MICHIGAN STATE UNIVERSITY

Project Plan Presentation

World Feature Generation for ADAS Simulation

The Capstone Experience

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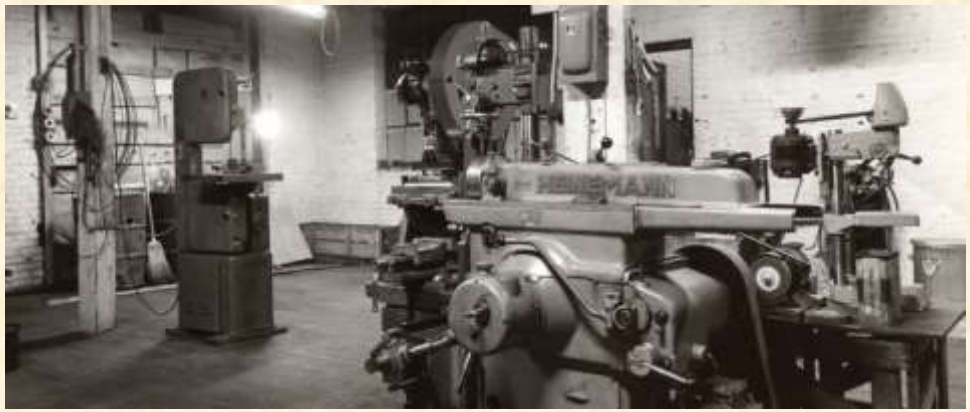
From Students…
…to Professionals

Project Sponsor Overview

- Began as a one-man shop tool shop
- A global automotive supplier headquartered in Aurora, Ontario
- 345 manufacturing facilities
- 177,00 employees



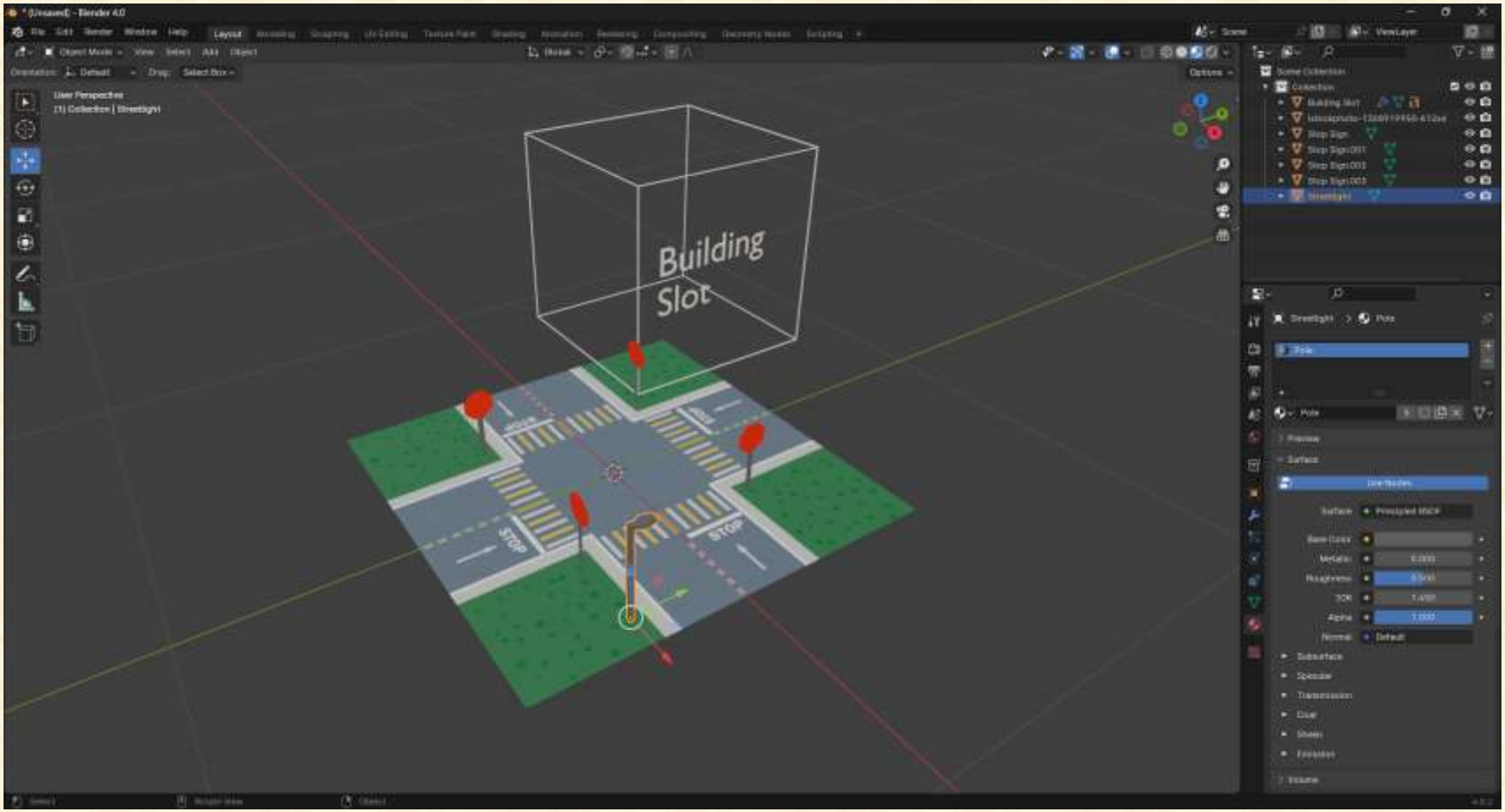
Project Functional Specifications

- Carla comes with a limited maps and creating more is time consuming
- Testing on the same maps all the time creates potential blind spots
- Procedurally generate UE4 environments for use in testing
- Catch bugs earlier and more often by simulating a variety of environments and conditions

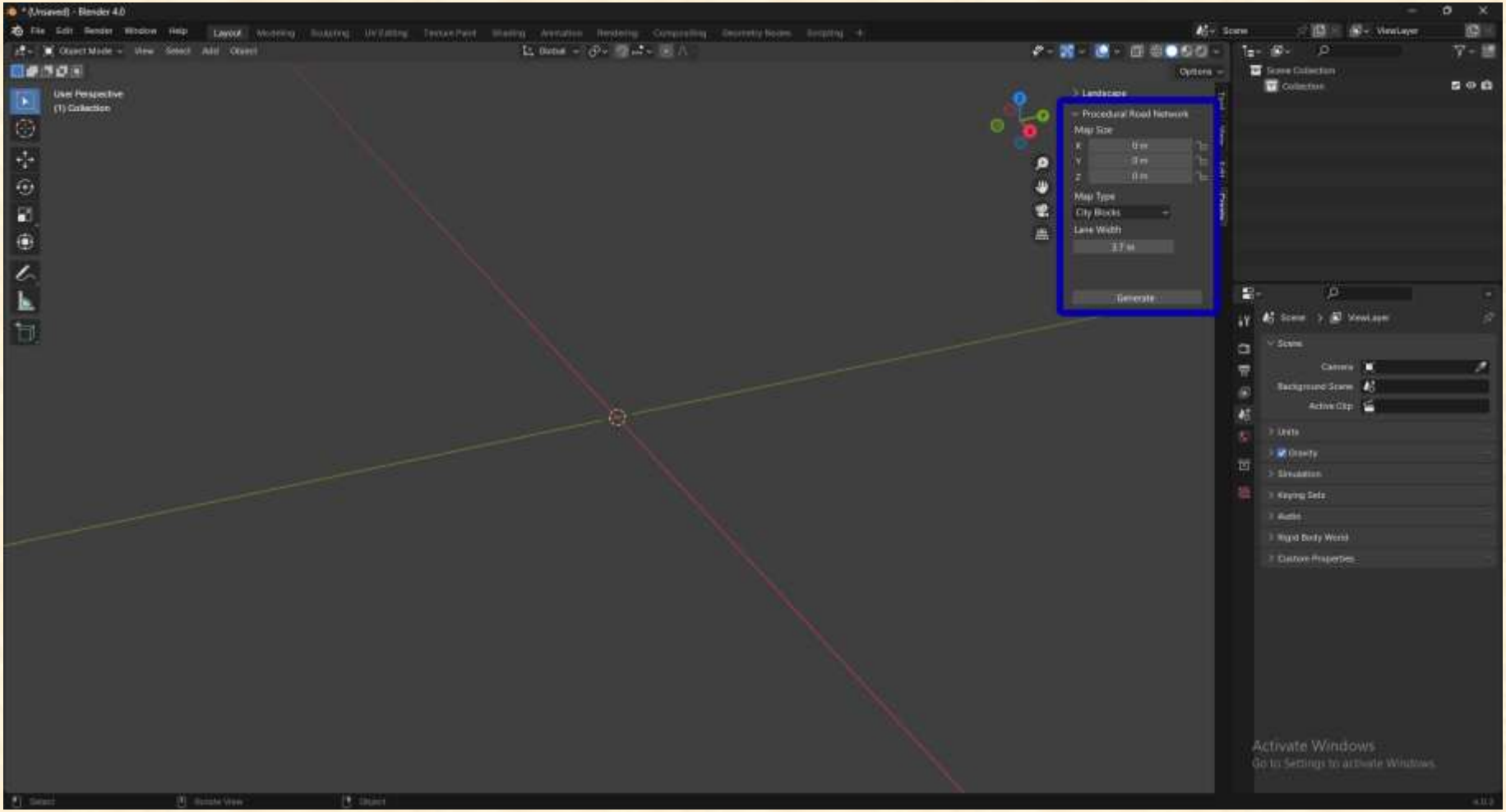
Project Design Specifications

- This simulator serves as a driving simulation tool for Magna to help Magna save testing costs.
- At its core, it is a driving simulation tool that will be run in Carla, which will run in Unreal.
- Use Blender to create parts of the map, such as houses, buildings, trash cans, road, etc.

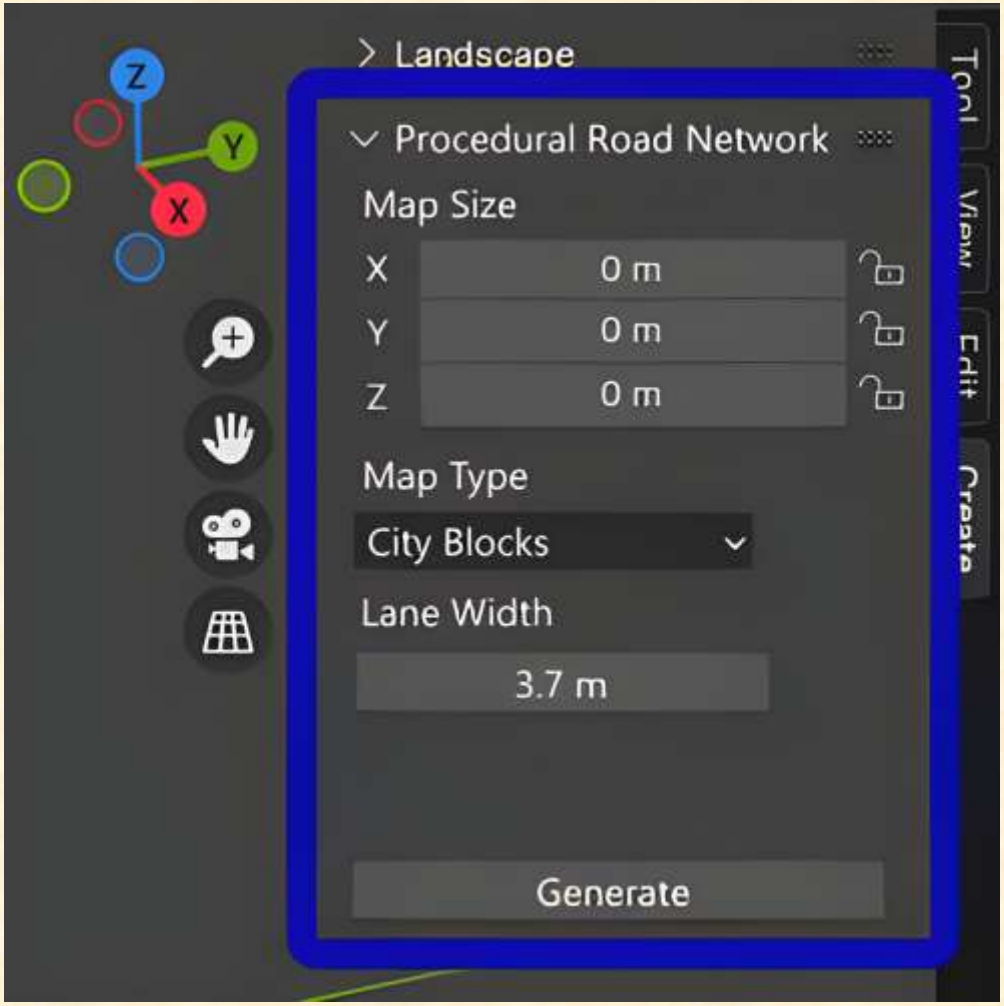
Screen Mockup: Blender Object Slots



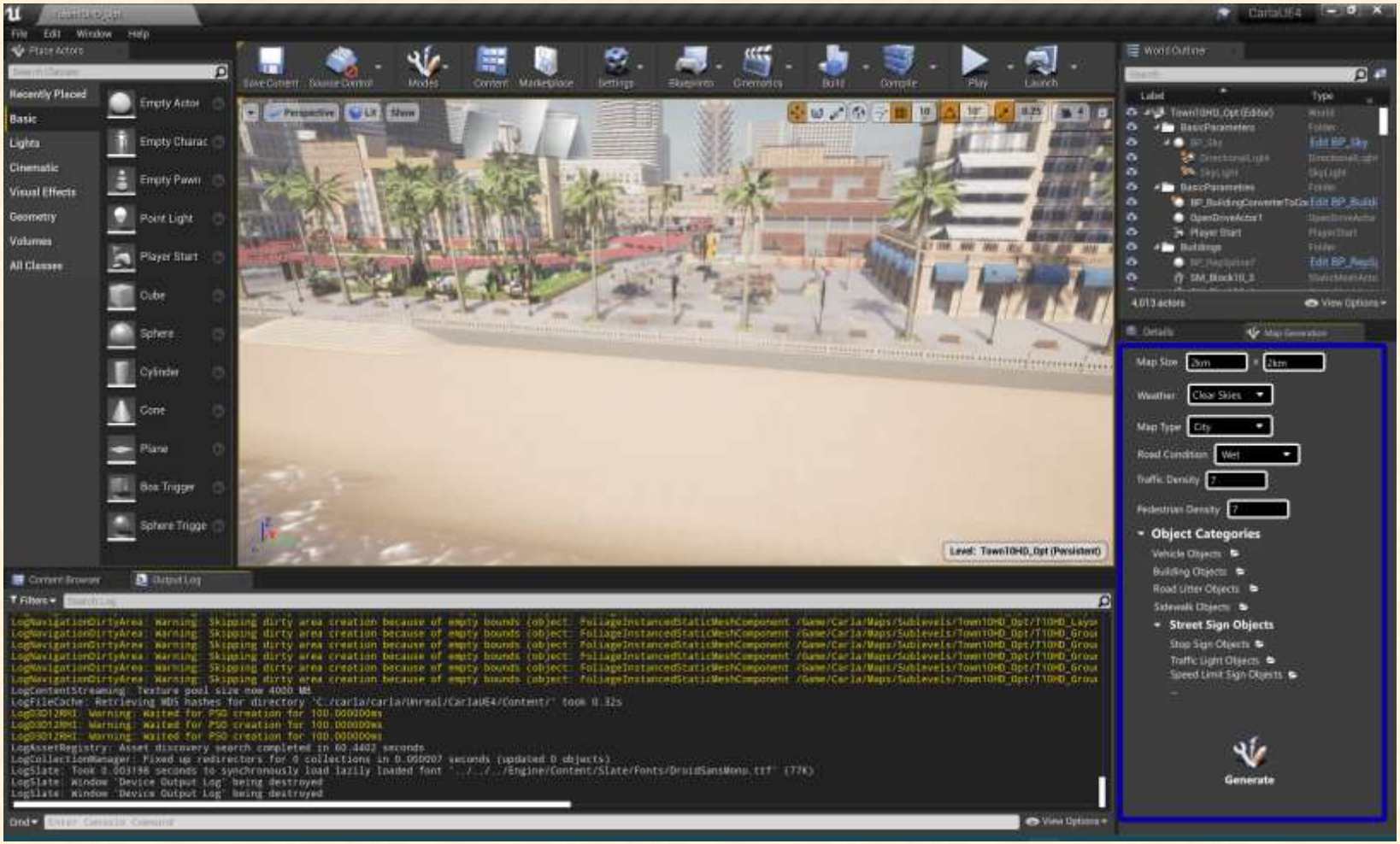
Screen Mockup: Blender Road Generation



Screen Mockup: Blender Road Generation

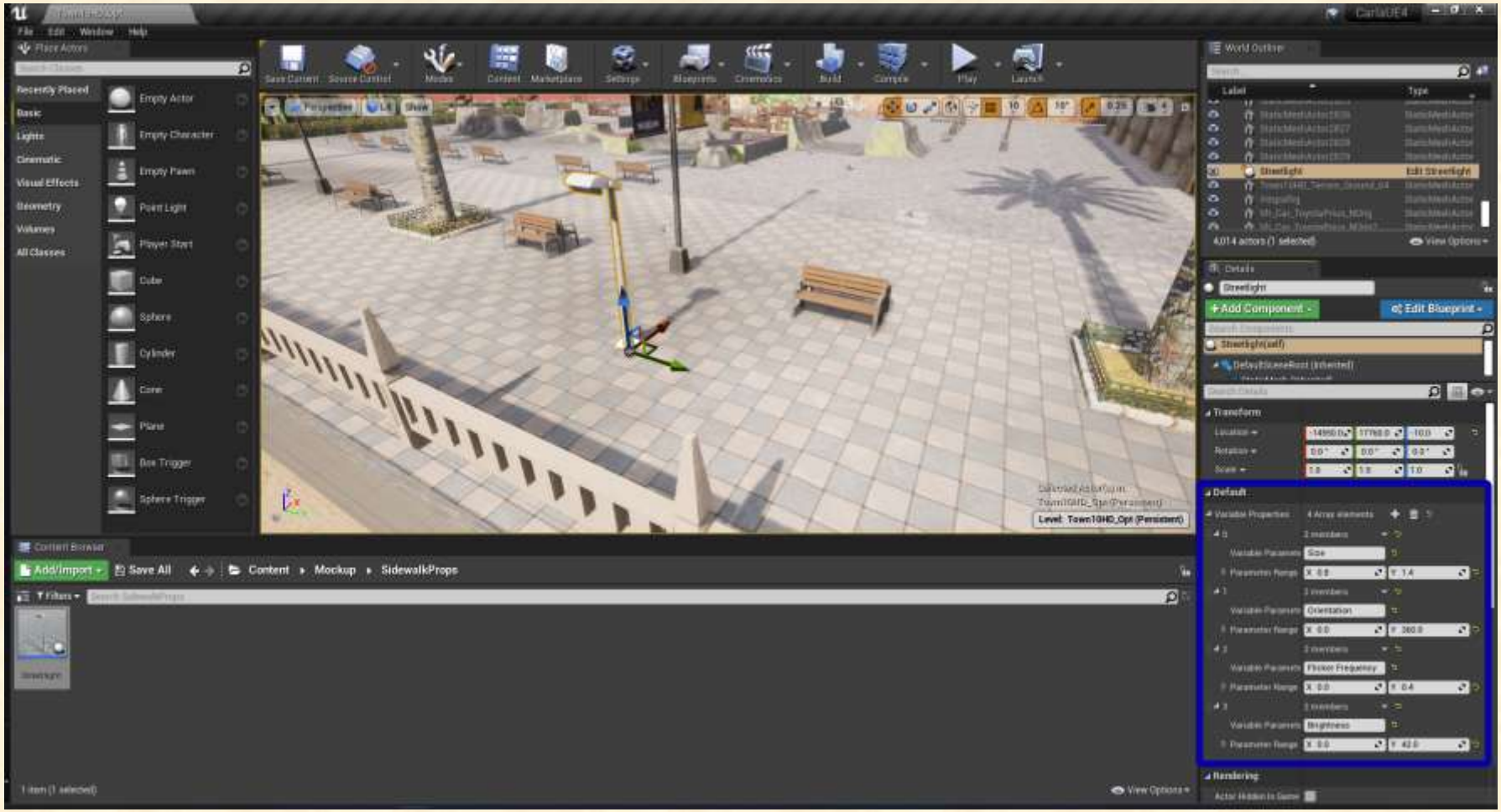


Screen Mockup: Unreal Map Generation

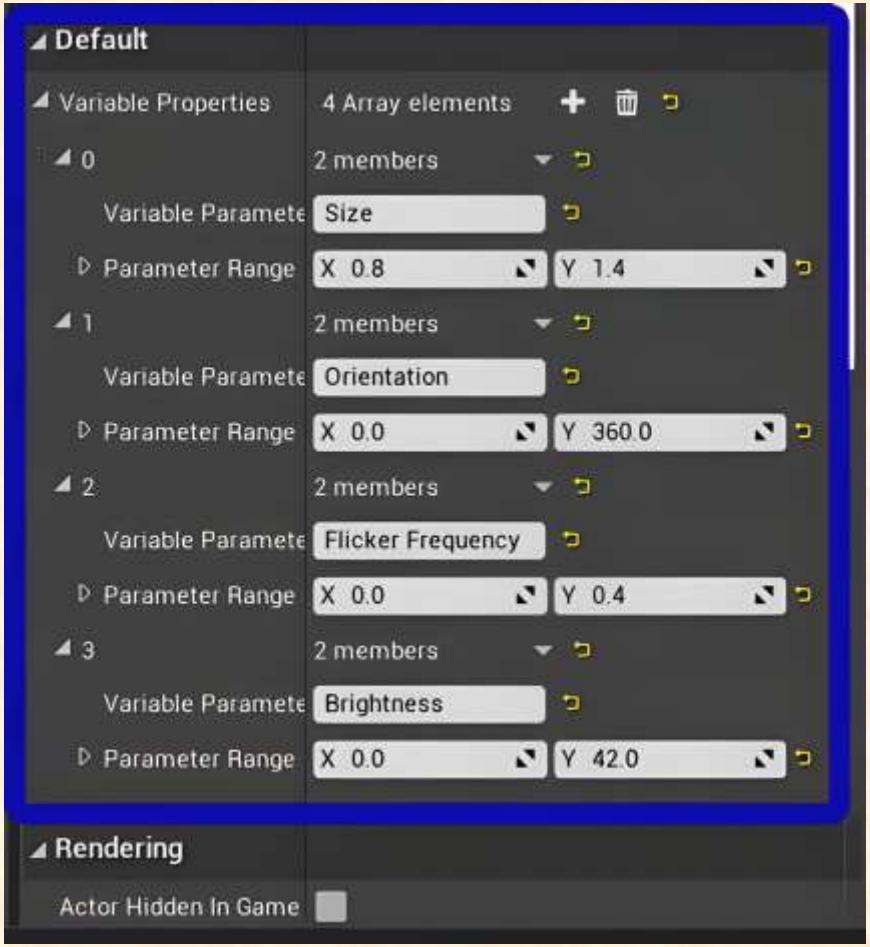


Screen Mockup: Unreal Map Generation

Screen Mockup: Unreal Object Properties



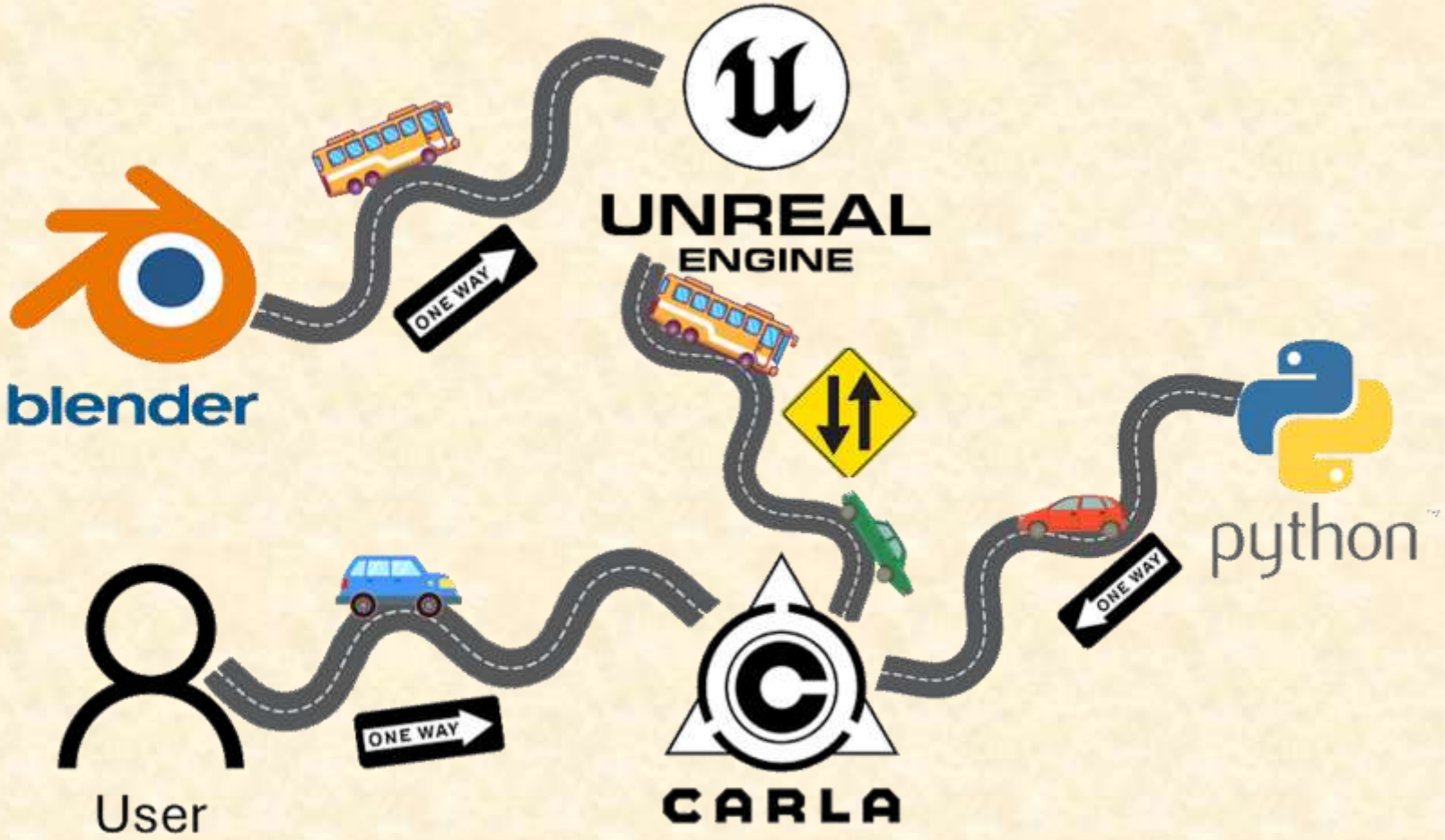
Screen Mockup: Unreal Object Properties



Project Technical Specifications

- Software Versions
  - Carla Simulator 0.9.15
  - Unreal Engine 4: version 4.26
  - Blender 4.2.1
  - Visual Studio 2019
  - Python 3.8.10
- System Requirements
  - Carla
    - 35GB of storage space
  - Unreal
    - 95-135GB of storage space
    - 2 GB RAM
    - 2.0+ GHz Processor
    - Windows 7, macOS 10.9.2 or later
    - Minimum graphics card is NVIDIA GeForce 470 GTX or AMD Radeon 6870 HD series
  - CMake 3.15 +
  - GIT
  - Make 3.81
  - 7Zip
- ASAM OpenDRIVE standard (1.4)

Project System Architecture



Project System Components

- Hardware Platforms
  - PC/Laptop
- Software Platforms / Technologies
  - CARLA – autonomous driving simulator
  - Unreal Engine – The engine CARLA runs in
  - Blender – to create assets
  - Visual Studio – to build and edit UI

Project Risks

- Risk 1
  - We were uncertain how to go about making an automated pipeline to/from Carla.
  - We have decided to use a built from source version of Carla, which is baked into Unreal engine.
- Risk 2
  - Ability to generate the extent of assets necessary for effective testing.
  - We will make a gradient between a folder of each asset type, allowing to create a broad stroke of different assets based on a few extremes.
- Risk 3
  - How can we compress the size of files enough that having hundreds of environments will not cripple storage space.
  - By using a seeding system, we can "regenerate" the environments from scratch, saving a lot of storage space at the expense of longer loading times when launching the environments.
- Risk 4
  - Generate assets performant enough to effectively test without reducing simulation quality.
  - Select primary polygons that are warped by the gradient, limiting the number of extra polygons generated by adjusting/adding assets in the gradient.

Questions?