Project Report: Animation of World Landmarks using Vuforia and Unity

Group Members:

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4. David Geis

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1. Project Overview

Title:

Animation of World Landmarks on a World Map using Vuforia Engine and Unity

Objective:

The objective of this project was to animate ten iconic landmarks on a world map using augmented reality (AR) technologies. The landmarks included the Taj Mahal in India, the Eiffel Tower in France, and eight other significant structures. We utilized the Vuforia engine to create a database and animate these objects within Unity.

2. Analysis of Each Problem

Problem 1: Landmark Identification and Placement

Accurately identifying the geographical locations of the landmarks and placing them on a digital world map required precise coordination and verification. This task involved gathering correct latitude and longitude data for each landmark and ensuring they were correctly mapped in the AR environment.

Problem 2: Database Creation with Vuforia

Creating a database in Vuforia that could recognize and track the world map was challenging. It involved uploading the world map image to Vuforia, setting up image targets, and ensuring that Vuforia could consistently recognize and track the map in different lighting conditions and from various angles.

Problem 3: Animation in Unity

Implementing animations for each landmark in Unity required a deep understanding of Unity’s animation tools. This included setting up keyframes, defining animation sequences, and ensuring smooth transitions and interactions within the AR environment. We had to ensure that animations were synchronized and didn't cause performance bottlenecks.

Problem 4: Acquiring and Preparing 3D Models

Finding appropriate 3D models of the landmarks online was a time-consuming process. The models were available in various formats, and many required conversion to FBX format to be compatible with Unity. Additionally, some models needed modifications in Blender to ensure they fit the project's requirements and looked realistic in the AR environment.

3. Issues During Implementation

Issue 1: Image Recognition Accuracy

The Vuforia engine had difficulty accurately recognizing the world map, especially under varying lighting conditions. This caused issues in the stability of the AR experience, with landmarks sometimes not appearing or being incorrectly positioned.

Issue 2: Model Scaling and Positioning

Ensuring that each 3D model was correctly scaled and positioned on the world map was challenging. It required meticulous adjustments in Unity to match the real-world proportions and correct placement relative to the map.

Issue 3: Performance Optimization

Animating multiple objects simultaneously in an AR environment led to performance issues, such as lag and stuttering, particularly on lower-end devices. This required us to focus on optimizing both the models and the AR experience to ensure smooth performance.

Issue 4: Model Format Compatibility

The 3D models we found were in various formats and often needed to be converted to FBX format for Unity. This conversion process sometimes resulted in loss of detail or required additional modifications in Blender to ensure compatibility and visual accuracy.

4. Solutions to Overcome the Issues

Solution to Issue 1: Improved Image Targets

We addressed the image recognition accuracy by using high-contrast, high-resolution images of the world map as image targets in Vuforia. This improved Vuforia's ability to recognize and track the map more reliably, even under different lighting conditions.

Solution to Issue 2: Fine-Tuning in Unity

To tackle the scaling and positioning issues, we used Unity’s scene view to manually adjust the scale and position of each landmark. We made use of Unity’s coordinate system and snapping tools to ensure precise placement. Regular testing and iterations helped in fine-tuning the positions.

Solution to Issue 3: Performance Optimization Techniques

We optimized performance by simplifying the 3D models. We also optimized the animation scripts to run efficiently and adjusted frame rates to ensure smooth animations.

Solution to Issue 4: Model Conversion and Modification

We dedicated time to finding suitable 3D models online and converting them to FBX format using tools like Blender. We also modified the models as necessary in Blender, ensuring they met our visual and technical requirements for the project. This included adjusting textures, simplifying geometry, and ensuring proper scale.

**We Exported The Project Onto Android and Built it and Captured everything on Phone camera**

5. Features

* Background Audio: We have added a background audio to provide an immersive experience. The audio plays as soon as the image target is detected.
* Touchable objects: Taj Mahal and Statue of Liberty models have a trigger component which play some unique audio and particle effects on touch.
* Spline Animation: An airplane object that flies around the map through a spline based animation.
* Mixamo Character: A boy character imported from Adobe Mixamo with a waving animation applied.

6. Contribution of Each Individual Member

For this assignment, since we had to work with a new tool, the Unity Game Engine, every team member was eager to collaborate on all the core elements of the project.

Pratham Yadav

* Led the creation of the Vuforia database.
* Handled the integration of Vuforia with Unity.
* Wrote the animation scripts to rotate the objects when rendered.

Jenil Pandya

* Focused on landmark identification and placement on the world map.
* Made a Spline That Goes through all the Landmarks on the Image
* Implemented a Spline Animator Script that Was Attached to an Airplane Model that Goes throughout World Map following the spline
* Provided Character Animation Using Mixamo and Animator Controller

Anant Chanchad:

* Dedicated time to finding 3D models online.
* Handled performance testing and troubleshooting.
* Contributed to optimizing the AR environment for better user experience.
* Assisted with documentation and report preparation.

David Geis

* Managed the animation of landmarks within Unity.
* Assisted with the resolution of image recognition issues.
* Worked on improving image targets for Vuforia.

Nikesh Chitambaram

* Converted 3D models to FBX format and modified them in Blender.
* Implemented Particle Effect and Distinct Sound Effect for each of the landmarks.
* Contributed to optimizing the AR environment for better user experience.