

Virtual Car Showroom

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Abstract— A virtual showroom is a digital representation of a physical showroom or store, where customers can browse and interact with products in a virtual environment. This can include features such as product information, 360-degree views, and the ability to zoom in on products for closer inspection. The showroom will allow users to explore and interact with different car models in a 3D environment, providing a realistic and immersive experience. Some examples of companies that use virtual showrooms include BMW and Ralph. The comfort of real-world experience at their fingertips without the need of travel. The virtual showroom will include interactive features that allow users to interact with the car models. This will require programming using C# scripting in Unity, including animations, physics simulations, and user input handling. The car models will also be programmed with interactive features, such as opening doors, adjusting seats, and turning on headlights.

Index Terms— Head Mounted Display, Oculus Device, Ralph, Sensor, Unity Engine, Virtual Reality, Virtual World.

I. INTRODUCTION

A digital setting called a virtual car showroom enables users to explore and engage with various auto models in a lifelike and immersive manner on a digitally platform that uses Unity and C# .NET to create a virtual car showroom. This platform combines the strength of the C# .NET foundation and the Unity 3D game engine to provide users a highly immersive and engaging experience. It is usually less expensive to set up and operate a virtual car dealership than a physical one. This is true because a virtual showroom has no related leasing fees, employee costs, or maintenance costs. Customers may quickly and easily compare several automobile models and features online without having to travel to various dealerships. This saves time and makes the automobile purchase process more efficient. It may assist car dealers in projecting a more contemporary and technologically savvy image, which can improve the perception of their brand and reputation. Long-term, this can support attracting more consumers and boosting revenue. Customers and car businesses may both profit greatly from virtual car showrooms. Without having to physically visit a dealership, customers may research numerous automobile models and features at their own leisure and from any place. By providing a highly interesting and dynamic car-buying experience, auto dealerships can increase their sales and reach a larger audience.

II. LITERATURE SURVEY

The authors in [1] presents virtual car showroom can be helpful for both car producers and users. On the one hand, it allows producers to present user's different cars, which may be inaccessible in the real showroom at the moment. On the other hand, it enables users to configure their cars in a way that may be impossible in the real showroom,

for e.g., customization and colors changing only. They also discuss the challenges and limitations of virtual reality technology and suggest future research directions in the field. The authors in [2] proposed metaverse-powered online distance education, can emerge to allow rich, hybrid formal and informal learning experiences in online 3D virtual campuses. This project is created during the pandemic situation. So, the students can able to feel like the real world and it also feels like they are physically presented in classroom. The paper provides a comprehensive survey of virtual reality technology in the metaverse. The authors highlight the importance of virtual reality technology in enhancing the user experience in the metaverse and its potential to revolutionize various industries. They also discuss the challenges and limitations of virtual reality technology and suggest future research directions in the field.

The authors in [3] presented a framework for creating VR escape rooms that can be used to enhance learning experiences in education, particularly in the areas of engineering, computer science, and mathematics. The authors argue that VR escape rooms can provide an immersive and engaging learning environment that encourages students to actively participate in the learning process. The paper also provides a case study of a VR escape room designed to teach fundamental concepts in computer science and programming. The authors evaluated the effectiveness of the VR escape room in terms of students' engagement, motivation, and learning outcomes, and the results showed that the VR escape room was effective in enhancing students' learning experiences. The authors in [4] discussed the challenges faced by traditional e-commerce platforms during the pandemic, such as the inability to provide a real-world shopping experience to customers. The authors argue that VR and AR technologies have the potential to overcome these challenges by providing a more immersive and interactive shopping experience. The paper presents various case studies and examples of companies that have successfully implemented VR and AR technologies in their e-commerce platforms. The authors also discuss the potential benefits of VR and AR in e-commerce, such as increased customer engagement, improved product visualization, and reduced returns and refunds.

The authors in [5] described the development of a mobile application that allows users to virtually explore and interact with car models in a showroom setting using AR technology. They discuss the design considerations and challenges involved in developing such an application, including the need to optimize the application for mobile devices and to provide a seamless and intuitive user experience. The paper presents the results of a user study conducted to evaluate the effectiveness and usability of the virtual showroom application. The study found that the application was generally well-received by users and provided a realistic and engaging experience. The authors in [6] described the development of a VR-based home design system that allows users to create and interact with virtual models of home designs in real-time. They discuss the design and implementation of the system, including the use of 3D modeling and rendering techniques, user interface design, and hardware requirements. The paper presents the results of a user study conducted to evaluate the effectiveness and usability of the VR-based home design system. The study found that the system was generally well-received by users and provided a realistic and immersive experience.

This Unity [7] tutorial on developing virtual reality applications brings together industry experts and academics to introduce Unity and its VR components. The tutorial aims to teach participants how to use Unity to create fully immersive VR experiences. Unity is a versatile game engine known for its user-friendly interface, low-level developer access, and the ability to reuse assets, which results in faster development when compared to traditional methods. The widespread use of Unity and its compatibility with consumer-level VR hardware has given creators in a variety of fields newfound freedom. The tutorial covers various VR components and gives you hands-on experience building VR applications with Unity. Attendees are encouraged to bring their own laptops with Unity installed, as well as their own VR peripherals if they have them.

The study [8] investigates the prominent privacy risk of smartphone shoulder surfing, particularly during daily commutes in public transport. According to survey, shoulder surfing incidents occur in a variety of situations and contexts, with factors such as spatial relationship influencing their success. When they were observed, participants expressed feelings of violation, harassment, vulnerability, and discomfort. Previous research concentrated on shoulder surfing during authentication events, but it is now recognized that other smartphone content is also vulnerable. Due to privacy and ethical concerns, conducting comprehensive studies on shoulder surfing is difficult. The use of omnidirectional or 360° videos in Virtual Reality, on the other hand, shows promise in researching immersive experiences, user interfaces, and shoulder surfing incidents. This method allows for controlled examinations of content, spatial relationships, and observer behavior, among other things.

The authors in [9] introduces the concept of virtual field studies in public display research as an alternative to traditional field studies. While field studies are expensive and time-consuming, virtual field studies provide infinite control over setting and display configurations, allowing for rapid testing of various scenarios. Two user studies were conducted to assess the feasibility of virtual field studies. The findings showed that phenomena such as the

honeypot effect could occur in virtual reality (VR), and that user behavior in VR resembled real-world behavior. However, VR users demonstrated a greater desire to explore and interact with public displays. This study highlights the potential of virtual reality as a tool for conducting field studies, but certain issues must be addressed. The study [10] focuses on the difficulties encountered in video game development, specifically the prevalence of "crunch time" periods and the scarcity of research on the effects of time pressure. A survey was conducted among Global Game Jam participants, revealing key findings. Ad hoc development approaches and face-to-face communication are common during crunch time, according to the findings, with iterative brainstorming being the most popular method for initial requirements. Continuous integration, scope management, and version control are common development practices, and regular communication and quality assurance activities are prioritized. Agile development experience had a weak correlation with perceived success.

III. PROPOSED SYSTEM

VR vehicle showrooms have substantially improved as a result of developments in technology and software. Old and contemporary VR automobile dealerships include a number of significant changes, Realistic visuals that mimic the appearance and feel of an actual automobile dealership may be seen in new VR car showrooms. Users may enjoy a more immersive environment and view the automobiles in amazing detail as a result. Modern VR vehicle dealerships have significantly greater interaction than those of the past. Users frequently have the ability to unlock doors, change settings, and even mimic driving an automobile. They are able to comprehend the characteristics and capabilities of the automobile considerably better as a result. Compared to earlier VR vehicle dealerships, the new ones are substantially more accessible. More individuals now have access to the technology required to visit a VR auto dealership thanks to the emergence of inexpensive VR headsets and smartphones that can be used with VR apps. The most recent developments in Unity-based VR auto dealership technology provide a number of additional features and enhancements. These developments consist of Realistic physics and interactions by utilizing the physics engine in Unity, programmers may build realistic interactions between the environment and the vehicle, such as opening doors, changing seats, or twisting the steering wheel, customers will have a more interesting and realistic experience as a result.

The block diagram of the proposed system is given in Figure 1 in which we used Unity, c#, Oculus VR, where Unity's sophisticated lighting and shading tools can provide realistic and dynamic lighting situations, support for many platforms by Unity's support for numerous platforms enables the deployment of VR auto showrooms on a variety of devices, including computers, mobile devices, and VR headsets, increasing the experience's accessibility to a larger spectrum of clients. Whereas C# scripting was used for back-end work like car rotation, test driving, color changing etc,

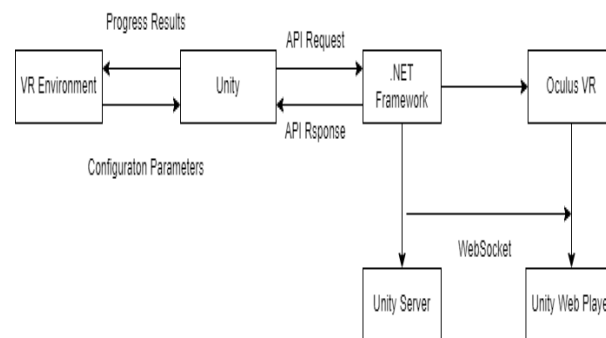


Figure 1. Block diagram of the proposed system

The proposed system is divided into several modules and each of the module is explained as below:

A. Unity Engine

The virtual setting and models in the virtual auto dealership were made using the cross-platform Unity game engine. It offers all the resources required to produce 3D models, animations, and physics simulations.

B. Unity Web Player

3D virtual auto showroom apps could be published and operated in web browsers using Unity Web Player. Customers could access immersive and engaging virtual vehicle dealerships with just a web browser, without having to download or set up any additional software, thanks to this technology.

C. Unity Server

It is a good idea to use a Unity server to build a virtual car showroom, especially if you want to keep everything in the Unity environment. Build a Unity project and add the required materials, textures, and assets, such as automobile models. The required information, including the names, models, and descriptions of the cars, should be generated by a script and saved in a database or file. A request for the data is sent when a client-side Unity programme connects to the server. The clientside application receives the data that the server has retrieved from the database or file. The virtual vehicle showroom is then shown by the client-side application using the data.

D. .NET Framework

The client-side Unity application receives the essential information from the C# .NET server, including automobile models, descriptions, and specs. The server offers a web socket for real-time communication and a web API for the Unity application to request the data.

E. Web Socket

The web socket gives the client-side Unity programmed and the C# .NET server a real-time, two-way communication channel. The web socket can be used to handle real-time events, such as user interactions, or to broadcast changes to several clients, such when a new automobile is introduced to the showroom.

IV. RESULTS AND DISCUSSIONS

Automakers, dealerships, and customers may all profit from VR auto showrooms in a variety of ways. The testing of VR showroom is shown in Figure 2. VR showrooms may boost interest and engagement among customers by giving them an immersive and interactive experience of the automobile models, which in turn boosts sales. By eliminating the requirement for physical showrooms, VR showrooms can save down on the expense of rent, utilities, and maintenance. VR showrooms give customers the chance to personalize and visualize their preferred cars in a more convenient and enjoyable way, which improves the overall purchasing experience. VR showrooms may provide clients access to more thorough information about the characteristics and capabilities of the automobile, resulting in better-informed purchase choices. The outside and inside view of virtual showroom is depicted in Figure 3 and Figure 4 respectively.

Virtual showrooms can result in better levels of customer happiness and loyalty by offering an innovative and interesting method to view automotive models. Virtual showrooms can help automakers and dealerships connect with a larger audience, including people who live far away from a real showroom. VR showrooms can be a safer alternative to conventional showrooms, particularly when social separation is necessary if the buyer feels uncomfortable going to a real showroom. The interior of a car is virtualized in Figure 5.

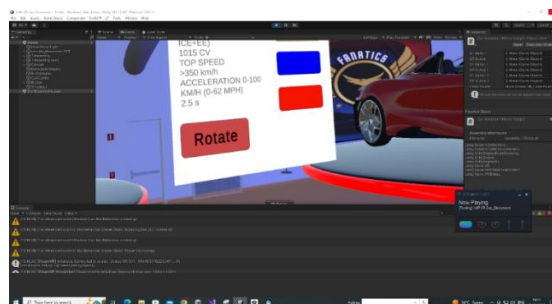


Figure 2. Testing

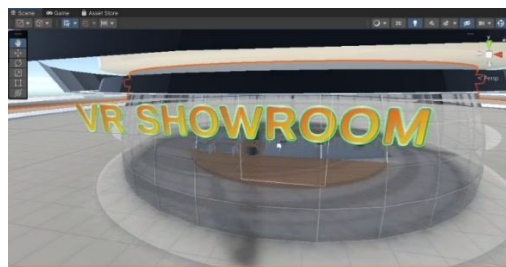


Figure 3. Output of VR Showroom



Figure 4. Inside of VR Showroom



Figure 5. Car's Interior

V. CONCLUSION

This proposed work will result in a virtual car showroom that provides users with a realistic and immersive experience, enabling them to explore and interact with different car models. This can be used by car manufacturers, dealerships, or car enthusiasts to showcase their products or to create engaging content for their audience. A game changer for the auto sector, the use of the Unity engine for building virtual automobile showrooms gives car shops a strong tool to present their inventory and provide clients with a memorable and customized experience.

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