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Development of Visual Image Recognition Based VR Information Search System

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Abstract: Keywords input and two-dimensional information output have been the mainstream of information search system. However, as HMD is having more potential to become next widely used device, information search system would also have improvement in function. This research proposes Visual Image Recognition Based VR Information Search System which utilizes the capability of HMD. In this system, visual image as an input is recognized and the linked three-dimensional VR environment is output. More efficient and natural search input, and more interactive and informative search output are expected.

Key Word: Image recognition, VR website, Information Search

1. INTRODUCTION

Online search has already become a major tool for people to receive information, and according to a recent report, online searches on mobile devices are majority of online searches on major industries [1]. On the other hand, Augmented Reality or Virtual Reality HMDs (Head-Mounted Displays) are becoming potential devices which could replace current mobile devices. A recent paper claimed that after the generation of Mobile Social Web, Wearable Augmented Reality will be the next generation media, where virtual and physical realities are merged through wearable technologies [2].

As media device transfers from mobile device to Head-Mounted Display, information search system could not be limited to keywords input and two-dimensional information output, such as text, image and video. The new way of search and information delivering needs to be introduced. In this research, Visual Image Recognition Based VR Information Search System is proposed and developed. The system input is user's visual image, and after image recognition, it outputs three-dimensional VR environments as information. In other words, when user sees an object, he or she can experience the related virtual reality world for information.

2. METHOD

The concept of Visual Image Recognition Based VR Information Search System is that when user wearing HMD sees an object, he or she can immerse into the VR world which describes the object. For example, as in Figure 1, when user see a bottled water which claims the water source is a beautiful mountain, he or she can actually immerse into the VR mountain and see where the water comes from.

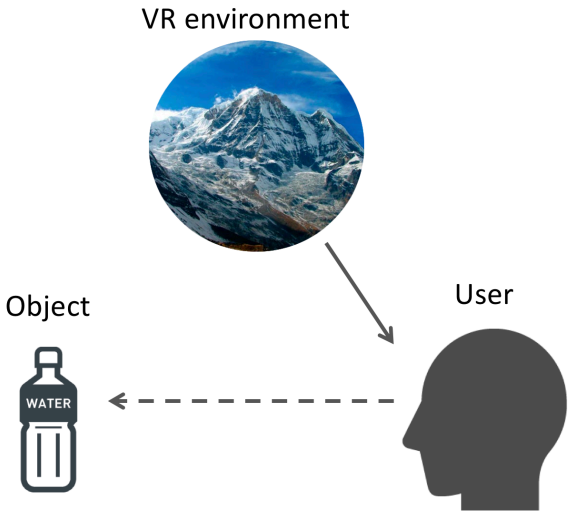

Figure 1: System Concept

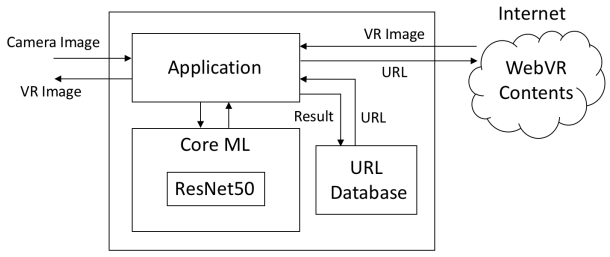

Figure 2: System Layout

The system is implemented on iPhone as an iOS app. Video see-through smartphone HMD is built with smartphone and head mount device. The inputs of the system are smartphone camera captured images, and the outputs of the system are VR websites. Camera captured images are processed through deep-learning based image recognition, and recognition results are linked to VR website URLs. The system layout is shown in Figure 2.

Video see-through smartphone HMD is realized by displaying side-by-side image generated from camera captured image on smartphone screen and utilizing head mount device for smartphone. The captured image then run through on-device image recognition process, and the result also shown as side-by-side image of virtual reality information. For on-device image recognition, trained machine learning model is integrated into iOS app with Apple's Core ML. Trained model used for this research is ResNet50, which detects the dominant object in an image, from 1000 categories. The system can receive tap events on screen, and when tap event occur, the image recognition result is matched in database. Then a specific WebVR URL is accessed. Customized VR websites are built on A-Frame, which is a web framework for building VR content.

3. RESULT

An evaluation demo event was held, with three pairs of objects and VR websites were prepared. When users see a broccoli, they immerse into VR forest (Figure 3 and Figure 4) ; when users see a water bottle, they immerse into VR beach; when users see a space shuttle, they immerse into VR space. Even though some participants commented they felt sick due to the low frame rate of video see-through image, most feedback about the system are positive. Visual image input is a more efficient and natural way to search for information compared to keywords input, and VR information output is a more interactive and informative way to receive information compared to text and image output.

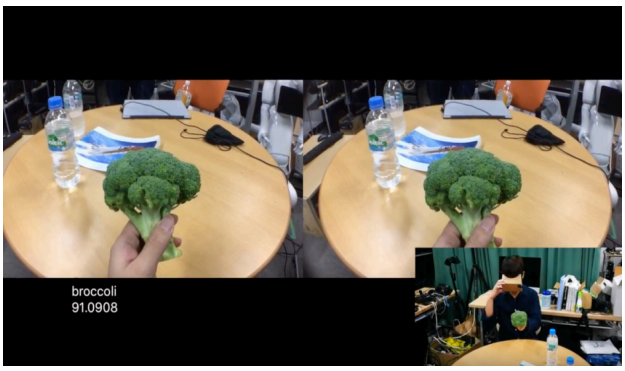

Figure 3: User sees through broccoli

Figure 4: User sees VR forest

4. CONCLUSION

This paper set out to propose and develop search and information delivering system on wearable Head-Mounted Display devices. Through implementing image recognition and VR websites access function, Visual Image Recognition Based VR Information Search System was built on smartphone based HMD. With its natural user interface and interactive information delivering, this system breaks through the limitation of traditional search systems and reveals the potential of Head-Mounted Display to replace current mobile devices. Many functions which people are familiar with today can be redefined when wearable Head-Mounted Displays become widely used.

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