Architecture and Virtual Reality

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Abstract: Architecture and Interior Design Industry is known for constant change and innovation. This paper talks about considering Virtual Reality as Presentation and Design Tool in real-world scale (1:1), how virtual reality responds to the requirements of Architectural presentations and deciding factors to adopt the technology, Technological Requirements, currently available solutions.

Keywords : **Virtual Reality, Mixed Reality, Augmented Reality, True Scale, Cardboard, Daydream, VR Player.**

I. Introduction

Sitting in Architects Workplace, you can discover buildings around the world including ones that don't yet exist. You can walk along the boundaries of an under-construction structure in Delhi, then toggle over to the Site of Chatrapati Shivaji Maharaj Memorial sited in the Arabian sea near Mumbai. But be alert, when you reach out to touch a Cannon you might just poke an architect, standing just beyond you and your VR goggles.

This situation of being transported to another environment without leaving your current location is becoming increasingly common since almost all top architects are using virtual reality (VR) into their practices. In addition to that augmented reality (AR) and mixed reality (MR), virtual reality lets designers cross the limitations of visualization, giving associates and clients new and exciting ways to experience and understand a building or space long before commencing the construction.

Figure 1 Excitement of VR users with Very Basic VR Device Google Cardboard (Image Courtesy: mbryonic.com)

With VR, architects can express not only what a building will look like, but also what it will feel like.
Traditionally we have blueprints, 2D drawings, Physical Scaled down 3D models, Computerised 3D views and 3D walkthroughs for the last 20 years. Visualizing a future building has always been a challenge to the client, especially if it's not their area of expertise. It is always hard to fully grasp the real dimensions of design for a person outside the design industry.

To give the experience of 1:1 scale models, builders adopted a way to build sample flats or buildings. But it has many limitations. And to fulfil the basic requirement of experiencing a space in 1:1 scale before execution, VR enters into the setup.
Going beyond the two-dimensional canvas, with a VR headset, user steps inside a model of a building and view it in 1:1 scale, like s/he, was really there.
Virtual reality has been around in some form for decades. The View-Master system was introduced in 1939, four years after the advent of Kodachrome colour film made the use of small high-quality photographic colour images practical. The tourist attraction and travel views predominated in View-Master's early lists of available reels, most of which were meant to be interesting to users of all ages but the technology has not been flexible or advanced enough to have a widespread application until now. With advances in mobile technology, which placed high-resolution imagery into everyone's hands, VR has experienced an explosion in the past two years.

II. Material and Methodology

VR/MR/AR are the concepts which help us to actually stand in a proposed space, walk around, pick up objects and move them. It's hard for someone to understand the space with defining dimensions. VR takes the person into the space to feel and understand the dimensions of reality.
In Architecture and Interior Design, some decisions can really be taken quickly just by looking at the objects or elements. E.g. Does a column block your line of sight? Is that ceiling too low? Is it really worth the cost to add 1,000 square feet to your lobby? We don't need to work on drawings and models, VR answers these questions in minutes without having to decipher plans and models.
There are different ways and workflows of using VR in Architectural Practice. We can use this technology since the beginning of the design until we finish the construction.To get into the VR one need both a Hardware and a Software. The hardware we need is a VR Device.

Figure 2 VR Device Mounted on Head
It is simply a goggle with 2 Magnifying lenses creating a darkroom to focus on the screen just 30mm away from user's

eyes. The simplest and basic device needs A mobile device to act a screen. There is a large number of the spectrum of very good quality VR devices. To name a few there are Google Day Dream, Google Card Board, Mi VR Play2, Samsung Gear and in High-End Devices, there are few developed by companies like Oculus, Sony, HTC and Microsoft. Another tool we need to have on Basic Devices is a mobile application to display the Views and walkthroughs specially made for VR Experience.

Building models created in BIM or any other modelling software like Trimble Sketchup Make need to be rendered for VR experiences using special software like Yulio or Iris-VR. Final rendered images are transferred to the mobile device which has a VR viewer application installed and that's it. Mounting a VR Device on user's head takes the user in Virtual Reality.

Human Eyes and Nervous System in collaboration with Human Brain play very important role in experiencing VR. The efferent nerve fibre finds the orientation of the human head, similarly, gyroscope sensors in the mobile device fixed in the VR device find the orientation of the mobile screen. This bridge the gap between human and technology and the user can experience full 360-degree spherical VR. Indeed, even at the Concept stage, VR can be a successful method for investigating the connections between spaces – the effect of light on a room at different timings of the day or year, or perspectives from mezzanine floors. With a physical scale model or BIM demonstrate on screen or paper, regardless you need to envision what it resembles to exist inside the space. With VR, you really encounter the extent and scale. With VR, Architect and Client both can fully interact with the proposed building model or space. Using cloud computing technology this can be done over a distance. Being at a distance of many kilometres, Architect can see what client is looking at and talk about. Sitting at a desk in the office, Architect can change anything in the model and user can experience that change real time, and that too at 1:1 scale, which is otherwise not possible in any kind of presentation techniques till a date.

With another type of hardware sensors, holding in the hand, client or architect can lift or shift any object, point at anything to get the attention of the each other physically being at a distance of many kilometres.

Figure 3 Image courtesy Freedom Architects Design – Handheld Devices for VR/AR/MR

In VR we can experience all dimensions at true scale. Practically being at a particular location we can virtually walk in the space, look at the objects, change the parameters of almost everything, saving the changes in different versions on the computer or the mobile device which later can be used for revisions in the drawing.

While showing the changes required or while approving and finalising the design, Architect and client can communicate with each other real-time using built-in microphone system of the VR device or Mobile Handset fitted into the VR.

The virtual tour is another dimension of VR. Traditional Walkthroughs are like cinema. The user sees what a filmmaker wants to show. But in VR Tours, Client can select the area he wants to visit and move or jump from one place to another looking around in 360 degrees, again sitting at the desk without physically leaving the location.

Augmented Reality (AR) is an advancement in VR where Hardware is slightly different, the glasses are see-through and you can still see the world around you, but an image is displayed in front of your eyes. and more advanced with Duel Cameras mounted or incorporated outside the device. Those cameras capture the real environment in front of the user and superimpose the models created by Architects wisely. This gives the user an experience of looking the real objects with new materials and textures. The user can also experience the virtual objects placed in empty real space helps the user to decide the orientation of the objects, actual lighting inside the space, the convenience of the circulation space when objects are placed in that particular are and much more. Listing the Benefits of AR in Architecture and Interior Design is really unending. Special goggles help the user to be in the real world simultaneously being in the Virtual World. We can physically walk into the raw space but eyes and brain are fooled using Virtual Reality give the user a feel of a walking into the furnished space.

Mixed Reality (MR) is almost same as AR but differences are recognisable. This technology is developed by Microsoft and the software to use this technology is silently pushed to every windows laptop with the latest Creators Update of windows Ten in the year 2017.

Figure 4 AECOM A design team at AECOM, wearing Microsoft HoloLens viewers, observes a project in MR

HoloLens Goggles takes 3D modelling applications on windows laptops to the Augmented Reality to design objects with multiuser experience, creating a 360-degree immersive environment. Microsoft calls this a Mixed Reality.

III. Results and Tables

Creating the most realistic and interactive VR experiences is a skilled process, so firms typically outsource or employ specialists. Looking at the potential future of Computing in Virtual Reality, Large tech companies such as Facebook, Google, and Microsoft have already started investing in VR technology. In the past two years, the number of augmented and virtual reality jobs posted on LinkedIn has tripled.

Giant in Computation, Apple is now presenting VR support on their websites. Apple has made a number of relatively high-profile hires for its virtual reality project, also have bought a number of VR Related Companies. When Giants are working so hard on particular technology, we can trust and expect a blast and boom in nearest future.

IV. Conclusion

Experience of a Strong sense of presence somewhere else can only be given by Virtual Reality. Multiple viewers at different locations can experience the same design in real time. Architect Sees what client is seeing and helps them see what architect wants to share in real time. The Simple and the most effective way to communicate a design to the client goes though VR Goggles. VR helps Design and Construction industry make decisions faster and save time throughout the design and construction process and ultimately saving the cost of the project.

V. Acknowledgement

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