

PROCEDURAL VIRTUAL CITY GENERATION APPLIED TO AN AUGMENTED REALITY ENVIRONMENT

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PROBLEM & MOTIVATION

Several professional figures often need to generate content. The most created element is the city environment for games or cinematic scenes, movie scenarios, for architects to show ideas and for urban planners to visualise city-data.

The process must be automated since creation by hand is expensive, time-consuming and requires adequate knowledge and resources.

More diversity is needed as typically virtually generating a city produces alike results and visually unappealing when not varying algorithms or using off the shelf assets.



SOLUTION

Procedural content generation (PCG) allows rapid city prototyping in minutes creating the assets defining all the aspects of an urban environment in automated way.

I intend to create a Unity 3D tool paired with an app and help users to procedurally generate always new and original versions of cities using procedurally generated buildings.

The Augmented Reality environment brings the urban area created into the physical space captured by the phone camera helping visualisation of the content generated often required by urban planners.



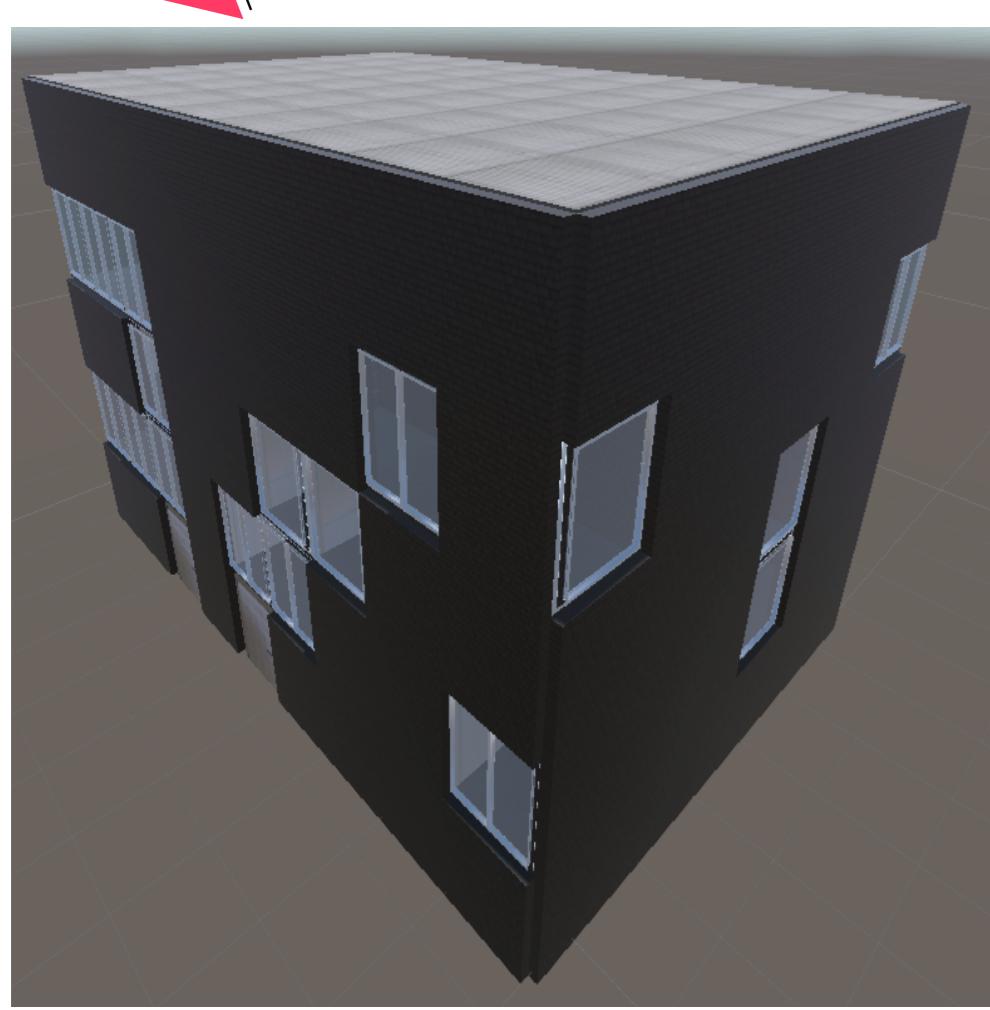
AIM & OBJECTIVES

Creating a tool to procedurally generate realistic and varied virtual cities optimised to be used in AR with low spec machines while remaining accessible to non-expert users.

1. Analyse algorithms from existing tools to use the most efficient
2. Procedurally generate a city with procedurally generated buildings achieving a consistent frame rate
3. Ensure efficient system optimising user experience on both the generation tools and AR app.
4. Create an accessible AR setting assessing potential benefits.

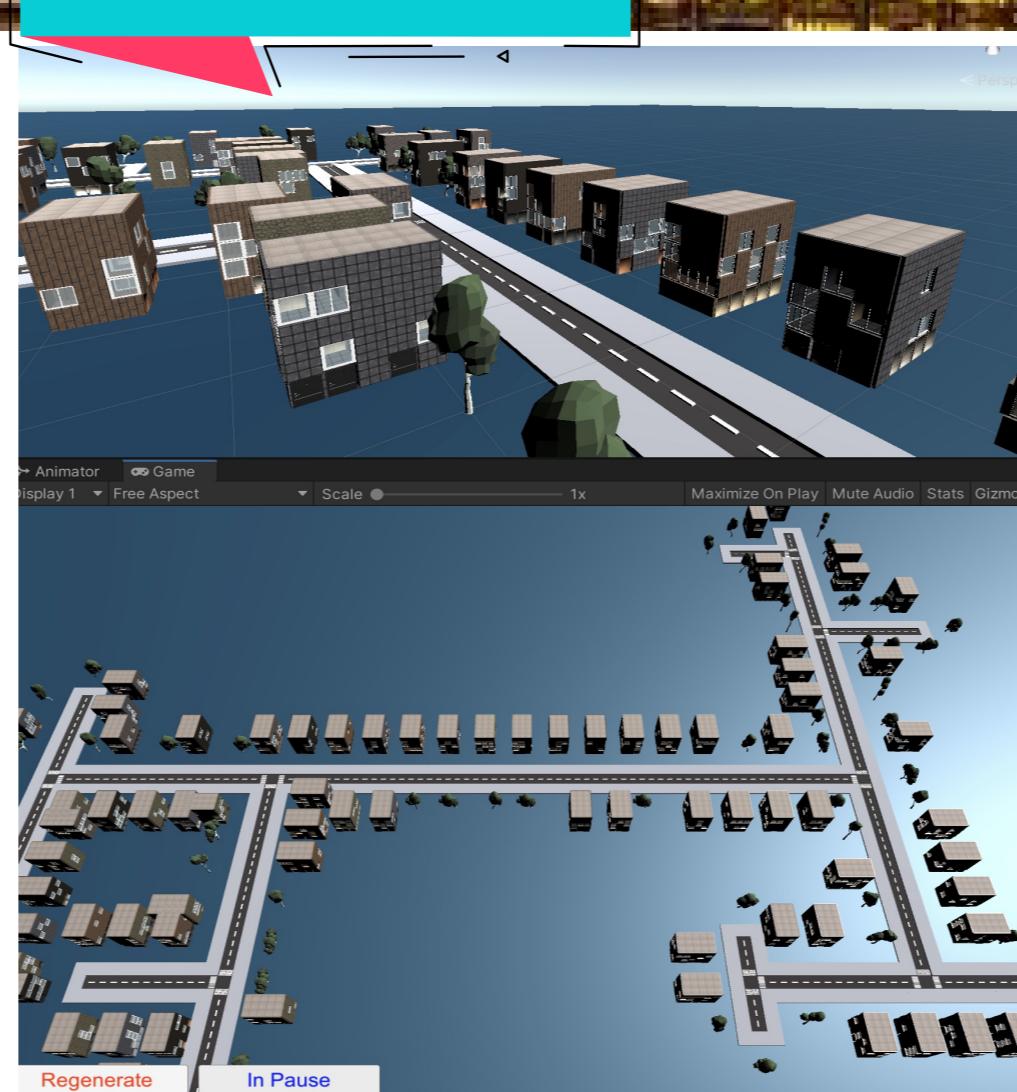


BUILDING



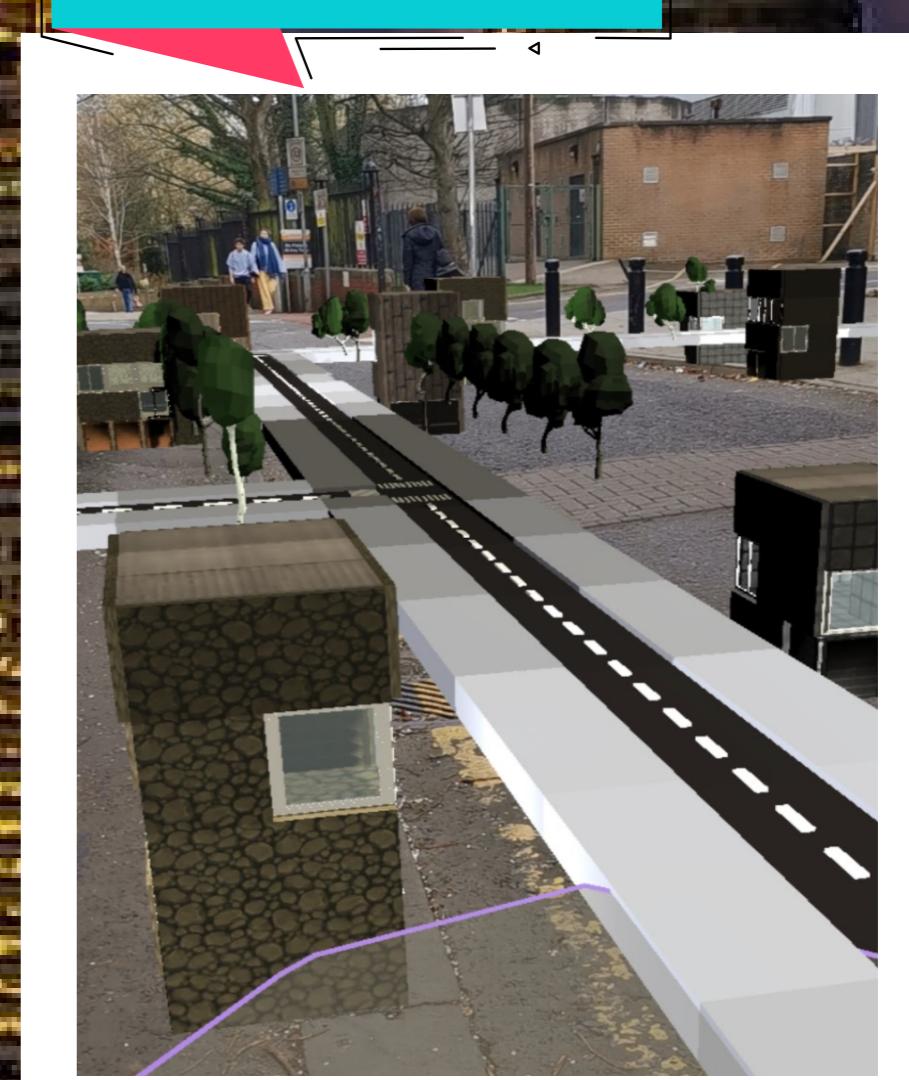
The tool first procedurally spawns a building using a random selection of different assets including several windows, doors and materials. Playable characters may interact with the building as the room structure allows interaction with a game.

CITY



Then the software procedurally develops a city composed of procedurally generated buildings appropriately placed to keep high quality and a decent framerate on a road map generated using an L-system based algorithm.

AUGMENTED REALITY



Finally, the AR application is used to visually build up hybrid (virtual and real) urban spaces creating an environment that could not be physically possible otherwise. Augmented Reality superimposes virtual elements over the real world turning any surface into a playable space.

TECHNOLOGIES

My tool is divided into two parts, an Android app, targeting the most used mobile phone operating system to visualise in AR users' creations and a PC version allowing the user to have more control over the generation of the city content.

To develop both applications, the language of choice is C# using Unity3D.

FUTURE WORK

I am designing my dissertation as a starting point to increase and elaborate on research on the AR field and show its potential. The tool should additionally offer the user more options to export the building and city and also give the user the choice of keeping or changing details when generating buildings or streets. Finally, better optimisation for the FPS count (frames per second, distinct images shown per second) might be achieved.