

# Virtual Archaeological Museum

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**Abstract**— The project virtual archaeological museum mainly focuses on the need for innovations to provide and preserve the archaeological heritage and its legacy or history through virtual reality environments. The main importance of the project is to deliver an immersive and real-time experiences which fills out the gap between ancient historical things which includes artifacts, fossils, paintings with the general people who are seeking to know the information. The virtual environment displays archaeological museum resurrecting the civilizations and artifacts in a virtual world. Researchers, Educators, Students and other information seeking professionals are benefiting from this project by having an immersive experience of the environment and interpreting the archaeological data and having appreciation of our worldwide heritage.

**Keywords**—virtual reality, culture, heritage, artifacts, civilization, archaeology, museum, audience, immersive, experience, visual, environment.

## I. INTRODUCTION

### A. Goals and Objectives

The main goal of this project is to create an immersive experience and educational knowledge or information on archaeological museum which helps users in exploring the ancient and historical civilizations and artifacts virtually. The objectives of this project includes: (1) To develop a visual appealing environment virtually which represents the archaeological statues and artifacts, (2) To provide information and context for each artifact which includes historical background and cultural context, (3) To increase user engagement and interactive learning, (4) To promote archaeological museum with educational institutions and integrate the culture and heritage into curriculum, (5) Expanding and updating museum's content with new discoveries by providing better experience and engagement.

### B. Designed Environment and Aspects

This overview of the museum consists of an environment where it includes the city around it and the museum is placed between the city and have a sky. Based on "Fig. 1" to "Fig. 15" Going into the museum we can see that there are rooms and lobby which consists of fossils, artifacts, sculptures and paintings all over the museum and the best part is the golden globe where it rotates. While going into the museum we can see that there are rooms and lobby which consists of fossils, artifacts, sculptures and paintings all over the museum and the best part is the golden globe where it rotates. Also there are few more rooms where one room consists of statues of ancient kings and each statues consists story of its own, and we are having one more this is the theatre room, where it is generally

a dark room with seats inside it and there will be a projector, projecting a movie or an educational video which helps people who seeks information. The experience of the museum is very much realistic that user even feels that he is watch the real museum. As the textures, lighting and ambient music will helps in enhancing the visual experience. Also we made very highly detailed sculptures where you can literally feel the textures of it. All these aspects will help in having good visual experience and feels like real-time environment.



Fig. 1. Example of outer environment of museum



Fig. 2. Example of museum overview



Fig. 3. Example of environment with character



Fig. 4. Example of character with ground



Fig. 5. Example of character viewing at museum

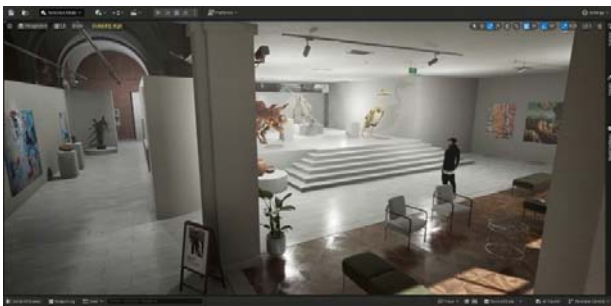


Fig. 6. Example of inside view of museum

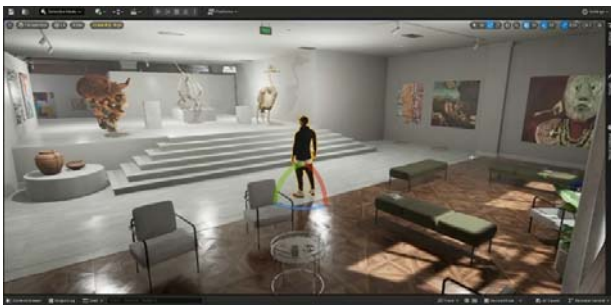


Fig. 7. Example of zoomed view of inner museum



Fig. 8. Example of a fossil room



Fig. 9. Example of hallway in museum



Fig. 10. Example of a dinosaurous room



Fig. 11. Example of a lobby



Fig. 12. Example of theater room projecting a film



Fig. 13. Example of character watching levitating globe



Fig. 14. Example of character running in hall way



Fig. 15. Example of sculpture room

### C. Target Audience

The main target audience for this project are information seeking people like educators, researchers, tourists, students, and other general audiences. Can be able to learn and explore about history and ancient civilizations.

### D. Intention and purpose of the project

The main intention of the project is to have immersive visual experience for users by gaining educational experience which reflects tradition, culture and museum visits with the help of virtual reality. The main purpose is to fill out the gap between ancient history and audience by creating a virtual environment that facilitates how our culture is preserved and understanding the ancient civilizations in an immersive way.

### E. Usage of application

The main use of this application is to provide educational information to the audience who wants to seek information. It acts as a tool for the education and research and enhancement of culture. The multimedia content or the graphical content that we used can enhance the learning experience and there by understanding different cultures. These museums are useful for the future generations and everything is moving into virtual revolution these type of applications can be appreciated by future generations.

## II. RELATED WORK

### A. Scientific References

This project virtual archaeological museum sits on the same page of growing field of virtual reality applications which helps in enhancing culture and learning experience. There are some relevant scientific references which highlights about the similarities of our project discussion is based on.

This paper discusses about the overview of virtual applications in enhancing culture and heritage. The similarities are both the projects says about the virtual realities potential which enhances the user experiences and engagements which further follows understanding of culture and ancient heritage civilizations [1]. This paper focuses on the potential in the educational sector of virtual museums

whereas the similarities in both the projects are to recognize the virtual reality ability to create the environment and to have an interactive and engaging learning [2]. The paper discusses an example of virtual reality museum experience, whereas the similarities in both the work is to develop the virtual reality applications which allows users to experience, explore and visualize archaeological artifacts and sculptures [3]. This paper focus on the collaboration of virtual reality systems to preserve the cultural heritage where this is the common element that matches with our work, where our project's objective is to preserve our culture and civilization and present it for our future generations [4]. This paper highlights about the design considerations which helps in development of project and having similarities like both aligns with developing importance of the users experience in creating the virtual museum applications [5]. This paper says the uses of virtual reality in archeology which helps in the literature review and it aligns to our project in the aspect of creating immersive archaeological museum experience [6]. This paper offers an overview about the revolution of the virtual reality on how we are experiencing and interacting with culture and it also aligns with our project by highlighting ability to interact and engage with users for exploring artifacts and other aspects [7]. This paper deals with the visitors experience in museums where it aligns out goals by how virtual reality can increase user engagement and considering which is valuable for development of project [8]. This paper says about the perception and applications of virtual reality where it is not directly focused on the museums but it offers the insights for building archaeological museum experience [9]. This paper addresses on development of virtual reality application for archeology dissemination where it aligns to our project by considering an example of how virtual reality is used to show archaeological artifacts. Where we can include and design user experience elements for development of museum experience [10].

## III. IMPLEMENTATION

The implementation of the virtual archaeological museum will involve several phase starting from scratch to exporting to unreal and making implementations and integrations and then deploy the project. The implementation process is divided into sub sections to have a clear view on it.

After having a discussion about the project and dealing with do's and dont's we have come to the conclusion to start the work from scratch where the work needs to be done in great quality because of the immersive experience that user needs to get while using the application.

### A. Modelling

- After discussing what need to be implemented we just went with the 3d modelling software's like blender, SketchUp, AutoCAD, maya, 3DsMax etc. As we are using in unreal engine we took all the objects from marketplace.
- As we need more items like artifacts, fossils, sculptures, paintings and lot more objects so we decided to put more focus on capturing the details of artifacts. So, we considered using realistic 3D models from the world of unreal engine world of archaeological objects and environments.

- Not compromising on the quality we choose to consider from the unreal asset store, where as in unity 3d asset store doesn't have high quality objects to use.

### B. Unreal Engine Environment

- After collecting every object that needs to create an environment it is essential to import them to the unreal engine. We considered unreal engine due to the fact that we can't able to achieve the required quality for the artifacts and other objects including the environment.
- Arrangement of the environment followed by the museum interior needs to be done in such a way that it needs to be a real time museum. Now it's time to arrange all the required objects by optimizing the models for rendering within the environment to ensure smooth performance.
- Make sure that textures, materials needs to be applied within unreal engine to enhance the visual quality of the models. It's time to enhance and setup the lighting such as ambient lighting, environmental lighting, object focus lighting and checking where every needs to be dark. And make sure to include atmospheric effects. Adding sky, sun, sun light to the environment and add other buildings, streets, plants, trees, and cars or vehicles to enhance the realism for immersive visualization.

### C. Functionality and Interactivity

- Now implementing main elements like adding behaviours, scripts and other interactive elements to enhance user engagement and immersion experience. Scripts and programming logics need to be developed to enable user interactions such as information retrieval.
- We discussed about the interactions and came to a conclusion that to implement user movement, object selection and information retrieval for artifacts for text popups. We have developed using proximity and time sensors we made it happen like when the player approaches an artifact, then using proximity sensor it detects the fixed distance of the player and then the information gets pop up with the text and by using the time sensor we are keeping the information stable and then when the player gets back from the artifact then the information gets fades off.
- We also integrated music which is a main multimedia content which we incorporated ambient music for the museum. The multimedia elements are synchronized with user interactions to enhance the visual experience and involve in the deeper engagement with the ancient heritage. Also included animated objects in the museum such as a globe which will rotate and other animated characters which roam around the museum.
- Include user interface elements or components such as play, quit, resume, pause buttons on the screen needs to be developed and implemented. So, that user can be able to interact with the buttons and also we used W,A,S,D and space to jump which comes under character movements.

- Also we have included multimedia room where it is a movie room. It is for educational purpose so only educational videos like archaeological videos or documentaries are to be played. Basically it is a projector which projects movie or desired video when the player enters the room.

### D. User Testing

- Just package the whole project and testing needs to be conducted to identify and bugs, issues with performances and concerns on usability. User feedback needs to be collected who ever used the application, analyse and refine the experience and improve user satisfaction.
- If integrating to into the virtual reality devices then make sure that testing needs to be performed across different devices to ensure a seamless experience for all users.

### E. Deployment and Promotion

- Once the virtual archaeological museum is completed then it is deployed and should be made accessible to the audience who are targeted.
- This application needs to be exported to apk file or any extension of our preferred output. But here we made it for the computer hardware in the project. Then publish the application in stores and websites or educational platforms. Need to promote the application and putting efforts to raise awareness of the culture and heritage.

## IV. FUNCTIONALITY

The functionality includes all the sections where they are needed to implement in the project. So, let's see the functionalities: (1) Vision: The vision the main element to make the project immersive and having better experience. Where the sculptures, paintings, fossils and artifacts and also including the environment are the models we collected from the marketplace of unreal and some of them are paid and few of them are free source. These are done to make the environment look good and enhance realism. The viewing part including textures and information is the vision. Have a look at "Fig. 16" to "Fig. 20" to get a better understanding about vision and its quality of objects and environment.



Fig. 16. Example of museum



Fig. 17. Example of character with environment behind him.

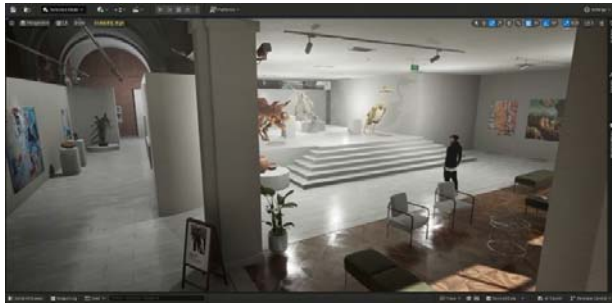


Fig. 18. Example of inside museum with rooms and lobby



Fig. 19. Example of paintings with furniture



Fig. 20. Example of character running in lobby with other artifacts

(2) Sound: Here we used ambient sound of museum where we collected the real-time sounds from the museum to make the experience better. As soon as player enters into the museum the music starts playing. (3) Animation: We have implemented three objects which are animated, one is golden globe which rotates and the remaining two are the animated persons. Where one sits in a chair by nodding his head, and other person dances by listening music. For referencing animated characters examples please refer to the “Fig. 21” to “Fig. 24”.



Fig. 21. Example of a character watching animated rotating globe.



Fig. 22. Example of a character wearing headset and dancing



Fig. 23. Example of a animated character

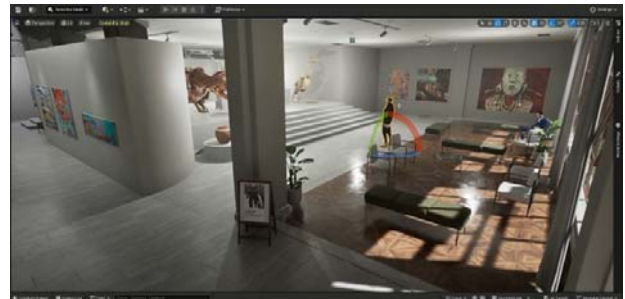


Fig. 24. Example of a character nodding his head by sitting in chair

(4) Interactivity: The user triggered events that are used in the project are (a) When the player goes near to the sculptures, paintings, fossils or artifacts then the information gets displayed regarding the object. Please refer to “Fig. 25”.



Fig. 25. Example of information displaying over the painting

(b) The ambient music will be played when player enters the museum, also triggered by user. (c) When the player enters

into the room where dinosaur fossil is displayed, initially it is a dark room and after entering the light turns on. Please refer to “Fig. 26”and “Fig. 27”.



Fig. 26. Example of a player entering into dark room



Fig. 27. Example of player entered into that dark room and it illuminates

(5) Characters: Again there are 2 characters as we discussed in animation they are our implementation. (6) Sensors: So as we discussed in the interactivity section for the user triggered events we used proximity sensor for displaying information and time sensor for glowing light in room up to when player stays in the room. There is interactivity buttons for the keyboard. Please refer to “Fig. 28”to “Fig. 30”.



Fig. 28. Example of proximity sensor



Fig. 29. Example of a time sensor



Fig. 30. Example of a light sensor

(7) Player: In this project we built it for windows screens so we added as a third person player controller. Please refer to “Fig. 31”.



Fig. 31. Example of character in third person view

(8) AI Implementation: This part is out of our knowledge and time and we also discussed what to implement. We wanted guide to speak to the player and answer some of the questions. Or there needs to be a game where questions are generated by ChatGPT and player needs to answer them. Due to time constraints and unreal performance and lack of rendering and development and device capability this is not yet done. (9) Interface Elements: In this project regarding the player we used W,A,S,D and space for movements and jumping. And we used play, quit and esc buttons for the game play. For reference purpose please refer to “Fig. 32”.



Fig. 32. Example of start screen with play and quit buttons.

(10) Custom Character: In this project we used Custom character which is downloaded from Mixamo. These are the implementations of functionalities that we used in the virtual archaeological museum. For reference purpose please refer “Fig. 33” to “Fig. 35”.



Fig. 33. Example of a custom character 1 from mixamo



Fig. 34. Example of a custom character 2 from mixamo



Fig. 35. Example of a custom character 3 from mixamo

## V. CONCLUSION

In conclusion, the implementation of virtual archaeological museum in unreal engine has resulted a immersive virtual reality experience that helps users to explore the heritage like artifacts, fossils, paintings, portraits, sculptures and etc in virtual environment. The reason to take up this project is to showcase the capability of virtual reality technology which helps in preservation of culture, heritage, and ancient civilization for future generations.

The implementations that we have implemented are vision for the textures and materials to look realistic to the user and coming to sound, we have implemented ambient sound to have a real-time sound experience while simulating the application. Also we have implemented the animated objects like rotating globe, 2 character animations which roam inside the museum, one character have headphones and dance and another character sits in the chair and nods his head. And for interactivity we used time and proximity sensors for text popup for artifact and time limit for displaying the information and this is implemented for the interactivity and added player as third person controller for controlling the player. Added interface elements like start, quit, resume, buttons for interaction purpose. And coming to AI implementation that is out of our mind and difficult to handle and there is no proper guidance to make it happen and implementing ai would be a tuff task and most of the time we took for collecting all the objects and arranging the environment for visual experience.

This VR application is very much useful because of the following reasons: (1) Students can gain most insights into history and archaeology through immersive experience of exploration and interactive learning experience. (2) Researchers can utilize the VR environment for detailed information, interpretation and documentations of archeologic data. (3) Helps in preserving the cultural heritage by creating archives that can be accessed by the future generations through virtual reality. (4) With the help of immersive experience the engagement and connection between heritage and ancient culture. (5) Main use of virtual reality for this application is that any person with disabilities or who can't visit the actual museum can watch and immerse through the virtual reality without going anywhere.

The main targeted audiences for this application specifically are educators, researchers, information seeking people, tourists and general audience.

Main of the benefits of this application are (1) without going in person we can have a experience of visiting museum, (2) gaining knowledge, (3) improve technological programs, (4) can be accessible to the future generations easily, (5) easy viewing of artifacts and other objects, (6) enhanced learning, (7) increases interest for every individual.

Main problems that we got encountered while developing this application are: (1) To collect high quality artifacts and objects to better experience and further includes performance issues, (2) problem in developing the AI implementation where most of the time has been killed in visual part for better experience and AI implementation is out of our mind to implement. (3) Feedback issues with user interface buttons for switching between scene, (4) Issues with text control and codes and other shortcomings like limited content coverage and technical constraints and there is need for further refinements in interactions.

For future work we would like to implement more artifacts, portraits and other fossils, improve performance, include AI Implementation, introduce multiplayer support, collaborating with archaeologists and institutions for better enhancements in accuracy, taking feedback from the users and making required improvements.

So, Finally this application can be a valuable resource for educational sector, exploring culturally and preserving our culture worldwide.

## ACKNOWLEDGMENT

For Having high quality models, assets, and environments, we acknowledge valuable resources provided by

- Unreal Engine Marketplace [11],
- TurboSquid [12] and
- sketchfab [13].

As these platforms helped me to find out the content that enhances the quality of development. Also we acknowledge that the process of making, developing, implementing the stuff for the project is from YouTube [14]-[17] channels and want to mention a few.

We would like to express our gratitude and appreciation to faculty advisor, Dr. Sharad Sharma, for his encouragement and feedback during the development of the project and his guidance in academics plays a crucial role for ensuring the

project to complete by fulfilling the educational goals. We would also extend gratitude to our teaching assistants, Rishitha Reddy. Pesaladinne, and Nanda Gowri. Ganta for their assistance in the project.

[11] <https://www.unrealengine.com/marketplace/en-US/free?count=20&sortBy=effectiveDate&sortDir=DESC&start=0>

[12] <https://www.turbosquid.com/Search/3D-Models/free/unreal>

[13] <https://sketchfab.com/tags/unrealengine>

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[17] [https://www.youtube.com/channel/UCGxt9c\\_CREmnquHjPEknHYw](https://www.youtube.com/channel/UCGxt9c_CREmnquHjPEknHYw)

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