

Virtual Reality for Real Estate

its evolution in Bluemind Software

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Abstract — this paper presents the results of the VR4RE (Virtual Reality for Real Estate) project, which aims at saving time and money for both real estate sellers and buyers by employing modern technologies. VR4RE is one of the innovative projects developed by Bluemind Software and it is in an advanced state. This paper also illustrates the history of in-house technological attempts at creating appropriate presentation tools for real estate properties with 3D and VR (Virtual Reality).

Keywords—*virtual reality; 3D modelling; real estate;*

I. INTRODUCTION

The origins of VR can be traced back to “The Ultimate Display” [1], a paper by Sutherland which presented the key concepts of immersion in a virtual world and which also introduced the challenge to make that world look real, act real, sound real, feel real.

Brooks defines a virtual reality experience as any in which the user is effectively immersed in a responsive virtual world. This implies user dynamic control of viewpoint.[2]

Immersive virtual reality is defined by Andries van Dam et al. as technology that gives the user the psychophysical experience of being surrounded by a virtual, that is, computer-generated, environment. This experience is elicited with a combination of hardware, software, and interaction devices to create a human centric rather than a computer-determined point of view.[3]

Haptics (the interaction) are an important part of this experience and the authors benefit of existing research done our university [4].

VR4RE (Virtual Reality for Real Estate) is one of the innovative ideas developed at Bluemind Software and it is in an advanced development stage.

From the other innovative projects of Bluemind Software we mention 3DCar (the first interactive 3D car configurator), ASIC Client (the first Android client application to access MIT's iLabs Remote Laboratory Management System) and Lab Configurator (a simple and secure method to use mobile

devices to configure embedded devices which run online laboratories).

VR4RE helps real-estate owners by teleporting visitors from anywhere (in VR) directly to the property that is for sale or rent and helps visitors save time and money by visiting a broad range of properties from afar and only the most compelling ones in person.

VR technology is currently entering the Real Estate market (it is one of the many application areas) worldwide through various companies. As [5] concluded, with the continuous reduction of costs it does gain a bigger and bigger role to play in the real estate market.

This paper presents the evolution and results of the VR4RE project and serves as a progress report.

II. THE FIRST PROTOTYPE

The starting idea for VR4RE came during discussions with a real estate developer in 2008. After having seen 3DCar, the real estate developer asked if the same technology could be used to present real estate. The next real estate crisis, along with earlier and more expensive means of production, interfered with making that idea real at that time.

The first good looking prototype came out after a Startup Weekend in Brasov, Romania, in 2013.

It was an apartment visualization application and made use of real time 3D model rendering for PC. The application included interactive doors. It must be noted that the application was developed to run in a web-page (directly in Chrome and with the help of add-ons in other browsers).

This prototype showed us the usefulness of the Unity 3D development environment (and that of its Asset Store) to develop well-looking 3D applications fast. This greatly influenced the development environment choice for future 3D projects, such as TimeWalk, towards Unity 3D.

Figure 1 presents the living room of the used apartment as seen online and in desktop versions of the prototype.



Fig. 1. The first prototype (image taken from the application)

III. IN TIMEWALK

TimeWalk [6] will be presented with more details in a later paper. It is important to know that TimeWalk aims at:

- creating a virtual copy of the world to enable virtual tourism;
- connect the two (physical and virtual) worlds by means of not only IoT but also the fact that one can shop in TimeWalk and have the products delivered at home;
- updating and preserving this virtual world, so that future generations can experience how it was in the past;

- preserving human person memories and actions to help future generations meet past ones.

The VR4RE prototype (at that time called 3DGate) was included in TimeWalk's proof of concept, thus enabling IVR with Oculus Rift for the first time. The inclusion also facilitated the first window view on the surroundings of the apartment. In this case, the apartment was placed in one of the skyscrapers of Times Square, New York

Figure 2 present a screenshot with two TimeWalk characters looking down through the windows of the apartment.



Fig. 2. Prototype included in TimeWalk's proof of concept

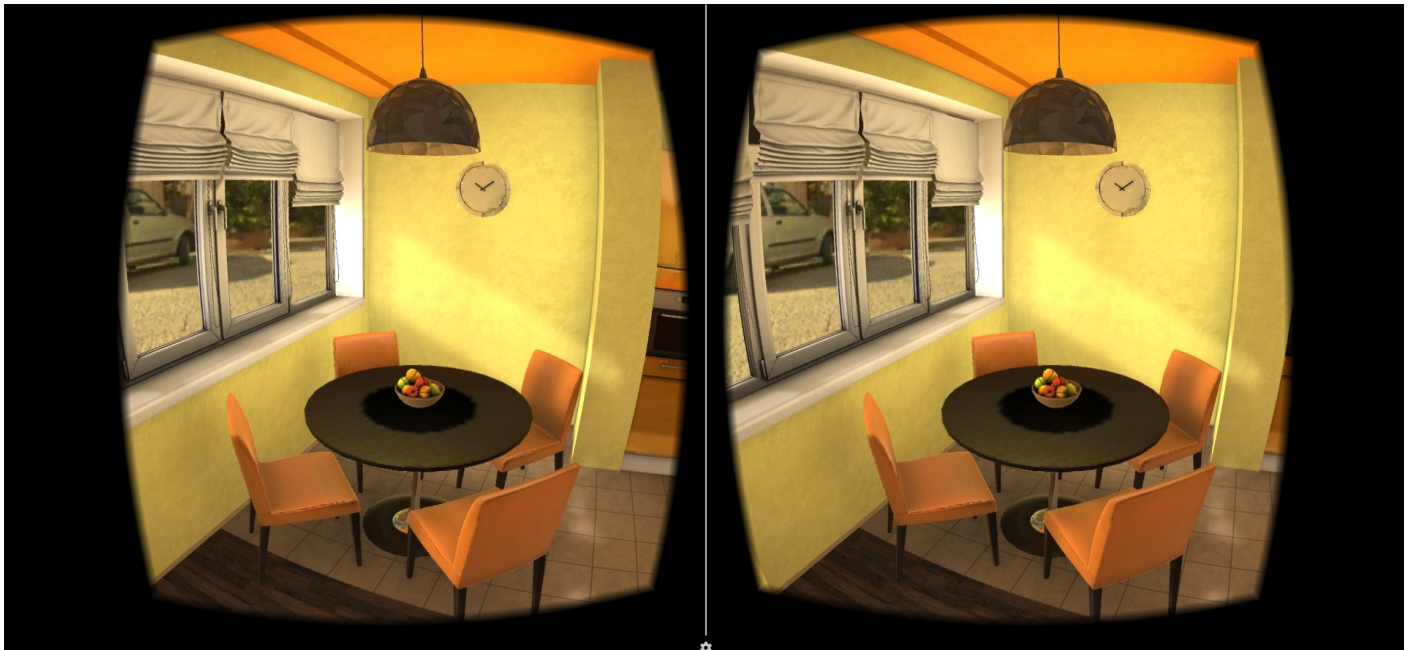


Fig. 3. Android application for smartphones with Google Cardboard

IV. GOOGLE CARDBOARD

In 2015 we started experimenting with creating mobile apps for Google Cardboard devices. While we were not very impressed of the initial results (using a do-it-yourself cardboard and AVATAR) we were pleased with the outcome when using a better Google Cardboard, such as the Dive's one. More and better Cardboards are appearing.

We started experimenting with these simple and cheap devices because our existing HMDs (head-mounted displays) were great but just too expensive for end-users. The Cardboard enables us to reach a much broader market because of its lower hardware cost (including Samsung Gear users)

In 2015 we have also integrated a new apartment and made it accessible for smartphones with Google Cardboard. To this context we have also added exterior views using 360 degree photos for the first time (figure 3).

V. FIRST CLIENT IMPLEMENTATION

In early 2016 we did finally develop our first project for a real estate developer: a whole level (Figure 4) of the in-construction "La Colina" residence in Brasov, Romania, with the assistance of the Ascendent Imobiliare real-estate-agency.

The result was an Android application for Google Cardboard plus a Windows application which works with and without Oculus Rift.

Because of the more complex scene and the limits of mobile devices, it greatly challenged our optimization capabilities.

In the development of the previously presented applications (including this one) we have still used Unity 3D as the development environment of choice.

VI. CURRENT STAGE. ADDAPTING TO THE MARKET

The feedback that we got with the assistance of our partners showed us that our 3D VR technology is great for presenting in-construction and expensive real estate

We have also learned that, for wide adoption, a solution to generate 3D models and the final VR applications at much lower costs is needed.



Fig. 4. Top view of the second floor presented in the application



Fig. 5. Online VR apartment tour in the browser using 360 degrees images (on smartphone)

We realized that creating VR tours using 360 degree photos makes them accessible to common apartment owners and the technology suits existing real estate property.

We have already created the 360 degrees VR technology to provide the cheaper alternative.

It can be deployed online as a webpage to make it easily accessible.

It can be switched to full screen and to VR mode - works with smartphones together with Google Cardboard, Samsung Gear and other similar devices.

Even better, it can be used in a mobile friendly way even without any VR goggles.

Figure 5 presents an implementation done at Ascendent Imobiliare using JavaScript.

VII. CONCLUSIONS AND FUTURE RESEARCH

This paper presented not only the evolution of VR4RE and just a little of the technology behind it. Those of you inclined towards entrepreneurship will have also noticed two different market segments approached with different technology:

- 360 degrees VR is more suitable for existing properties and also much cheaper to develop.
- 3D VR can offer a much more complete immersion especially if joined with haptics and positional tracking and is ideal for properties to be built.

HTC Vive / Steam VR does the second nicely already. We are developing an application with it for a real estate developer as we write this paper. We will brief regarding the outcome.

The company is also addressing the first point with the development of a service which is an innovation.

Bluemind Software is currently searching for the proper accelerator to bring this innovation fast to the market.

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