

Virtual Reality in Interior Designing

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Abstract

There is great potential for ICT in the area of interior design, as seen by the growth of virtual reality software and technology. The use of ICT technologies provides a more accurate picture of the proposal's original concept (the research). With the use of hardware tools like the Oculus Rift and the HTC Vive, a team of real-time visualizers has made it possible to freely move about within a virtual room and even build it. The state of the art in information and communication technology (ICT) software tools for creating in virtual reality allows for an ever more lifelike simulation. The article proposed a fresh method of virtual reality interior design by leveraging state-of-the-art computer-simulated-reality (CVR) technology and software.

Keywords: virtual reality, real-time visualizations, dynamic visualizations

Introduction

Avoiding costly construction delays and design miscommunication requires meticulous digital planning of a structure from the ground up. Modern information and communication technology (ICT) tools, such as virtual reality (VR), disrupt static design environments by enabling interactive picture production. As a kind of virtual reality technology, dynamic real-time visualisation (DRTV) offers a fresh perspective on conventional interior planning methods. These findings provide light on novel ways to put virtual reality technology to use in the field of interior decoration. The total time spent on the virtual building process is reduced by using gaming engine technology in 3D design. The capacity to create an interactive virtual world is what separates standard 3D design software from a gaming programme that may be used as a 3D design software. Using a 3D game engine as the backbone of DRTV's development allows for the creation of a highly engaging and responsive virtual interior for the user to explore. Then, the user is free to roam the space and get a feel for the decor. Because of the flexibility and plethora of possibilities it provides, game development software may be used as a dynamic design process and solution in the realm of interior design. In addition, it opens up fresh possibilities for contrasting it with other approaches to design.

When presenting the 3D home models in an animated fashion, one might utilise one of three animation representation strategies. One of them is the more traditional kind of animation in which viewers only observe the action. There is absolutely no way for consumers to engage with the virtual environment. The second kind is known as "interactive visualisation." Usi is still static, however technologies like the point technique allow for interactivity even with 2D animation. The

third approach is an interactive visualisation that makes use of a gaming engine as its development software. The 3D designs used in navigation may become interactive, allowing users to interact with and contribute to the 3D environment. It may be challenging for interior designers to convey their vision while using CAD software, which allows them to produce 3D visualisations. The user is immersed in the virtual world and free to roam its rooms thanks to the interactive virtual tour. In addition, when the interior designer enters the space in question, he or she will be able to better understand the user's viewpoint.

Virtual Reality : Growing Real Time Need

Information in the domains of architecture, science, engineering, medical, commerce, entertainment, education, and training have all benefited from the use of interactive computer graphics [9]. This method may be used to both 2D and 3D displays, allowing for the manipulation of pictures and drawings in both mediums. Thus, virtual reality (VR) technology is a subfield of computer graphics used to create lifelike simulations of 3D environments by combining display technology with other computing methods like human-computer interaction (HCI), sensory technology, artificial intelligence (AI), and robotics. Virtual reality (VR) provides users with a simulation of the physical environment. Virtual reality, on the other hand, is an invention that has been widely used for educational reasons since it allows users to create settings in which they may communicate with any item in real time. Virtual reality (VR) technology is growing in popularity because of the various ways in which it may be useful. Virtual reality (VR) technology that incorporates with cutting-edge interactive devices like face and gesture recognition gadgets, haptic sensors, and tracking gadgets might give rise to HCI concepts, as was previously said. Interactivity, a virtual environment, immersion, and sensory input are the four pillars of virtual reality (VR), according to Sherman and Craig. To begin, what makes an experience interactive is when the user's actions have an effect in the virtual environment. A user may explore a 3D world and interact with its inhabitants, scenery, and other features thanks to an interactive environment. Second, the component of the virtual world that may be defined as a place populated by things and governed by physical laws. An alternative definition of a virtual world is an environment that only exists in the imagination of its creator and is only made visible to others via the medium of broadcast. Take the virtual and cinematic worlds as examples. Third, if you're engrossed in a virtual world, you'll feel as if you're really there. Environment sensing enables users to inhabit their environments and pick up on physical cues, much as they would in the real world. Sensory feedback, the last component, may be thought of as feedback created in response to human input. Users are able to alter their perspective and body orientation inside the virtual environment.

Interior design Feeling or Precepts of Aesthetics

Interior design, a subfield of architecture, involves the creation of habitable interior environments and furniture. Meanwhile, Wikipedia defines interior design as "an art and science to enhance the interior component of a building to create a healthier, more pleasant, and higher quality of life for the people utilising the area." The purpose of interior design is to create an area for living, working, or visiting that is both aesthetically pleasing and functional. Protecting users or consumers from harm caused by things like weather is another priority. From a different angle, satisfying client requirements is key to each successful interior design job. As a result, an interior designer is often in charge of coming up with project ideas, blueprints, doing necessary research, and overseeing the

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whole project. Interior designers often communicate their creative concepts and ideas to clients in the form of hand-drawn sketches of proposed projects.

It's no secret that in today's "Digital Age," digital tools like computers are ubiquitous. The widespread use of digital technologies has emerged as a cultural force. In tandem with these changes, the field of architecture, particularly in the realm of interior design, has come to regard digital technology as current techniques for designing constructions on the inside or the outside. Due to changes in client specifications, it is necessary to redraft these models and drawings. In addition, customers are often only given a small portion of the design's perspective due to the limitations of hand-drawn elements.

Virtual reality (VR) technology, a subset of computer graphics methods, was developed in a number of fields, including architecture and interior design, to help alleviate the aforementioned issues. Virtual reality was the method of choice for this kind of presentation. The virtual reality programme offers a 3D user interface and promotes user-computer interaction. Input devices like keyboards and mice were often employed for the interactive elements of a virtual reality scenario. Gesture recognition, though, may make these interactions more effective. Using this method, designers may create and decorate virtual rooms and locations according to their ideas and the specifications of their clients, who can then provide feedback to help the designer perfect the project. In addition, buyers may pick a design that best meets their requirements after seeing it in a virtual space. The designers are cognizant of the potential of virtual reality (VR) technology, and have embraced it as a tool for their project.

Application of VR & interiors Design and Architecture

The views and framework of an application are its architecture. In addition, it may be built from smaller subsystems that interact with one another to form the whole. Users (both designers and customers), input devices, virtual reality user interfaces, a computer, and a database are all integral parts of this framework. User A, typically the designer, or User B, the consumer, will start the process by inputting data through keyboard, mouse, or hand gesture recognition devices. Virtual reality (VR) interfaces shown on a computer will be used to transmit data requests from users' various devices. The information will be generated using virtual reality computer interfaces. The field of computer science known as "computer graphics" deals with the manipulation of graphical data. Data from VR application interfaces will be altered using computer graphics methods, one of which is virtual reality.

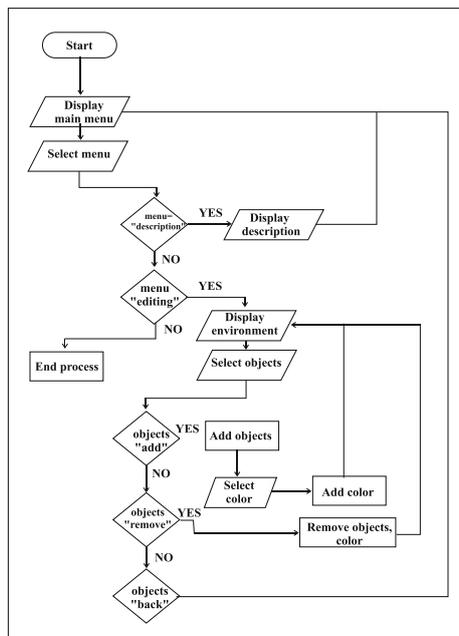
Both User A and User B have experienced comparable scenarios inside the software. Designing a space that can accommodate more than one person at a time is essential for facilitating efficient collaboration between the designer and the client. One of the users must act as a server, and everyone else must have access to the internet. When the server is ready, additional users may join the newly established room. Using their local IP addresses, clients may connect to the server through the host server thanks to the application's implementation of Unity Networking HLAPI features. Once the client is connected, the programme will provide the client and designer with a shared, synchronised workspace in which they may collaborate and create. Users on both the server and client sides may communicate to alter the location of 3D objects in the world. That is, the server will build a shared scene and both user A and user B will have access to it.

Application of Interior design Traditionally Vs VR generated

A flowchart is a diagram depicting the operations of a system. A flowchart may be used to analyse, create, and document even the most elementary of computer programmes. The figure below is a straightforward flowchart describing the workflow of a collaborative VR application. The programme will initially show 2D visuals for the user interfaces. The primary menu, which comprises of buttons and text, is shown in 2D. To enhance the overall appeal of the app, music will play in the background. The user may either start editing, see the descriptions, or exit the system. To begin, the programme will only provide textual descriptions if the users actively request them. That users may easily find and read all mandatory system documentation.

Users may begin the editing process by clicking the "Edit" or "Design" button. There are five options available to you here: the items to input, the colours to enter, the removal method, the display design, and the final outcome. The options are up to the user. When users input objects, the Unity items given will be placed in the 3D scenes. Everything, including dimensional items like models, textures, and landscapes. You may get all the assets you need for interior design from the Unity Asset Store or any other website that offers 3D models for download. Users may modify the texture of 3D objects and environments based on colour inputs.

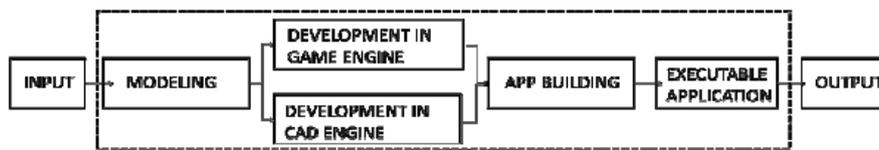
If a user does not want to make a mistake, such putting the incorrect item in the wrong spot, they may simply delete the object or change the colour of the object. The final design may then be shown for the user to consider. If a user does not choose to proceed, they may simply cancel the operation and leave the programme. Finally, consumers may cancel the procedure at any time if they change their minds. The flowchart outlines each crucial procedure used by this programme. Customers and designers, as users, may carry out the procedure. Because it is a collaborative application, their work may be synced in real-time, allowing them to do the same tasks simultaneously.



Source: on reference

Dynamic real time visualizations of interiors based on game engine

Computer games for gaming consoles (PC, Xbox, etc.) are what placed the game engine technology on the map. This technology's ability to create a realistic engaging environment of interiors—one in which an observer can freely move around and layout interactively in a virtual setting (move furniture as well as furnishings, edit the material and colour solutions of interior surfaces)—has led to its widespread adoption in the design and architecture industry. The steps involved in creating a DRTV model for use in the construction of interior spaces.



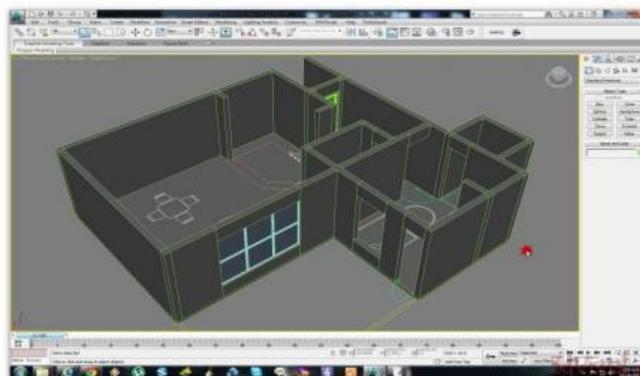
Source : In reference

Information output needs are first translated into input forms. These specifications are communicated to the Procedure through DRTV control devices that also serve as input. The term "process" refers to the full procedure of creating a DRTV application. Initially, 3D objects and environments are modelled. The next steps in the development engine are the application development procedures. There are two main development engines in use. The application is constructed in two different engines—the first being a gaming engine and the second being a CAD engine. Data is sent from the user to the output device (Oculus Rift, HTC Vive, etc.).

The processing of DRTV and virtual interior design both need the creation of 3D models (modelling). It may be broken down into two categories:

A 3D interior environment is a model of an inside area that was created using either a 2D or 3D blueprint of the structure.

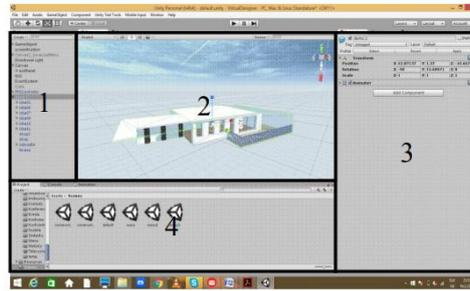
Furniture and other home decor items rendered in three dimensions Typical 3D CAAD programmes for working with 3D models (Figs. 2, 3) include 3D Studio Max, Sketchup, etc.



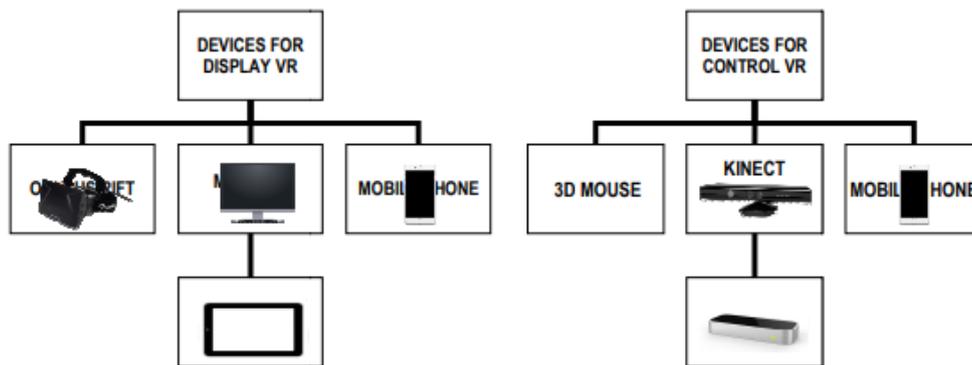
Source : In reference

After that, the models are brought into the game engine environment for development (CryEngine, Unity 3D), where the surface characteristics of objects, lighting conditions (interior and outdoor), and interactions are all set. The next stage is scripting the actions and reactions of users, virtual

environment, and objects in response to keystrokes, clicks, and swipes (or other input methods) through a keyboard, mouse, or sensor device (such as a Leap Motion, which recognises hand and finger gestures as instructions).



When the app development process is complete in the game engine, the resulting application may be used with the help of the connected output devices. Most DRTVs are built on a game engine environment, which limits the user to the design (Fig.1 - phase Run & walkthrough) but is frequently utilised in practise. Interior designers need more options for fine-tuning their work in a DRTV setting so they can make adjustments in real time. There are two basic categories of VR hardware required to achieve this effect.



Investors consider expenses as part of the design process for interior spaces. A connection to financial planning should be included into professional design software environments. DRTV permits interior solution upgrading prices throughout the whole design process. The expenditures associated with the chosen machinery and the interior fittings may be detailed. Within the framework of the project's inception (vizualizacky.sk), the Civil Engineering Department at the Technical University of Košice has been working on generating DRTV of construction projects. A case study is presented that shows how virtual reality might be used in DRTV for the design of interiors.

Case study of interior designing in VR

The focus of this research was on the interior design of a four-room flat in the proposed Saffron garden residential complex in the heart of Kosice (Fig. 6). The software 3D Studio Max is used to design the inside 3D environment and the 3D indoor items. In order to customise their visual appearance and interact with one another, these models were loaded into Unity 3D.

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Equipment for controlling and displaying interactions in the case study included the Oculus Rift VR Technology and other virtual reality devices such as keyboards, mice, Kinect, Leap Motion, tablets, and smartphones.

DRTV uses two main groups of commands:

- ✓ Object-related operations (such deleting, importing, rotating, and positioning),
- ✓ Instructions for modifying the surface's appearance (texture, reflection, gloss, etc.)

The design process starts with adding furniture and other fixtures to the virtual room. Furniture, electronics, and decorative pieces are the three main categories of interior design products in 3D. The ability to examine the visual results of our manipulations in real time from a first-person-shooter (FPS) perspective opens up new possibilities for interior design (Fig. 8). Surface-character-changing instructions allow us to alter the hues and textures of furniture, walls, and ceilings in a 3D interior space.



Figure 8: Selection of 3D interior objects from database and manipulating with it

In Fig. 9, we see one possible use for the DRTV tool: drawing out a comprehensive plan for an interior design project's financial outlay. There are two primary sections to the budget. All imported furniture and decorations are priced in the first section. Prices from various vendors are included as a source of information. Floors, walls, and ceilings are covered in the second section of the budget. The budget for this section is based on building price lists. However, a cost-free surface finish budget might be used in place of a price quote. The whole cost of buying an apartment and furnishing it is more easily understood when presented to the consumer in the context of a fully furnished unit in a residential complex. If the client does not have enough money to equip the flat immediately after buying it, the distribution of costs might be planned over a longer period of time. Therefore, he may prioritise certain pieces of furniture or adjust the level of technology to fit his budget. The developer has listed the price of the flat as 315 000 EUR (all numbers in EUR). DRTV estimates that the cost of furniture and fittings is 30 740 EUR (with VAT included), or 9.76% of the total price.

Conclusion

The case study highlighted a particular virtual reality use for home decor. Modern techniques for displaying and controlling VR make DRTV possible in the interior design industry. Intuitive DRTV design process, real-time design visualisation without the need for re-rendering, customizable furniture sizing based on space measurements, and real-time cost management.

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