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College Virtual Tour using Virtual Reality

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Abstract: ***Virtual reality has become one of the highly interesting and popular fields. Also in recent times, the concept of the metaverse and its idea of a virtual world is being spread rapidly. As the technological connotation of the term VR has been changing and encompasses various VR systems with different capabilities, it has also paved a way for virtual tourism. The current pandemic situation made people around the world stay inside their houses, which has led to the growth of virtual tourism. Yet the usage of VR is not as wide as its reach. The main reason for VR's less usage is its affordability, not everyone could afford a VR headset. The objective of this project is to create an immersive virtual tour of the college that can be used by even an individual without any proper gear. Virtual tours are a way for people to experience and explore a place that exists in reality as a physical space via the internet. The old techniques of the virtual tour are either of a pre-recorded video form or just some collections of 360-degree images. To improve the experience, we are creating a 3D virtual environment that the user can access without any restrictions. The user can download the file and can run the program on their desired platform***
Keywords: VR headset, Twinmotion

I. INTRODUCTION

Computer Generated scenes have a wider range of audience and VR is another field that attracts the viewers. Creating an environment is not an easy task. It takes a lot of time and skills to create a 3D replica of a real-life environment. Integrating VR into these computer-generated environments could bring much excellence to the technology. Due to the improvements in the software and in the field of VR, the virtual tour could give the viewers a whole new experience.

The objective of this project is to create a virtual tour that allows the user to view the college in a 360-degree view and navigate them into the college. Also, this project helps those people who are far away from the college to have a look at the facilities and infrastructure before admitting their child to do their studies. The main objective is to make the idea and experience of VR easier and efficient to all.

II. EXISTING SYSTEM

Photo Stitching is one of the easiest and widely used methods for a virtual tour. Photo stitching combines the multiple photos with overlapping fields and produce a panorama image. In simple words, it is the process of taking pictures in different directions from the same point to create a 360-degree image. In some cases, a pre-recorded video is played when the viewer clicks any trigger points. These pre-recorded videos are also called as delayed feedbacks. Even though VR is integrated to these methods, the experience of the viewer is not satisfied and they still have many questions for which they have to make a direct contact with a faculty member. Fig 1.1 shows the implementation of these existing system in some foreign universities. An easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it.

Fig 1.1 Exisiting System

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III.PROPOSED SYSTEM

The system that is being proposed here is a compatible, efficient and an exciting way to show the virtual tour of the college. To create an exterior mock up model of the college many references are collected as pictures. These pictures are taken using a high-definition camera so that the references can be viewed clearly at the time of modelling. The interior references are also captured in the same way. Once the references are captured, they are used to create the 3D model of the college using 3Ds Max. After modelling the college, the model is imported into Unreal Engine for adding materials and textures to the model. Twinmotion, a tool that is built upon Unreal Engine, is used to add elements and textures. Then to make the experience better sound effects and some other animations like human interactions are added to the project. Now this can be easily viewed using a basic VR headset. If a viewer doesn't have any VR headset, they will have an option to have a tour just using their PC.

A. Twinmotion

Twinmotion is an open-source powerful visualization tool. It is built over the Unreal engine, which makes the workflow much easier. The developed 3D models are uploaded into Twinmotion in just one click. The freshly imported model won't be having any material or textures added. Now twinmotion allows us to add thousands of textures and materials from its huge open-source library. It also allows the addition of materials and textures that are collected from other sources. Twinmotion is a very lightweight software compared to Unreal. So, the chances of twinmotion to crash are very low. After making all the exterior and interior changes twinmotion VR feature can be used to view the model in an immersive way.

B. Flow Diagram

Fig 1.2 shows the workflow of the project. This is to understand the process went through in creating the final result of the project. First, reference collections in the form of pictures come under pre-processing. This includes taking pictures of the exterior, interior and all the assets that are present. Then with the reference, mock-up 3D models are created in 3Ds max. These models are then imported into Unreal Engine to make it more realistic with textures and lighting. If the UE4 crashes, then a lighter version called Twinmotion is used for texturing and animations. Finally, after creating all the assets and VR environment the application is packed and exported for the user.

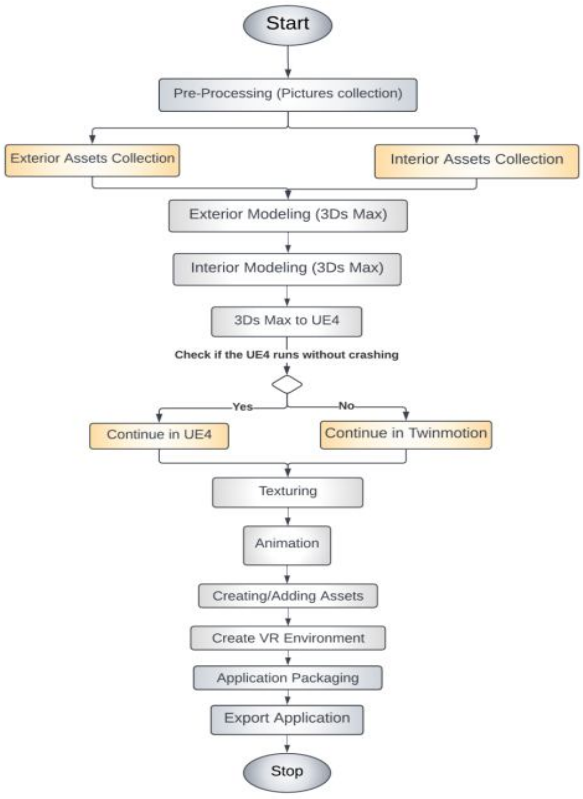

Fig.1.2 Workflow

C. Use Case Diagram

Fig 1.3 shows the use case diagram for the project. This diagram depicts how different users will have different kinds of interface to access. A user with a high-performance PC will be able to have full access, including VR and high-quality textures. A user with a low performance PC is only able to access a normal 360-degree view that can be viewed in their own PC display with low quality textures to make the experience smooth for the user.

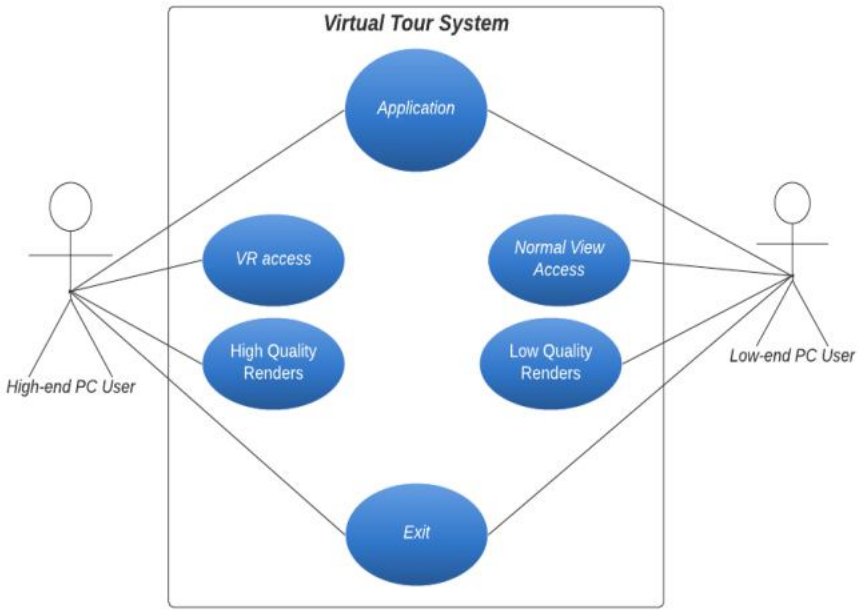

Fig. 1.3 Use Case Diagram

D. Activity Diagram

Fig 1.4 shows how the program opens according to the performance of the user's PC. If the user's PC is highly compatible then a VR program opens. If the user's PC is low in performance, then a static program opens. This saves the user's time and the PC's memory space

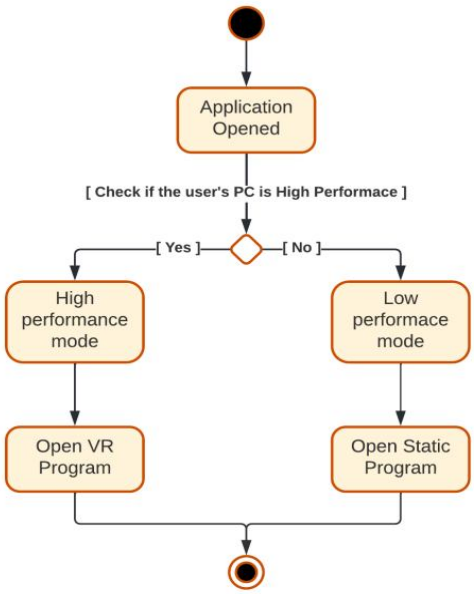

Fig. 1.4 Activity diagram

IV. WORK MODULES

A. *Pre-Processing*

Pre-processing is the process of creating items or things that are required before starting to make a 3D model. Without doing proper pre-processing work a 3D model can't be created or the model won't resemble those in real life. The three main pre-processing works done in this project are:

1) *Building Floorplans*

With the help of a floor plan, one can have an idea of how the rooms and classes are arranged in the building and also know the scale and measurements that are required for 3D modelling. Since the project requires the exact scale and measurements of the buildings and components in the college, the floor plan made the modelling process simpler. The measurements in the floor plan are analysed to understand the real dimensions of the building. The Fig 1.5 shows the floor plan of I block's third floor. Fig 1.6 show the whole cite plan of the college including the fountain and garden.

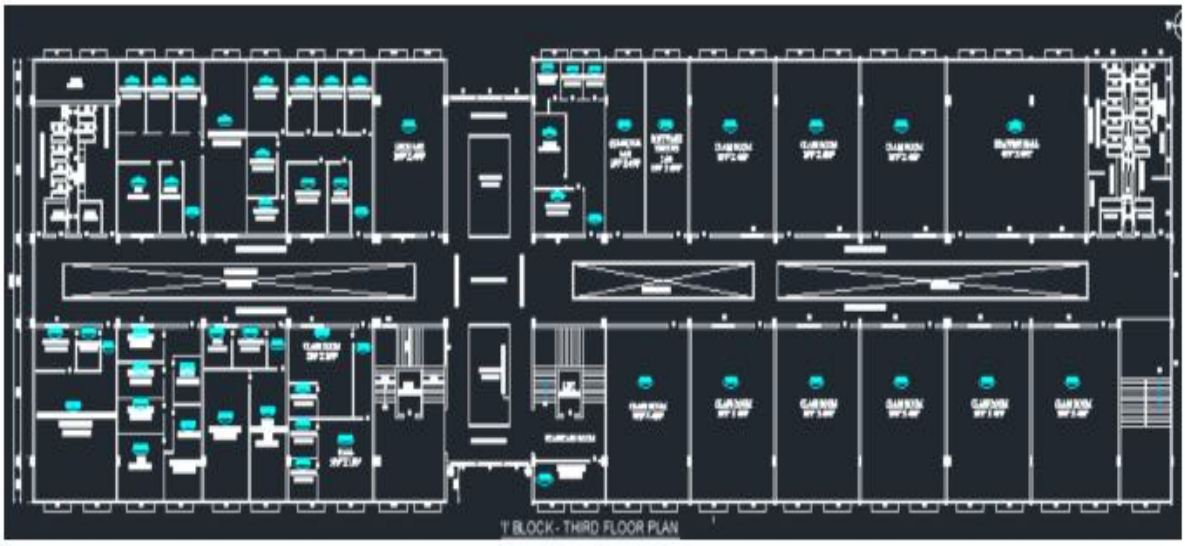

Fig 1.5 building Floorplan of particular block

Fig 1.6 Floorplan of College

2) Reference Photos

Once the measurements are identified from the floor plan, the next step is to have something as a reference to create the 3D models. For reference capturing a high definition DSLR camera is used because having a high resolution will help creating models with more details. Multiple photos are captured from different angles of the building in different lighting conditions. Some high-definition panoramic shots were also captured and used as referencing. The references are captured with steady hands to make sure there isn't any much of motion blur. The number of photos for a particular spot varies based on the complexity of the structure. Fig 1.7 shows some of the references that are captured for creating the interior and exterior of the college. Later all the images are gathered and organized in a file to be used on post-processing.

Fig. 1. 7 Reference photos

3) Reference Correction

Even after capturing the references with precautions, there were some lens distortions and motion blur. This made the modelling of objects difficult. So, to correct the images, the references were imported into Photoshop and the lens distortion and motion blur were corrected.

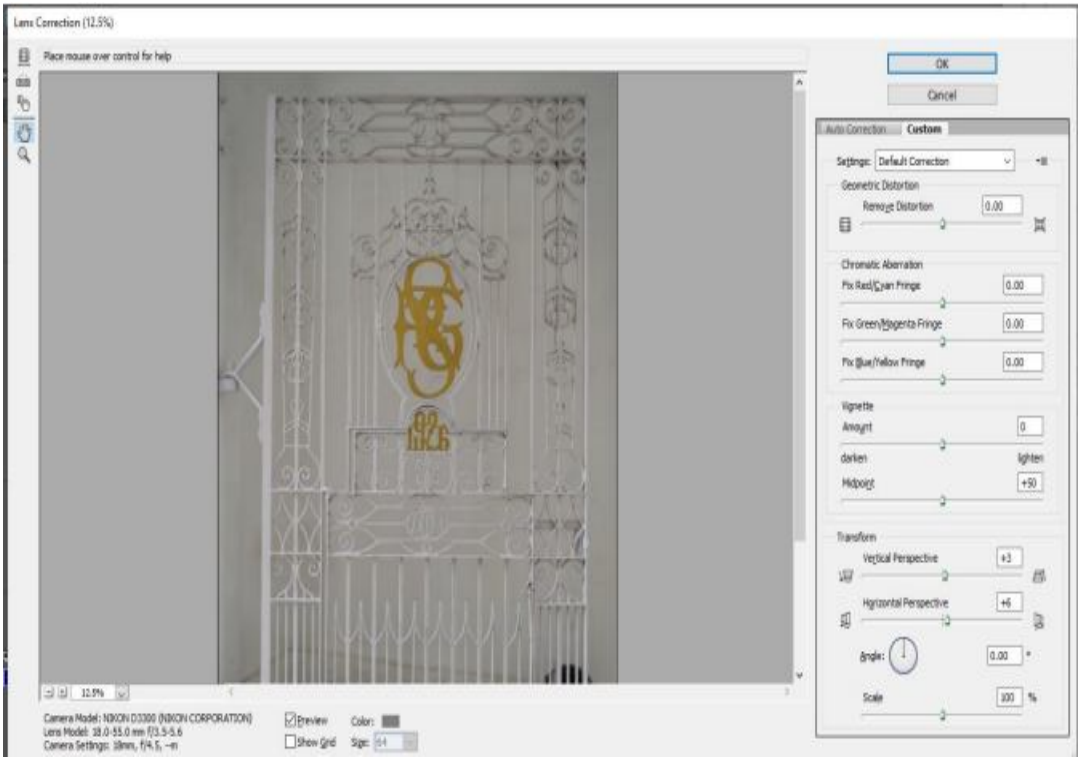

Fig.1.8 Lens Correction

B. Modelling

3D modelling is the process of developing a mathematical coordinate-based representation of any surface of an object in three dimensions by manipulating edges, vertices, and polygons. In simpler words, it's the creation of 3 dimensional objects, using 3D modelling software, which can be added to the virtual environment. The 3D models are created using the 3D modelling software with the help of the references collected or captured. The references of the real time objects help the process of modelling easier. 3d studio max is specialized in 3d visualization. So, it is used for creating 3d mock-up models of the college. Two types of modelling methods are used in this project,

1) Procedural Modelling

The field of computer graphics faces one of the key challenges like assembling a large number of assets. Creating a 3D asset requires a lot of skills and earlier each real time object was captured manually and the process was difficult. Procedural modelling is a technique that allows you to change or edit existing 3D models. It is an umbrella term for several techniques in computer graphics. A developing procedural model tool called metahuman is used for this project. This procedural model tool has various collections of human features which allows the creation of an animated digital human.

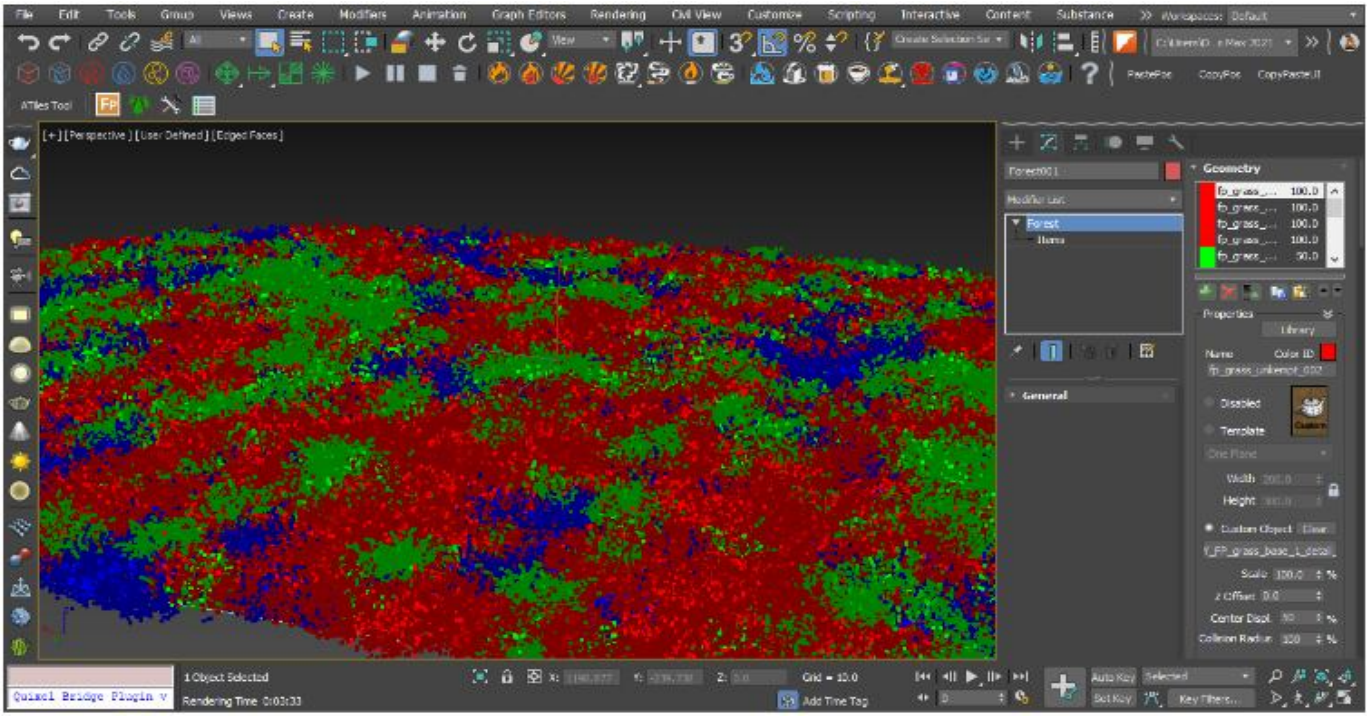

Fig 5.5 Procedural Modelling

2) Hard Surface Modelling

The main phase of the project is recreating the buildings that are present inside the campus. These infrastructures can't be created using the procedural modelling method as models created using that method are pre-built assets. As there won't be any assets for the unique infrastructures. The 3D models of the buildings are created from scratch. The method used for creating the non-organic objects like buildings is called hard surface modelling. Man-made or machined objects are created using the hard surface modelling method. Hard surface modelling of objects is done using 3ds MAX.

a) Interior Modelling: Once the exteriors are modelled using the procedural and hard surface modelling methods, modelling of the interior of the building is done. With the help of the detailed floor plan designed, the rooms and classes in the interior are created. Interior pre-built assets are added and some new assets are created with custom specifications.

b) Steps Modelling: Each floor is modelled in a similar manner. Steps are modelled to connect each floor and path ways are created. Once the interior of a building is created, the interior model is merged with the building exterior model to check whether the measurement and object ratios are accurate. The interior objects are modelled individually to provide customization flexibility for each distinct 3D object. Figure 5.7 shows the interior floor modelling and the figure 5.8 shows the steps modelling.

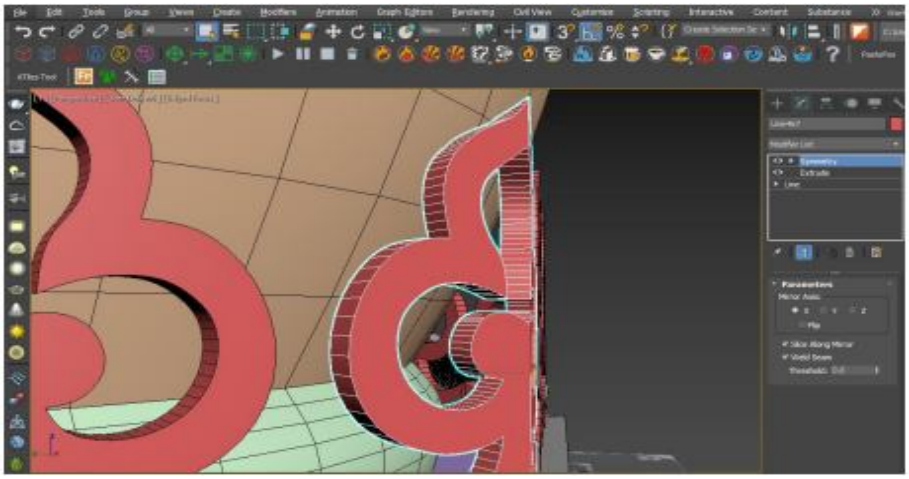

Fig 5.6 Hard surface Modelling

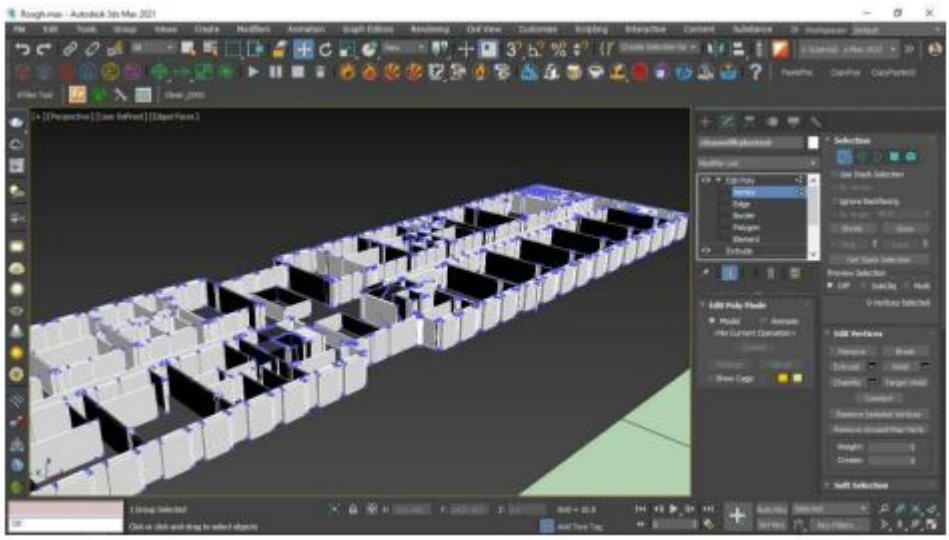

Fig 5.7 Interior floor Modelling

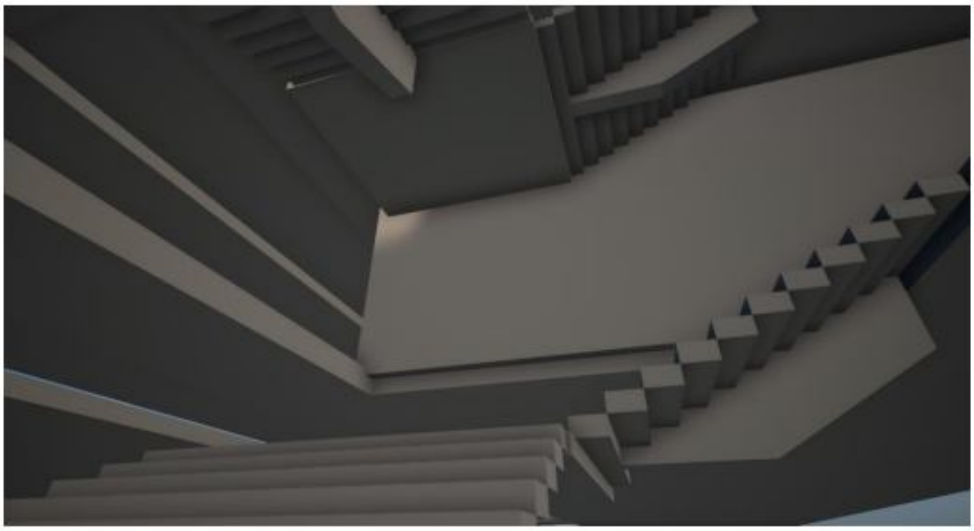

Fig 5.8 Steps Modelling

C. Simulation

1) Water Simulation

This project consists of a fountain and to create a fountain a technique of water simulation is used. Water simulation or Fluid simulation is a method to create water in the virtual environment. In order to create water simulation, Phoenix FD plugin is used. Phoenix FD is a plugin used in 3ds Max software. It is a powerful plugin for creating water simulation. Phoenix FD has many other simulations other than water simulation. Visual effects with liquids and gas can be used to simulate smoke and fog. Since it has many features within the same plugin, it is easy to render the final output and it will be responsive compared to other plugins or softwares. In this project phoenix FD is used to create a fountain in the college by connecting the pipes of the fountain and having an external output pipe vertically that splashes water out of the pipe.

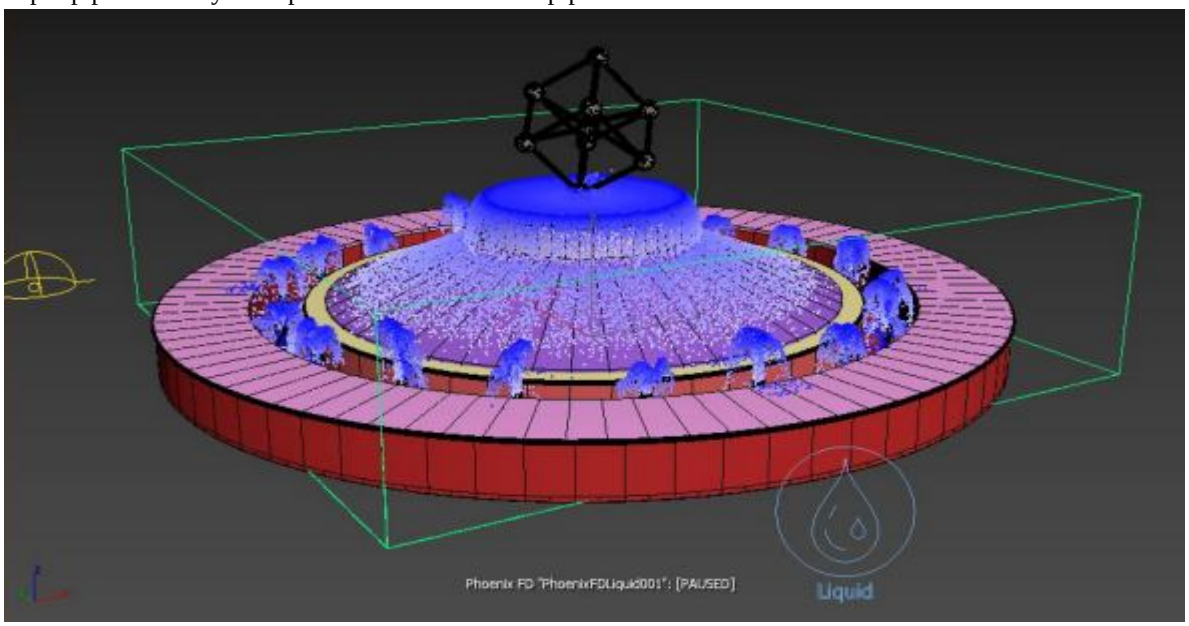

Fig 5.13 Water fountain simulation

2) Crowd Simulation

Adding crowds to the virtual environment is one of the key features in simulating a real life environment. To implement this feature crowd simulation is used. Crowd simulation is a process that is used to simulate the movement of large non-interactive characters in the virtual world. In order to create non-interactive characters, Anima is required. Anima is software that is used to create non-interactive characters by creating a path for the non-interactive characters to move in. Anima has the perfect physics compared to other software and it is more responsive.

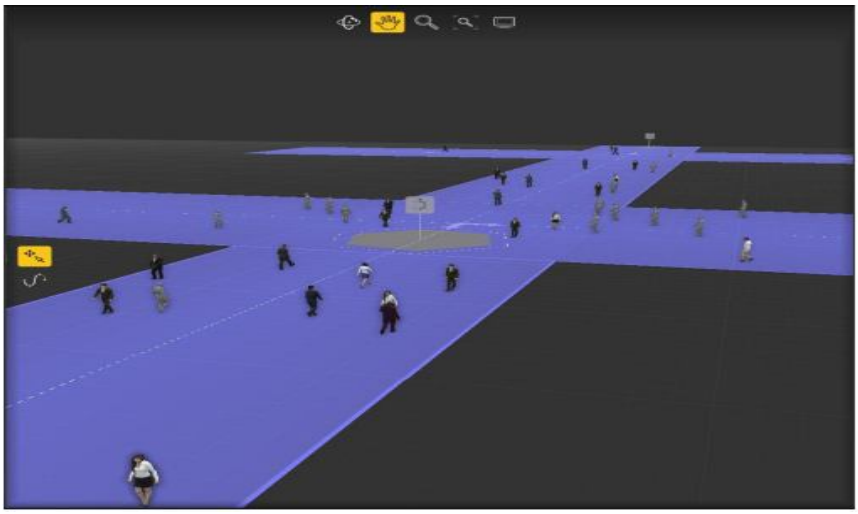

Fig 5.14 Crowd Simulation

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Crowd simulation is also obtained with the use of metahuman creator. The powerful cloud┐ based open source 3D character creation software helps to create 3D human characters with many customizations. The created characters are exported after full customizations. The model is then imported into Maya for rigging to get animated. Figure 5.15 and 5.16 shows the creation and customization of 3D characters in metahuman creator.

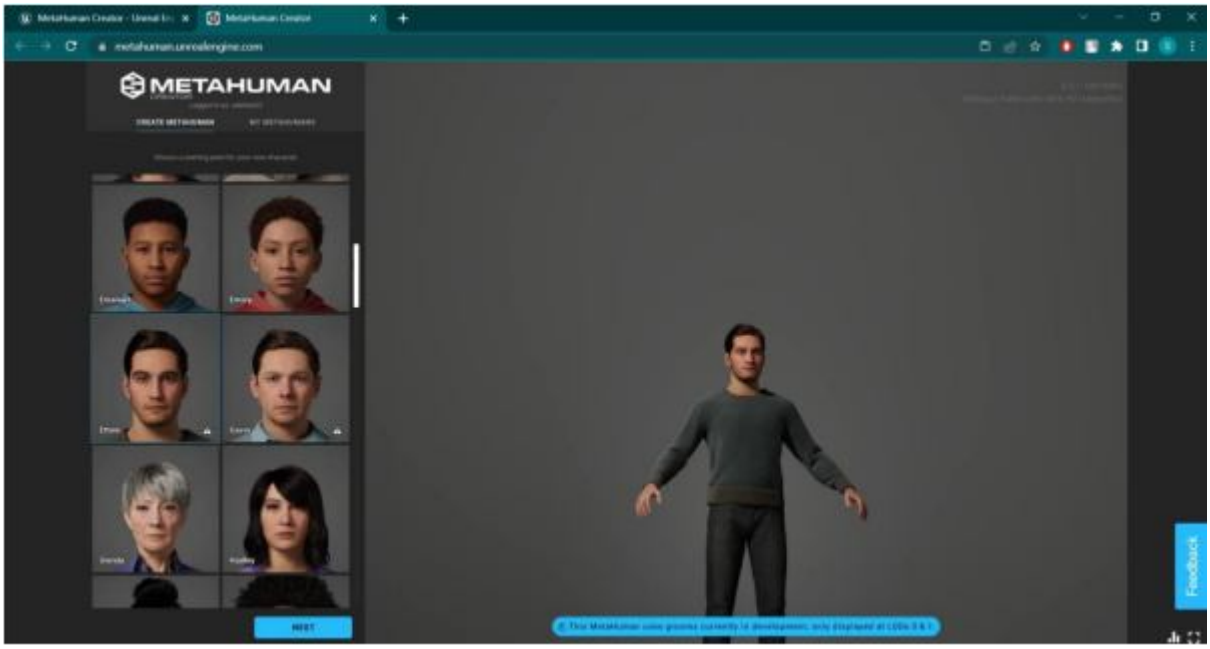


Fig 5.15 Metahuman Creato

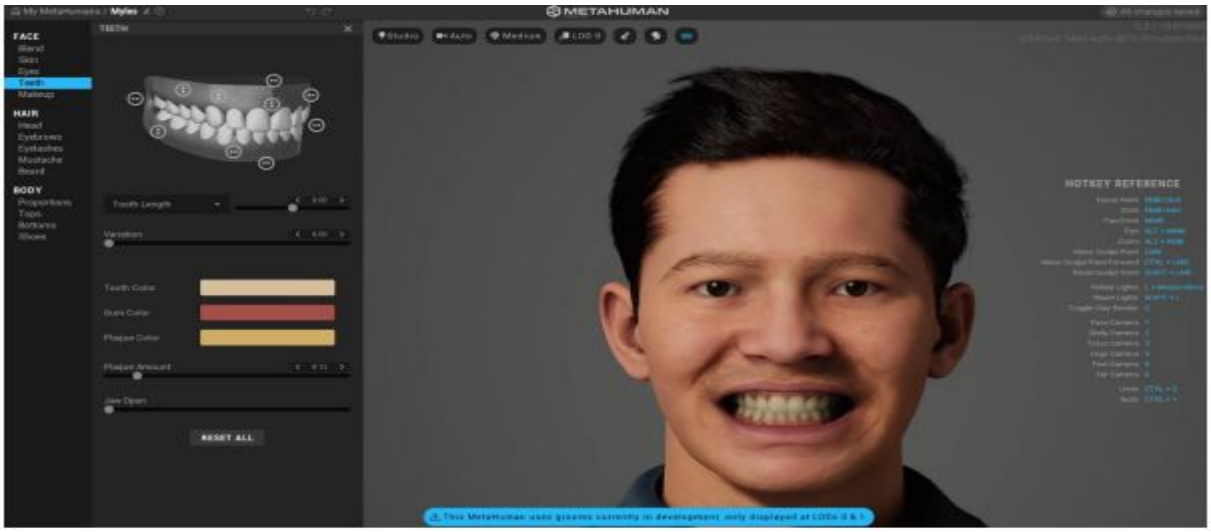


Fig 5.16 Character customization

D. Animation

The created 3D models are static and making them have some motions could improve the virtual experience. Movement to the objects are added by animating them. Animations are added to trees to make them move in response to the wind direction. Also animated characters are integrated into the environment to guide the viewer through the virtual college environment. A virtual 3D character is created using the meta human creator. Animations are later added to the meta human character. Animation presets are added to the model that includes normal walking animation and many other default animations. These characters can also be animated manually for custom animations. There are three types of animation methods that can be used in this project,

- Body motion capture
- Facial motion capture
- Key frame animation

E. Rendering

3D rendering is a computer graphics process that takes raw images and creates 3- dimensional scenes with proper materials and lightning. Rendering setups are modified specifically to use in VR headsets. The final result is rendered using stereo rendering technique. In Stereo rendering, two separate frames are rendered for each eye so the viewer gets the 3-dimensional look of the object seamlessly. The textured, animated and illuminated environment is exported as a presentation application.

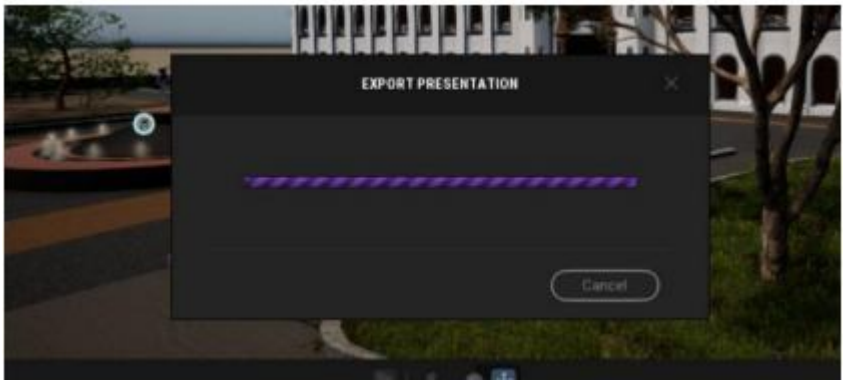


Fig 5.25 Presentation Export

V. CONCLUSIONS

This project has two final outputs. One is the rendered video file that can be viewed in a VR headset and another is a software that can be implemented inside the VR headset. The viewer can experience the virtual tour in two ways. The main reason for having two outputs is to make this virtual tour available for both low and high-performance PCs. In the final output the user is able to customize their preferred quality of the render. Users can also switch between PC view and VR preview. Figure 5.26 shows the customization options available for the users.

Fig 5.26 Customizations

A. Outputs of the Project

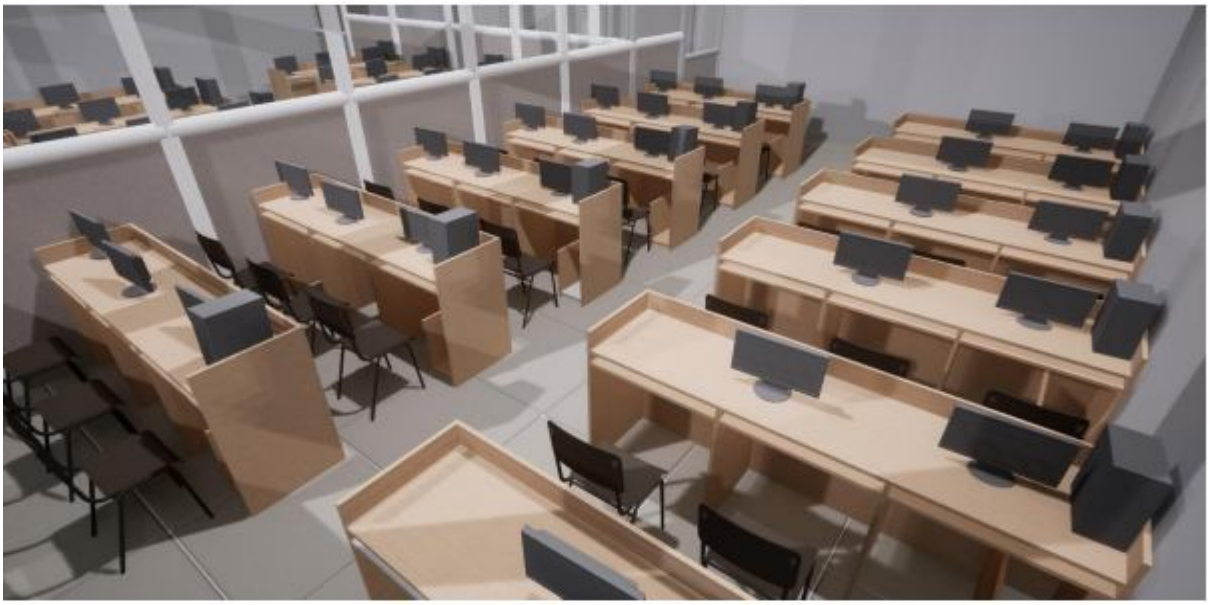
Campus Entrance view

Inside Campus view

Stair Case view

Department view

Faculty Cabin View



Lab View

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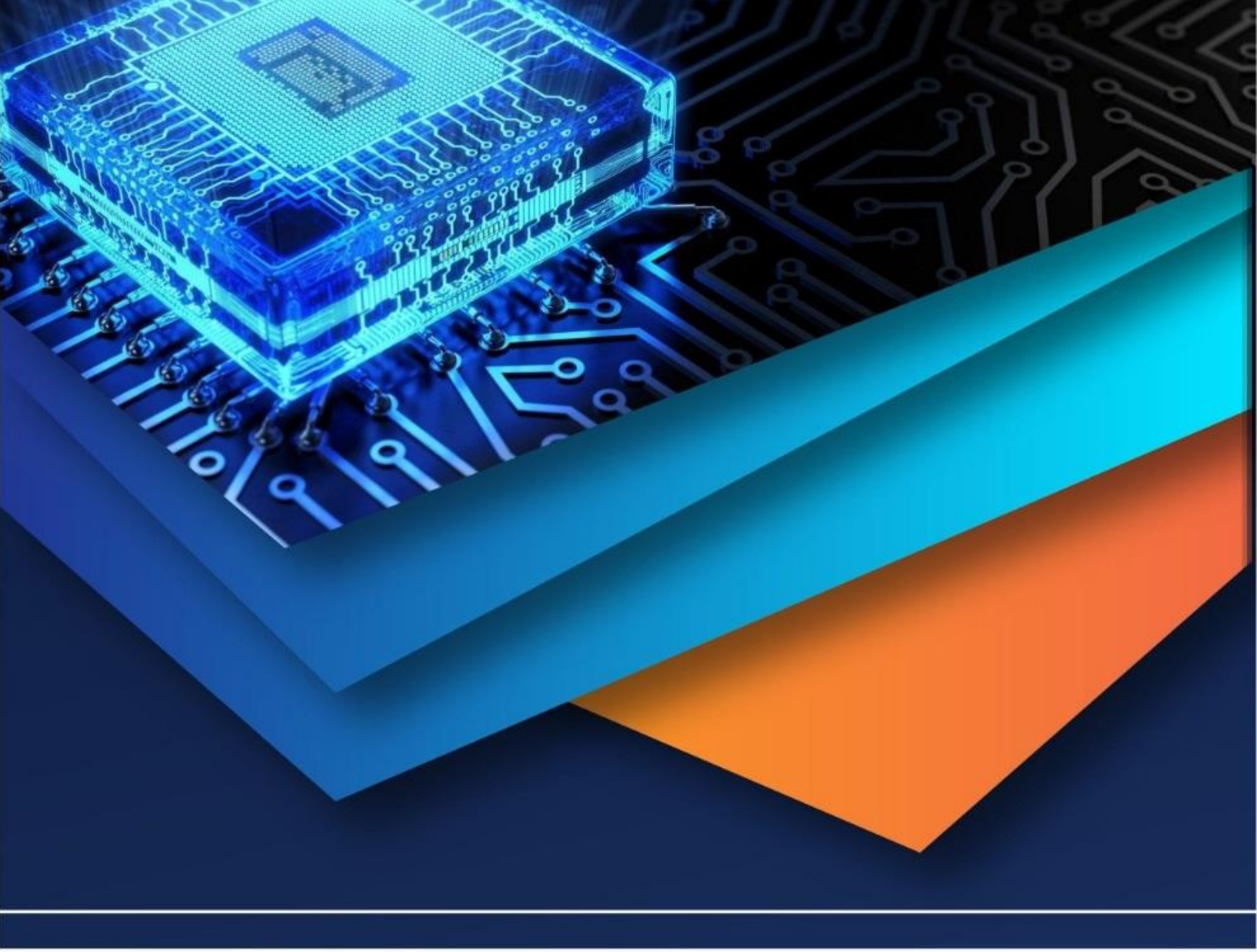

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