Implementation of Augmented Virtuality in Virtual Meeting Room Application

Eric Sumantri, Michael, Raymond Lesmana, and Handri Santoso

***Abstract*—This paper proposes a development of a virtual meeting room that implementing augmented reality. The differences between the virtual meeting in this paper with another are it provides the ability to allow user for typing more efficiently while they are still inside the virtual world and wearing head mounted display headset. It also gives user the ability for taking picture from the real world using camera on the device and send it to the virtual world. This application was developed using Samsung Gear VR as virtual reality headset and Unity3D as engine for developing this application. The paper successfully makes a mechanism to put images from the real world to the virtual reality.**

***Index Terms*— Augmented Virtuality, Mixed Reality, Virtual Environment.**

I. INTRODUCTION

MEETING is an occasion when two people or more meet each other to discuss something which has a particular purpose [1]. It is hard to set a meeting because the lack of meeting room available or the distances between the meeting participants ‘s location and the meeting place that are too far away. To solve this problem, usually the participant of the meeting tends to use video call technology. Nonetheless, there is some problem using this technology as a solution. The interaction between each participant is lacking compare to the traditional meeting where the participant can meet each other in real world [2]. Some researchers purpose the use of the Virtual Reality as an approach to solve this problem.

Virtual reality offers an immersive experience. The immersion of virtual reality made a more natural form of communication between people in virtual world become possible, one of the examples of this is the virtual meeting room. Virtual meeting space acted as a virtual location where people from many places can gather and meet digitally by using their avatar and be able interact between each other as if they are in the same place.

The current available virtual meeting space has a major drawback in the interaction methods available. The interaction is limited in a verbal communication such as voice talk. The user cannot write or share their pictures during interaction. This limitation is mainly due to the head mounted display headset that used in the recent virtual reality’s hardware.

The user’s view of the real world blocked by the headset. As a result, a simple interaction task in the real world context for example typing is deemed as a problem. Augmented virtuality can be a solution for this problem. Augmented virtuality is a form of mixed reality in which virtual world enhanced or augmented with a real world data or object [3]. By using augmented virtuality approach the real world view surrounded the user can be embedded to the virtual world, then user can see the situation of the real world while he is wearing the headset. This approach also enriched the interaction inside the virtual world by allowed the user to take picture or typing text and send it to the virtual world.

The rest of this paper is organized as follows. In section two the related works on using Virtual Reality technologies to improve meeting are reviewed. In section three, the overview of the system is described. In section four, the result of the proposed system is explained. In section five, the proposed system is discussed in more detail. Lastly, in section six, suggest and conclude the future prospect and research to be aim.

II. RELATED WORK

In this section, several related work prior to this research will be reviewed. The reviewed topic will be regarding augmented virtuality usage in virtual world and also regarding virtual meeting space.

Earlier works regarding this topic is the work of Gary Reynard and Steve Benford. In their work, they stated one of the limitations of the Collaborative Virtual Environment is the lack of ability to introduce information from real world into the collaboration [4]. They also proposed Vivid, their video conferencing prototype system, which use augmented virtuality in form of video stream inside the virtual reality. This, however could reduce the immersion of the virtual reality.

Another work focusing on augmented virtuality was the work of Mark Mcgill [5]. His approach on this augmented virtuality was similar to the approach used in this paper. In his research, he used three different study cases: typing, interacting with physical object and how the system applied to social.

Teleconference systems named The ICOCOON Virtual Meeting Room [6]. There is no system that matches the direct experience for a business meeting with many participants in a

Manuscript received June 9, 2018.

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flexible and affordable manner. Hence, they created a Virtual Meeting Room application in a 3D virtual environment.

Reidma et. al. has done research on a simulation of real meeting behavior to show the behavior of the people, their gesture, move their heads, bodies or their gaze movement during conversation with other using virtual meeting rooms. The research is done to show the effects of controlling specific parameters of the behavior to see their effect on communication. Their research shows several stages in developing virtual meeting room, and the effectiveness of using it [7].

Thompson, James, and Nanos have done research to determine the functional and technical requirements for a virtual meeting system. They propose a virtual meeting room that is providing a possible alternative to replace the traditional meetings by reducing costs and time for attendees to travel to other locations in order to attend the meetings. To determine the performance of the proposed system, the experiment is done by students as the students deploying the prototype for collaboration in group work. They inputted their comments and suggestions to improve the system [8].

After examining this works, the conclusion for the system design can be reached. In this proposed system design, Samsung Gear VR is chosen as the Virtual Reality headset. Then, Samsung Galaxy S6 is chosen as the computer of the Virtual Reality headset.

III. SYSTEM OVERVIEW

The system proposed in this paper is the smartphone based virtual meeting room application implementing augmented virtuality, which it allows users to take a picture and take a note while virtual meeting is running.

A. Hardware

The virtual reality hardware used in this paper is a smartphone-based virtual reality. The hardware consists of Gear VR headset and the Samsung Galaxy S6 shown on Fig. 1. The hardware combination proven to be capable to accommodate a quite high quality virtual reality content as shown by R.L. Mendez in his work [9] and K. Valentino et.al. using Samsung Galaxy S7 [10].

The virtual meeting space created by utilizing Unity3D. The virtual meeting space is designed as simple common meeting place that found normally in an office. The augmented virtuality functionality coded on Unity3D and integrated into the virtual reality meeting space. Software

B. Software

The software used in this paper is Unity3D. Unity3D is a cross platform game engine which is used to develop mobile applications, video games or even a simulation for computers/consoles. The programming language used in Unity3D is C#.

Fig. 1. The Samsung Gear VR and Samsung S7

C. Overview

Fig. 2 shows the flowchart of the designed system that described how the system work overall. The system works using the camera attached to the smartphone device, in this case the Samsung Galaxy S6. The image from the camera relays to the user view from the head mounted display so the user can see the real world from the camera attached to the back of the smartphone.

The complete workflow of the system is as follow: The users are required to set up an account as the login information. If the users have registered their account, then they can log in to the virtual reality meeting space. After the users have logged in, they will be spawned in the virtual reality meeting room. Each of them assigned with a predefined avatar and appear inside the meeting space. Next, the users have an option to activate the passthrough function by pressing a key on the head mounted display. The passthrough function allows the users of the system to see through the virtual reality headset into the real world using the Samsung Galaxy S6 camera to allow the users to have interactions with the real world even when using the virtual reality equipment of this proposed system. The passthrough function is also called the augmented virtuality function which makes users able to access to the real world. Whether the users want to activate this function or not, they can still enter the virtual reality meeting room. Finally after the meeting, the users are allowed to log out of the meeting room or enter a new room to have another meeting.

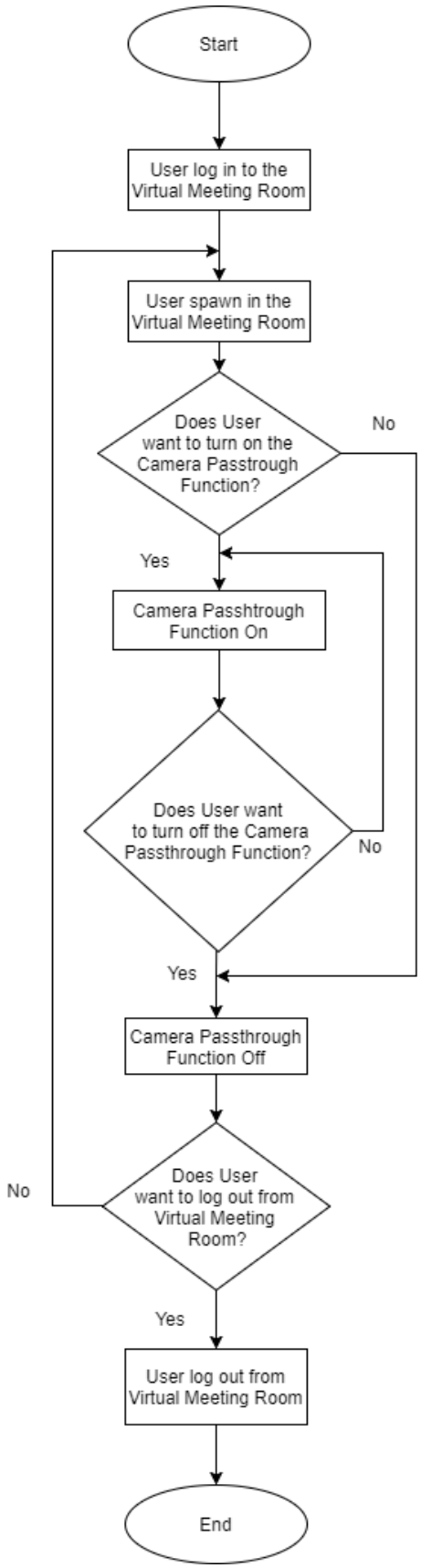

Fig. 2. System Flowchart How To Work

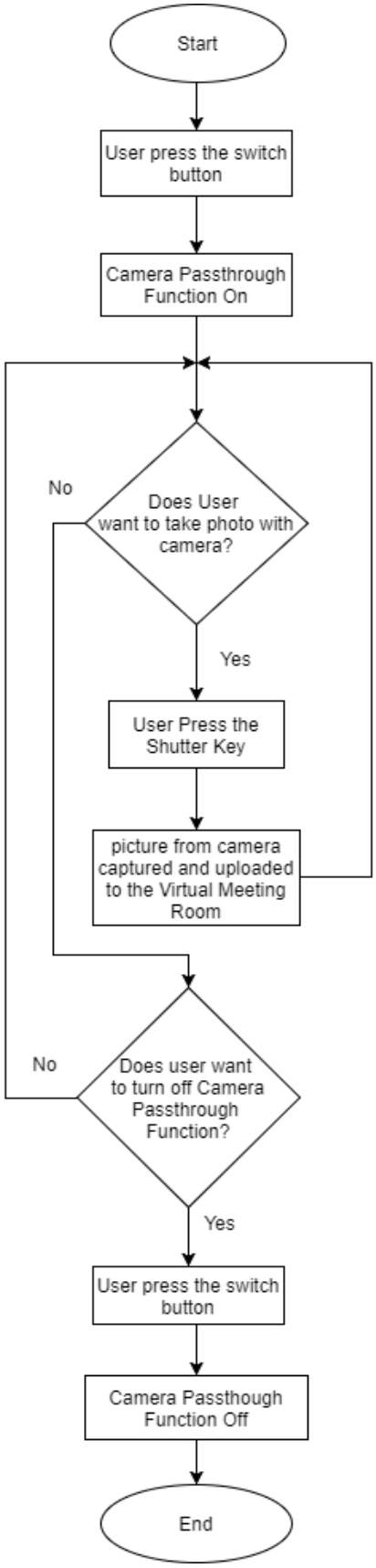

Fig. 3. System Flowchart How To Work

Fig. 3 shows the flowchart of the designed system that described how the feature of this system works. The complete workflow of the system's features as follow: The users press the switch button to activate the Augmented Virtuality function of the Samsung Gear VR headset. Then, the users will get the access to the real world with the view from Samsung Galaxy S6 camera. The users can do anything they want in the real world and they have a choice to take picture of what they see or no. They able to take a picture from the real world by pressing the shutter key from the Samsung Gear VR headset. After taking the picture, the results then uploaded to the virtual meeting space. If they press the shutter key again, their view will switch back to the virtual meeting space and it will turn off the Augmented Virtuality function.

D. Data Chunking

One of the Unity3D limitation is the limited data size that can be exchange. In our proposed system, we also face this problem when the users want to exchange data between each other in the Virtual Meeting Room. To solve this problem, we use a technique for data exchanging call chunking.

By chunking data, an exchange of big size data can be done successfully even with Unity3D limitation. In order to start exchanging data between sender and receiver a technique called handshake is used. Handshake is an exchange of standardized signals between devices in a computer network regulating the transfer of data. In other words, handshake is needed to determine when the exchange will be started and when it is finished. If the handshake is done successfully, the sender can start sending data to be receive by the receiver.

Next, we need to start chunking the data. Chunking is basically a technique that divides a long size data to several subsets data that we called chunks. This chunks then can be sent successfully even with Unity3D limitation. Each time a chunk is received by the receiver, the receiver needs to send a respond to notify the sender that the chunk has been received. This response will be sent for each chunk.

Once all of the chunks are received by the receiver, a termination notice will be sent by the receiver to the sender to notify that the action can be determined. This process is called handshake termination. Next, the receiver will start assembling the chunks to reconstruct the data to its original state. The chunks will be assembled according to its received order to prevent wrong data order assembled.

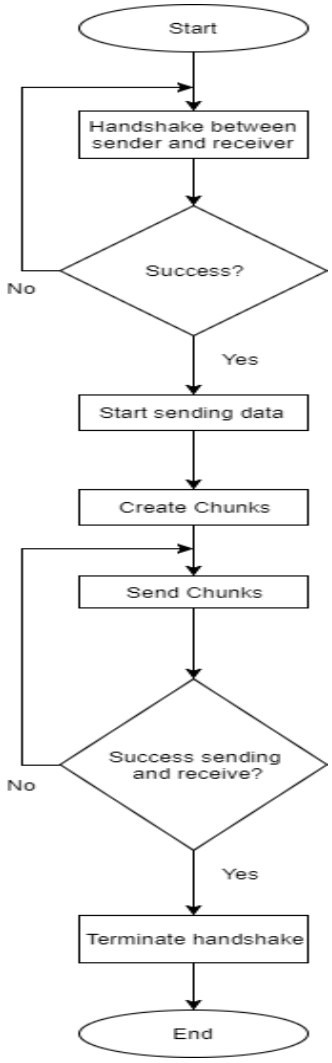

Fig. 4. Data Chunking

IV. RESULTS

A. Virtual Meeting Space

The meeting space created in Unity3D is like a simple layout of real office meeting room. Fig. 4 shows the layout of the meeting room which consists of a big table in the middle of the room and a central screen in the front of the table. The central screen is used to show the things uploaded by users such as pictures, handwritings, and documents. The meeting space is optimized to be able to run on mobile devices. Hence, the users can enter the virtual reality meeting room easily using the mobile devices anytime they want.

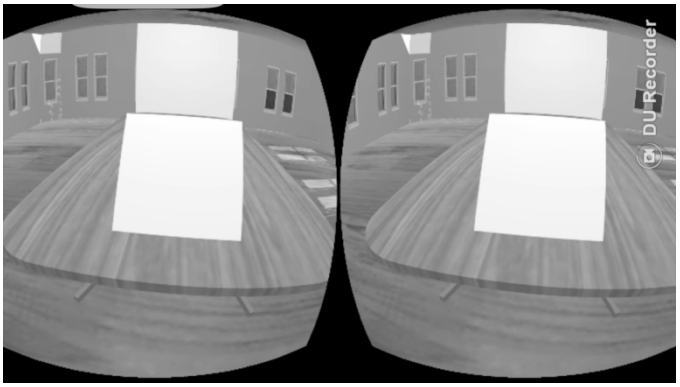

Fig. 5. The Virtual Meeting Space

B. The Augmented Virtuality

User can activate the camera passthrough function to see the real world from the headset while still maintain the presence inside the virtual world. The Fig. 5 shows when the function works. Then the user can take an image when using the passthrough function and introduce it to the virtual meeting space, where other users can see the image Fig. 6. Fig. 7 shows the result after the user took the image and then introduce it to the virtual world.

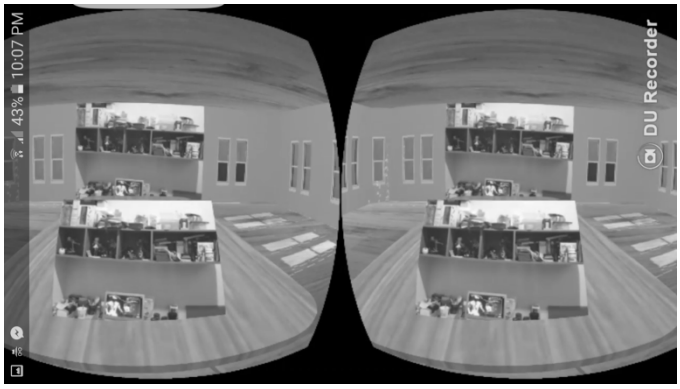

Fig. 6. The Passthrough Function

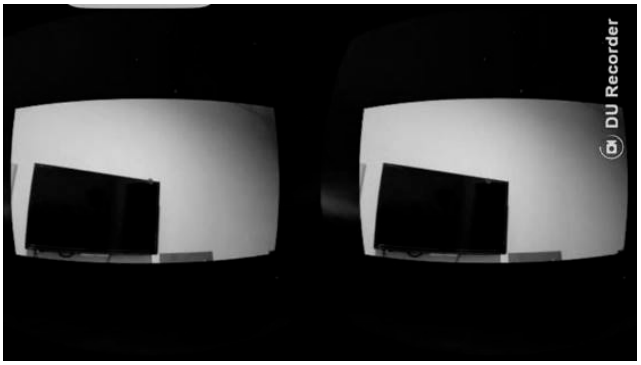

Fig. 7. The Result Image Inside the Virtual World

V. DISCUSSIONS

The system is developed to offer a new method to interact inside the virtual world in this case a virtual meeting room office. The system addresses the novel capabilities of the virtual reality as well as the augmented virtuality. The system aims to be a possible solution for problem faced in the previous research on this topic such as the problem to bring information from the real world into the virtual world and also the concern regarding the usability of augmented virtuality inside the virtual reality.

Augmented virtuality is useful as a way to introduce a real world object to the virtual world. It can be used to further enrich the interaction inside the virtual world. Moreover it can also be used to enable interaction to the physical object in the real world, such as writing or moving an object while the user is still using virtual reality headset. The proposed system arguably allows users to have a better interaction with each other since the proposed system still allows the users to have an interaction with the real world.

VI. CONCLUSION

This system addressed the issue of limited interaction method found in the virtual world. This paper contributed for a groundwork of more novel way of interaction based on the augmented virtuality capabilities. However, it should be addressed that this paper limited to bring image from real world to the virtual world. Further research is needed to do experiment prototyping required for creating a more general way to bring a real world information, that is not only image, into the virtual world.

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