Immersive and Interactive Visualizations using Virtual Reality

Meteor Studio: Dreamscape Data Visualization

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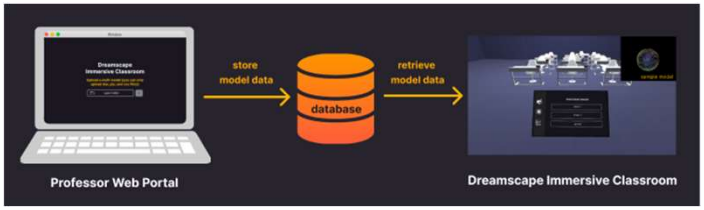
Introduction

The realm of education is faced with the challenge of conveying increasingly complex and voluminous data in a manner that is both comprehensible and engaging. Traditional methods, limited to two-dimensional visuals and static representations, often fail to capture the intricacies of the information, leading to a disconnect between learners and the subject matter. There is a critical need for more immersive and interactive tools that can bridge this gap and facilitate a deeper understanding of the data.

The project presents a suite of template designed to be integrated into various immersive experiences within Virtual Reality (VR) environments. This semester, two key features were developed: the transformation of graph files into interactive point clouds and the dynamic visualization of weather data on a 3D globe. These tools are part of a broader initiative to continually craft solutions that elevate data interaction and comprehension, thereby enriching the educational landscape.

Upload and Visualize 3D Graphs



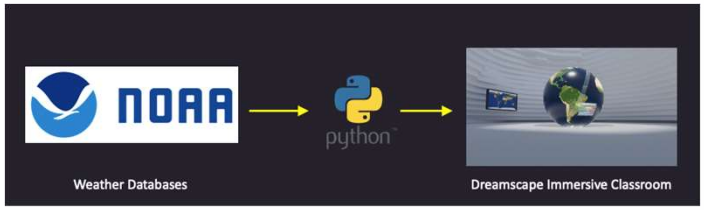
Purpose: To make complex mathematical models more accessible and engaging

This system is dedicated to transforming the way mathematical concepts are taught and understood. By incorporating immersive, interactive three-dimensional **point clouds** into the learning environment, it offers an opportunity for students to visualize and interact with intricate **mathematical models** in a virtual space. This system is particularly beneficial in advanced fields such as Calculus 3, where the visualization of complex equations and data sets can significantly enhance comprehension.

1. **File Upload**: The Angular web portal allows professors to log into and access a single page for creating lessons and uploading different point cloud model files. This portal will be accessed by the professor offline prior to their immersive lesson.
2. **File Storage**: Once uploaded, the .csv and .dae files are organized and stored in the Firebase database.
3. **Retrieval and Processing**: During runtime in the Unity scene, the files are retrieved in real time using the Firebase URL when the professor interacts with the tablet UI.
4. **Visualization**: The selected file is then parsed and converted into a list of Vector3 point by a C# script. These points are then visualized by a Point Cloud object, complete with capabilities for transformation, rotation, and selective focus.

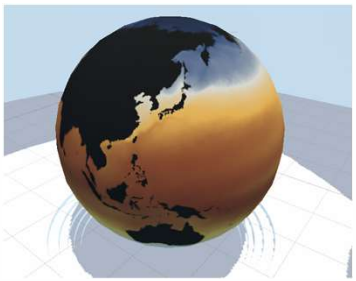
Future: Expand file formats, direct data pipeline from math model generators and student interactions

Mapping Weather Data on a 3D Globe



Purpose: To clarify and contextualize abstract climate data

This tool enhances the educational experience by providing real-time, interactive visualizations of weather and climate data on a 3D globe and serves as a powerful medium for general communication about weather patterns and **climate change**. By transforming raw data into engaging visuals, educators and communicators can facilitate a deeper understanding of complex **meteorological concepts** and the broader implications of climate patterns. It stands as an approach to foster awareness and convey the urgency of climate change, making it an essential tool for environmental education and advocacy.



1. **Data Acquisition**: Climate data is either sourced from the NOAA Global Data FTP Server or by converting netCDF data into JPEGs using Python scripting.
2. **Script Processing**: A custom C# script ingests the imagery by opening a MemoryStream, a flexible container for image data in memory.
3. **Texture Preparation**: Initially, a placeholder 2D Texture is generated, which is then populated with the image data using the `LoadImage` function, directly from the MemoryStream.
4. **Visualization**: The 2D Texture object, now containing the visual data, is dynamically applied to the globe's surface within Unity, enabling an interactive global display, and annotation capacity.

Future: Improve rendering, video display, playback capability and displaying multiple datasets at once

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