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Modeling the Real Estate Information System Based on Virtual Reality Technology

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Abstract

Recently, there has been increasing interest in IT companies for virtual reality technology. The the development of smartphone technology made it possible to experience virtual reality with a smartphone and a virtual reality kit like Google Cardboard or Samsung Gear VR. you can see different angles as you move your head 360 degrees and you can see the 3D view as if you were looking around a building. Virtual reality technology can help to convert a real estate information system into a telepresense or telexitstence system through which you can see as if you were there and using it can partly replace visiting a house or a bulidings. Even if you were not in the house or the building, you could look at the inner and outer spaces of it. It can reduce the costs and efforts in acquiring the information of the real estate which you want to know.

It is necessary to combine the spatial information technology and virtual reality technology in order to build the real estate information system based on virtual reality technology, and web technology (such as Web 2.0, Open API, and Mash-up) should be added to it. ln this paper, 4 steps for building the real estate information system based on virtual reality technology will be presented.

Keywords: Real estate information system, Virtual reality, 3D spatial information open platform, Open API, Vworld

1 Introduction

Recently there has been increasing interest in information technology companies for virtual reality technology. Facebook acquired Oculus Rift maker Oculus VR in 2014 for $2 billion. Also Google designed Cardboard Kit which is a fold-out cardboard smartphone mount that affords a virtual reality experience. A smartphone with stereoscopic display software fits into this device and the lenses allow a person to perceive the images as one single three-dimensional image. Samsung Electronics also developed Gear VR whch is a virtual reality device in collaboration with Oculus VR.

Virtual Reality technology may be popular with gamers, but IT companies like Facebook plan to leverage the technology to other industries, and I think real estate industry can be one of them. Spatial information technology and three-dimensional spatial data must be added to virtual reality technology in order to realize it. so precisely-established building space information data and good environment for mobile platform are required.

South Korea has such a good environment for this. The South Korean government has been building Vworld, three-dimensional spatial information system which is more accurate than Google Earth. Additionally the penetration rate for smartphones among mobile-phone users in the country was 70.14% at the end of June 2014, meaning that for the first time, seven out of every ten cellphone subscriptions owned smartphones, data compiled by the government showed.

Therefore, this study attempts to introduce Real Estate Information System Based on Virtual Reality Technology in South Korea.

For this purpose, chapter 2 attempts to make a theoretical investigation of the concept, function and major technology of virtual reality, three-dimensional spatial information open platforms and real state information systems. Chapter 3 discusses the steps or method to build the real estate information system based on virtual reality technology. Chapter 4, the concluding chapter, mentions the expected effect of the elicited model and the future direction of study.

2 Theoretical Investigation

2.1 Virtual Reality Technology

2.1.1 the Concept of Virtual Reality

Virtual Reality (VR), sometimes referred to as immersive multimedia, is a computer-simulated environment that can simulate physical presence in places in the real world or imagined worlds.[7] Most current virtual reality environments are primarily empirical experiences, displayed either on a computer screen or with special stereoscopic displays, and some regulated simulations include additional sensory information toward witness.[7]

2.1.2 The Function of Stereoscopic Method

Most 3D displays use this stereoscopic method to convey images. Stereoscopy creates the illusion of three-dimensional depth from given two-dimensional images.

Human vision, including the perception of depth, is a complex process which only begins with the acquisition of visual information taken in through the eyes; much

processing ensues within the brain, as it strives to make intelligent and meaningful sense of the raw information provided.[8] One of the very important visual functions that occur within the brain as it interprets what the eyes see is that of assessing the relative distances of various objects from the viewer, and the depth dimension of those same perceived objects. The brain makes use of a number of cues to determine relative distances and depth in a perceived scene.[8]

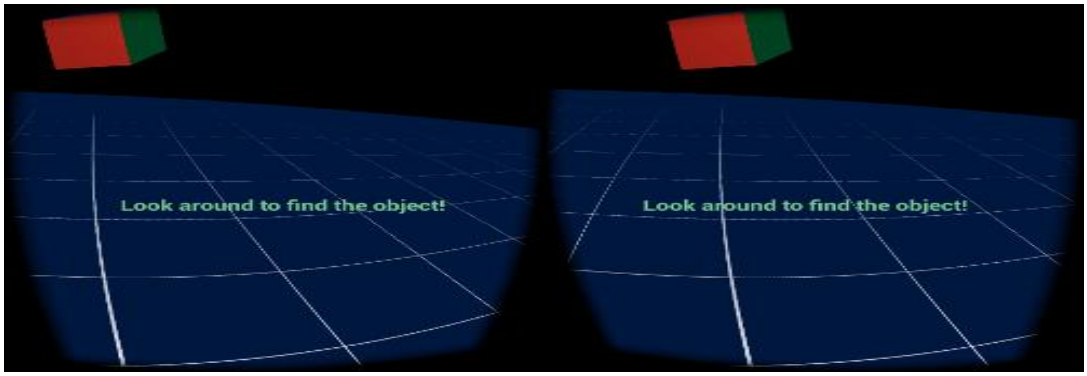

Fig 1. Stereoscopic method

Fig 1. is what appears on screen, a pair of 2D images, but this will appear as a 3D scene when viewed in a VR kit such as Google Cardboard Kit.

2.1.3 The Development of Virtual Reality Technology on Smartphones

In practice, it was very difficult to create a high-fidelity virtual reality experience, because of technical limitations on processing power, image resolution, and communication bandwidth. However, such limitations have been overcome with progression of processor, imaging, and disk communication which have become more powerful and cost effective over time.

Thanks to the development of technology and the great popularity of the smartphone. Nowadays most smartphones have a processor whose speed is over 2GHz and whose core is over two, a display with resolutions over Full HD(1920×1080), a gyroscope sensor which uses Earth's gravity to help determine orientation, a GPS receiver whose function is to calculate the user's exact location and an LTE(Long Term Evolution) module whose communication bandwith is enough for carrying 3D data of the real site.[2] So smartphones can be the main part of HMD(Head Mounted Display) with which virtual reality can be experienced and though which stereoscopic image can be viewed.[2]

Fig 2. Google Cardboard Kit and Samsung Gear VR

Google designed Cardboard kit which is a fold-out cardboard smartphone mount that, when combined with lenses, a magnet, a piece of hook-and-loop fastener and a rubber band and held against the face, affords a virtual reality experience. A smartphone with stereoscopic display software fits into this device and the lenses allow a person to perceive the images as one single three-dimensional image. and it costs under $ 10 if you have a smartphone whose OS is not out of date.

Samsung Gear VR is a virtual reality device developed by Samsung Electronics in collaboration with Oculus VR. Only the smartphone (Samsung Galaxy Note 4) can be used as the screen and driving computer, mounted inside the Gear VR device. Like Google Cardboard, Gear VR has no display itself.[10]

2.2 Spatial Information Open Platform

Unlike VR game, the real estate information system based on virtual reality technology should show the real world to users. So the spatial information technology or system is necessary in building real estate information systems based on virtual reality technology. In order to bulid it, the concepts such as Spatial Information Open Platform, Open API(Application Programming Interface), and Web 2.0 are necessary.

2.2.1 Spatial Information

Geometry of the real world we are living in, physical spatial components (buildings, roads, etc.) put in a diagram on the basis of real geometry, logical spatial components (administrative border, cadastral map) and including all the attributes in the diagram is called Spatial Information. Spatial Information is divided into two categories depending on the level of presentation: One is two-dimensional and the other is three-dimensional.[4]

2.2.2 Spatial Information Open Platform and Vworld

Spatial Information Open platform is the platform which is used with various purposes of seeing and exploiting further in two or three dimensions. The Real Estate Information System Based on Virtual Reality Technology should be built on not a two-dimensional spatial information systems but a three-dimensional spatial

information systems because virtual reality or augmented reality service can be realized in it. Vworld is a Spatial Information Open Platform that offers various ways for using spatial information available and open to everybody and held by Ministry of Land and Transportation of Korea.

Fig 3. Concept of spatial information open platform

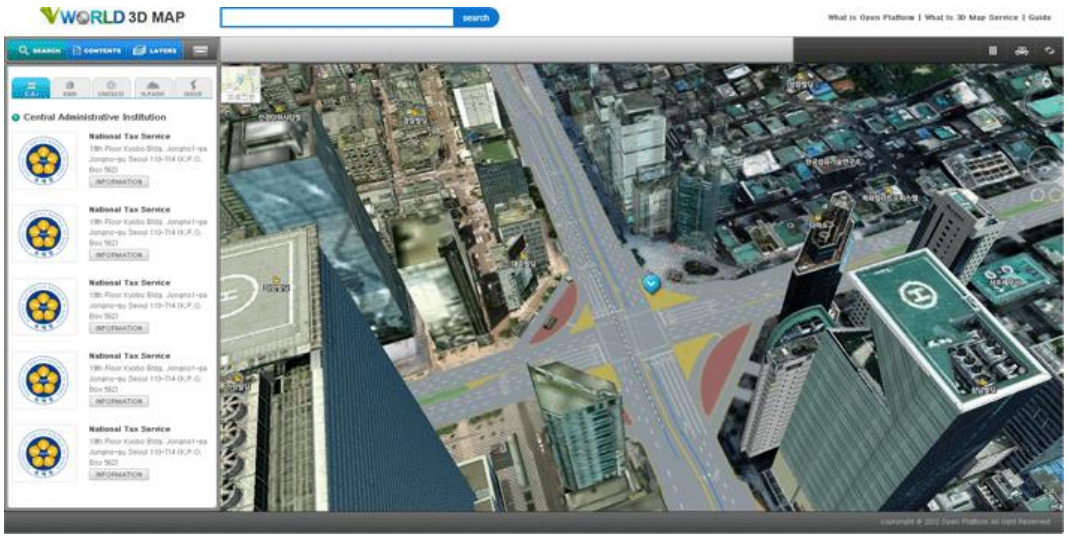

Fig 4. Vworld 3D Map Service

Vworld was built to overtake foreign markets with rapid expansion of spatial information industry of the world. Vworld 3D service provides services that enables users to see a map through internet. Vworld has the world's highest level of resolution, so it can show the views which look like real views. Unlike load views, it can provide free movement of eyes.[1] It also provides Open API service. So it is fit for VR services.

2.3. Real Estate Information System

The functions of Real Estate Information System is to provide timely real estate information for the public, and building and real estate practitioners.

3D spatial information platform is a platform that provides physical 3D views and physical information of real estate. it should be built based on real size and shape of the real estate.

On the other hand, real estate information system is a system that provides legal and economic information of real estate. Examples of the legal information of real estate are real estate public register data, urban planning map, legal regulation of administration law, etc. The history of real estate transaction price is an example of the ecomomic information of real estate.

First, the real estate public register data can be acquired by connecting the web site such as KLIS(Korea Land Information System), LURIS(Land Use Regulation Information System), UPIS(Urban Planning Information System), and Onnara(real estate information portal). These information can be acquired through spatial information open platform like Vworld too.

The real estate sale information is added in such a way to fill the MLS(multiple listing system) in the United States and REINS(real estate information network system) in Japan. Only certified real estate brokers and government agencies should be allowed to add and update the real estate information on it.

3 Modeling Real Estate information System Based on Virtual Reality Technology

3.1 Step 1: Building 3D spatial information system

The first step is to establish a three-dimensional space information system on which the real estate information system is based. It should be built on not a two-dimensional spatial information systems but a three-dimensional spatial information system because virtual reality or augmented reality service can be realized on it. So three-dimensional spatial information systems and real estate information system should be combined. Three-dimensional spatial information systems can be built using Open API of Vworld and Mash-up method in Web 2.0 environment.

3.2. Step 2: Adding data and 3D images on the 3D spatial information system

Various real estate information such as address, price, energy performance, 3D image, official price, rent, etc will be added to it. In the real estate sale data the credibility on sales item is important. and in Korea, low credibility on the data on sale item in the market and the fear of speculative real estate price uprise and market distortions are continuing on.[6] A lot of institutions and persons involved in the information system,

so it necessary to professionally improve the real estate information system. Only certified real estate brokers and government agencies should be allowed to add and update the real estate information on it.

Interior or exterior 360-degree images of the real estate can be captured by a 3D capturing 360-degree camera such as Samsung Project Beyond. Samsung unveiled a new camera called Project Beyond, which is a 3D-capturing 360-degree camera designed to capture videos and stream them on the Gear VR. The camera which apparently houses 16 full HD cameras shows a 360-degree panoramic view and captures everything in 3D, collecting a gigapixel of 3D data every second.[9]

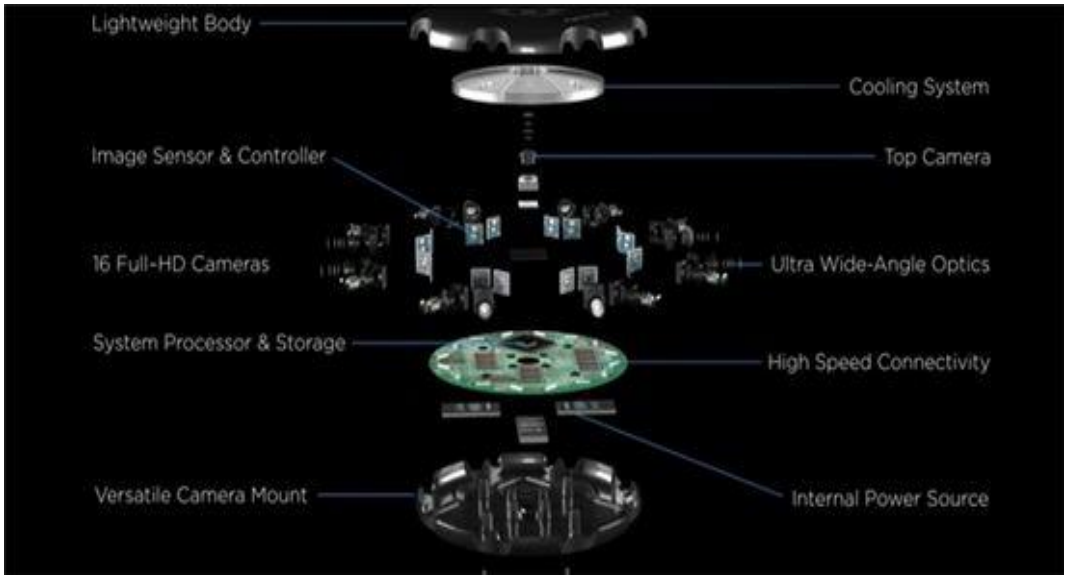

Fig 5. Components of Project Beyond, the 3D capturing 360-degree camera

3.3 Step 3: Developing the 3D mobile application of the real estate information system

In order to use virtual reality technology with a smartphone, the real estate information system based on virtual reality technology should be serviced in the form of mobile application. It means that mobile applications should be developed based on the mobile operating system such as Google Android or Apple IOS. The functions such as 3D map lookup and offline map service via download can be provided.

3.4 Step 4: Adapting 3D mobile application to VR

Stereoscopic photography consists of creating a 3D illusion starting from a pair of 2D images, a stereogram. The easiest way to enhance depth perception in the brain is to provide the eyes of the viewer with two different images, representing two perspectives of the same object, with a minor deviation equal or nearly equal to the perspectives that both eyes naturally receive in binocular vision.[8]

Adapting 3D mobile application to VR or AR needs VR SDK(Software Development Kit)for VR such as Google Cardboard SDK. By means of it, mobile real estate application can convert an ordinary image into a pair of stereoscopic images.[2]

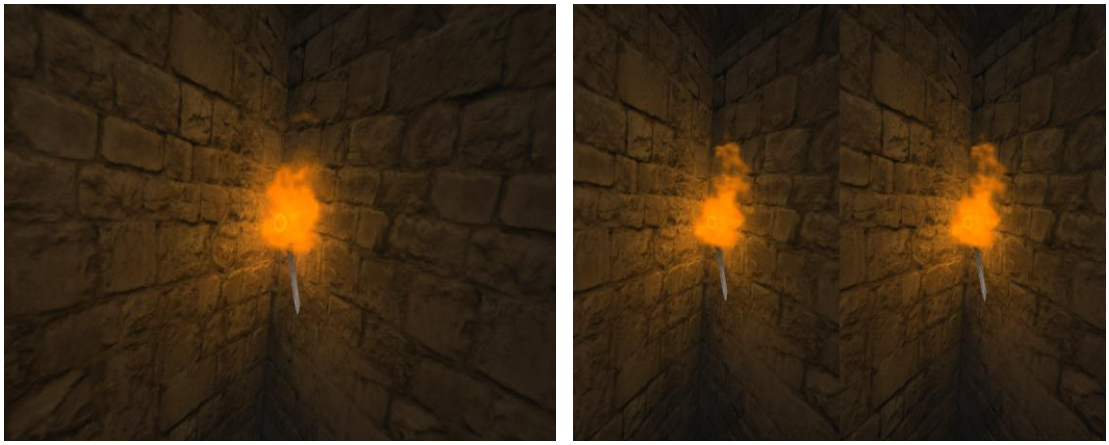

Fig 6. Image Converting by VR SDK(before and after)

So users can experience virtual reality with a smartphone and a virtual reality kit like Google Cardboard or Samsung Gear VR. In order to experience VR, a gyroscope sensor in head tracking technolgy, embedded in the smartphone, is necessary.

4 Conclusion

Location is very important at real estate value and in order to obtain the information of the real estate, going to the site directly and looking around the real estate is necessary. So it takes much time and cost much money to do this and transaction and search costs of the real estate is higher than those of other goods. Spatial information services like Google Earth give some location information but it is not sufficient to experience and evaluate the value of the location.

Virtual Reality technology can made real estate information system much better and it can partly replace the model house.[2] Even if you were not in the model house with it , you could look at the inner and outer spaces of it. It can reduce the costs and efforts in acquiring the information of the real estate which you want to know.[2] For this purpose, it is necessary to combine the spatial information technology and virtual reality technology in building the real estate information system based on virtual reality technology.

In this paper, 4 steps for building the real estate information system based on virtual reality technology have been presented. Step 1 is building three-dimensional spatial information system. Step 2 is adding data and 3D images on the three-dimensional spatial information system. Step 3 is developing the mobie application of

the real estate information system. Finally step 4 is adapting the 3D mobile application to VR or AR service.

You can experience virtual reality with a smart phone and a virtual reality kit like Google Cardboard Kit whose price is under $10 and you can see different views as you move your head 360 degrees. If the real estate information system utilized VR technology, in the future, you would be able to cheaply and easily experience the virtual world of a real location just as if you were looking around it.

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