# Mapping Clemson's Campus Through the Integration of GIS and Virtual Reality

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## ABSTRACT

The purpose of this project is to investigate how Geographic Information Systems (GIS) and virtual reality (VR) can be bridged to visualize future land use and planning scenarios using Clemson University's campus as a test case. The researcher will use CityEngine to build the virtual environment and bring into a VR environment to experience the effects of potential changes to the landscape.

## KEYWORDS

ACM proceedings, LaTeX, text tagging

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## 1 INTRODUCTION

The purpose of this project is to use both GIS and virtual reality to create a map of Clemson's campus. This paper reports on my attempt to do that through the use of CityEngine and the Samsung Gear VR headset. My hope is to report the challenges faced, and the reasoning behind building the map in GIS software and latterly integrating into a virtual reality environment versus the reverse process.

The visualization of GIS data is a fairly new concept and still presents many challenges. This is partly due to the fact that virtual reality itself remains a mystery to most. The need for virtual reality, specifically in the GIS world, has seen a significant increase over the last couple of decades. This increase has been more so in the area of urban development and planning. While there has been more of a demand for the integration of these two things, the process remains rigorous and uncommonly attempted.

*None
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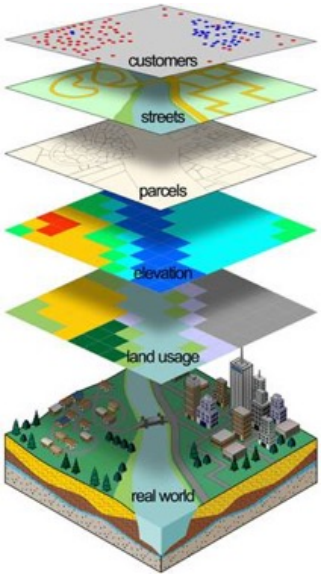



**Figure 1: Illustration of GIS.**

### 1.1 Geographical Information Systems (GIS)

Before one can fully comprehend the purpose behind this project, it would be beneficial to explore what GIS is and why it is important. GIS, or geographic information systems, "lets us visualize, question, analyze, and interpret data to understand relationships, patterns, and trends." (Esri). These systems allow us to pinpoint relative locations of data on Earth's surface that can later be used to create 2D databases that represent these spatial locations. These data can then be brought into programs like CityEngine and rendered into 3D models. Because of these capabilities, "there is a growing interest in and awareness of the economic and strategic value of GIS." This statement stands true for what we are trying to do here at Clemson.

The ability to visualize Clemson's campus using existing GIS data opens a window of opportunity to further explore various land us scenarios with low cost and low risk.

## 2 METHODS

### 2.1 Prior Methods

Prior methods are Virtual reality (VR) focussed and are inefficient and problematic.


**Figure 2: Illustration of GIS.**

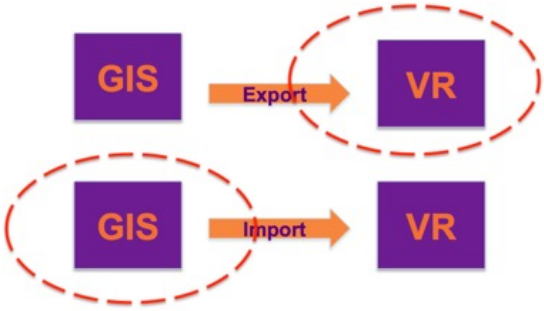



**Figure 3: Illustration of GIS.**

## 2.2 New Methods

New methoduses CityEngine to regularly update the scene and can be integrated into Virtual Reality technologies.

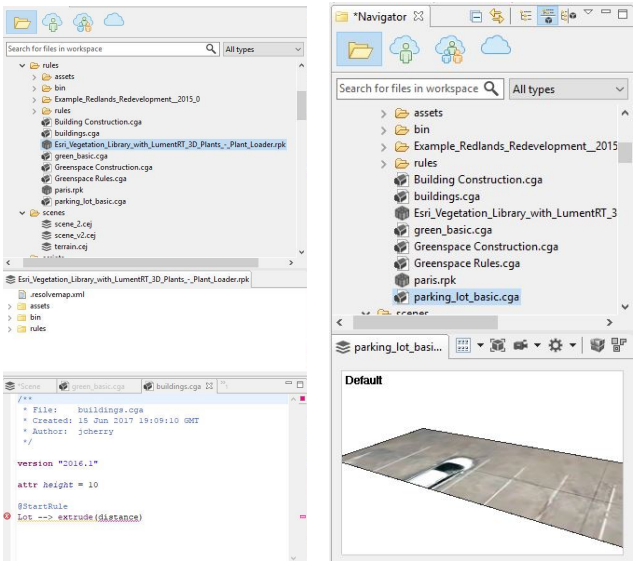
Before completing this project, I first had to grasp a better understanding of what CityEngine was, how it worked, and what all it was capable of handling as I had no prior GIS knowledge or experience. Esri CityEngine improves urban planning, architecture, and design, using its 3D visualization power to see the relationships of projects, assess their feasibility, and plan their implementation (Esri). The first week research was spent watching the Esri Essential Skills tutorial videos on the Esri website that explained step by step the different features and functionality of the software. Some of the most helpful tips where as simply as learning to navigate the program using shortcuts and where simple buttons were located. Additionally, the lessons on how to import data, extrude models, and write rules to create and improve these models were particularly helpful.

After some experimenting with the tutorials and following along with the starter packages, I had gained enough knowledge to begin working on my own project. The first step was finding a suitable terrain and topography to serve as the base map. This presented as the first of many challenges. The version of CityEngine I was using did not support the "Get Map Data" functionality required to acquire the terrain and topography to being building the map. This meant either having to download the new version or transferring all of the files to a different workspace. I went with the latter.

## 3 CONCLUSIONS

After exploring this new methodology of GIS and Virtual Reality integration, using a platform such is CityEngine to build and create first offers a promising future for projects as such. While the CityEngine software was not overly difficult to learn and navigate, prior GIS knowledge would have also been beneficial in seeing


**Figure 4: CityEngine's procedure**




(a) (b)

**Figure 5: Interface View**

better results. Nonetheless, I was able to gain a proficient amount of knowledge that allowed for what I would consider a successful map and evidence to conclude this new way of integration is more proficient than the last way of doing so.

## ACKNOWLEDGMENTS

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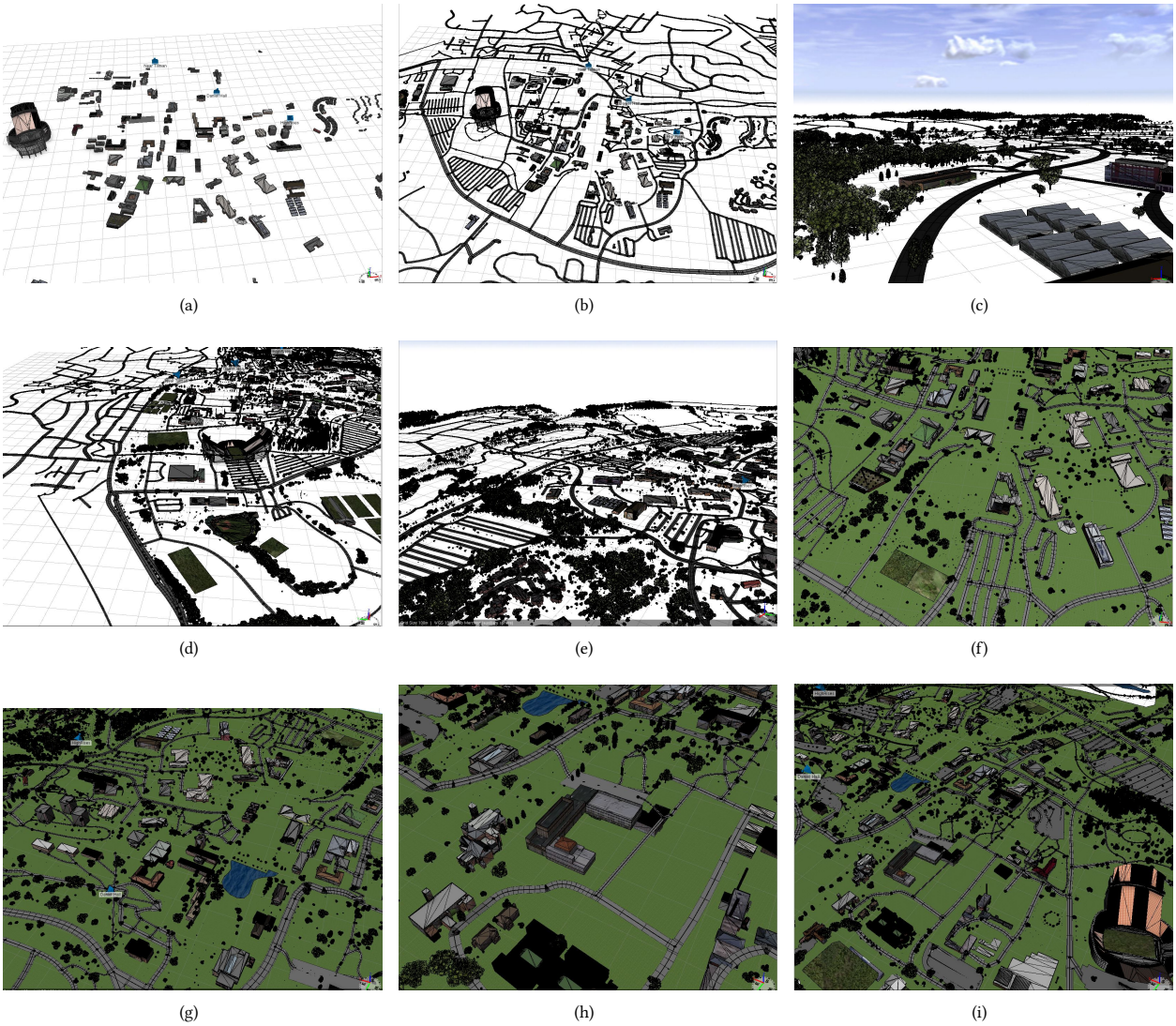

(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

**Figure 6: Results.**