component **Target Generator (Script)** and set the parameters:
 - a. Shift X (position shift between points along x-axes) in meters
 - b. Shift Z (position shift between points along z-axes) in meters
 - c. Min X, Max X
 - d. Min Z, Max Z

as shown in figure below.

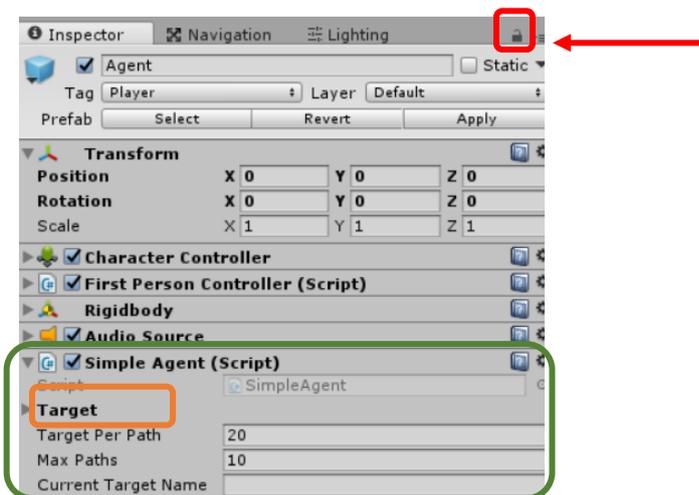


- 3) Click on button play
- 4) During play mode, inside “TargetPointsGenerator” will be instantiate a set of game objects called: “Target_0;; Target_n”, while you are in play mode select from Hierarchy the game object TargetPointsGenerator, and copy it (Ctrl+C)
- 5) Stop the scene clicking again on play button
- 6) Paste in Hierarchy with Ctrl+V the new one TargetPointsGenerator and delete the previous one
- 7) Now you can remove all the target points that aren’t inside the **Walkable Area**

3.3 Setting the Agent

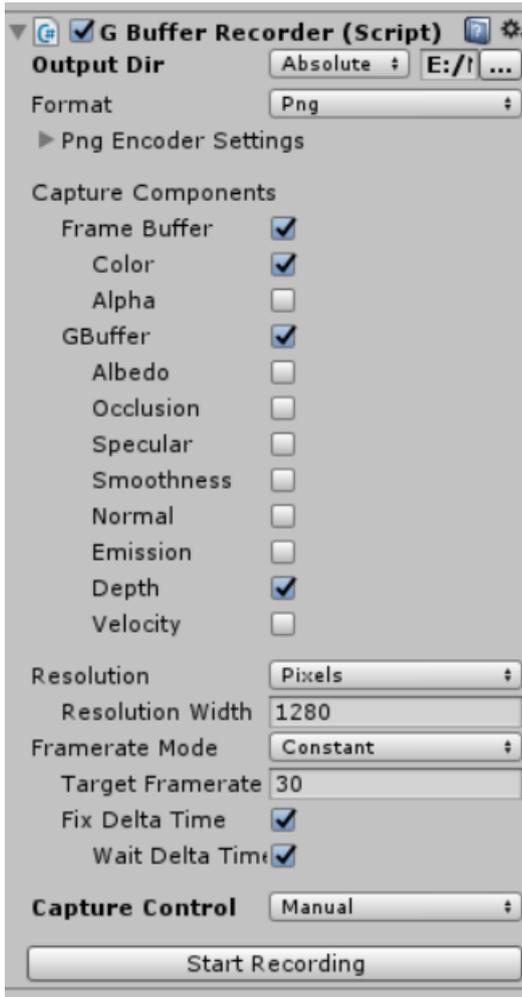
After that the target points have been created and deleted the unreachable outside the Walkable Area, we need to set the Agent that will be perform the Navigations.

- 1) Put into the **Scene** the prefab “Agent”
- 2) in **Inspector** window lock it as shown in this figure



- 3) Select all the created target points (Target_0, ..., Target_n), inside the GameObject “TargetPointsGenerator (1)” and drag and drop it into **Target** parameter of “**Simple Agent (Script)**” component
- 4) To start to simulate the navigations you have to set the parameters of “**Simple Agent (Script)**” :
 - a. Target Per Path
 - b. Max Paths

As son of the GameObject Agent you can find the GameObject Image with inside the component “G Buffer Recorder”, where you have to set:



- Output Dir: in it you have to create the folder FrameBuffer and Depth (optionally, uncheck Depth box if don't need it);
- Capture Components, FrameBuffer for the RGB camera channel and GBuffer to choose other possible camera channels
- Resolution
- Framerate: We suggest to use this default parameters

The Position Y of the GameObject Image represents the height of the Agent, if you want to change the height you have to change it and not change the Position Y of the Agent.

To start to simulate the navigations inside your virtual environment you can click “**Start Recording**” button, the generation will stop automatically when all the paths will be done. To stop it manually you can click the play button on top.

PS: Make sure to create inside the desired output folder, the folder “FrameBuffer”. If you want to capture also the Depth create also a folder “Depth”.

Optionally

Enabling the **Write Txt (Script)** and setting an output directory you can save the sequences of the target points reached for each generated Paths.

