Multi-UAV Multi-HoloLens streaming System

Daniar Estu Widiyanti, *Soo Young Shin
Department of IT Convergence Engineering,
Kumoh National Institute of Technology (KIT), Gumi, South Korea
Email: {daniarestuw, *wdragon}@kumoh.ac.kr

Abstract

A multiple Video Streaming system is proposed, which relies on the collaboration between Multiple HoloLens and Multiple UAV. This multi-streaming allows the Microsoft HoloLens user to switch among multiple perspective that provided by the multiple flying UAV. 5G LTE Connection are used to compensate the range limit of UAV. So, the range limit of UAV is no longer dependent on Wi-Fi signal.

I. Introduction

Mixed reality (MR) technology is a new technology that attaches the virtual objects to the real world and combines the virtual world with the real one [1]. The goal of mixed reality (MR) is to blend the physical and virtual objects on a single display, as if the virtual objects are situated in the physical space [2]. One of the MR Device, Microsoft HoloLens is a device that released by Microsoft Company. Microsoft HoloLens is a Head-Mounted Display device with a high computational power. It enables holographic images to be visualized from the user's perspective in a mixed-reality environment [3]. Until now, HoloLens already released 2 version. Microsoft HoloLens 1 and Microsoft HoloLens 2.

Unmanned Aerial Vehicle (UAV) or what people usually called as Drone are also being increasingly used in different kind of background. Drone have variety kind of type, it is all depends on the purposes of the drone. For this work, Bebop 2 Drone that use ROS as the operating system will be used.

A Collaboration between specifically Microsoft HoloLens and UAV is pretty rare, some of the previous work such as, streaming from UAV to make mapping that will be displayed by Microsoft HoloLens for Military purposes [1] and another Drone-HoloLens collaboration for exploring hidden areas [5] have been showed before. The basic of both works are how the Microsoft HoloLens can see what the UAV see when the UAV is flying.

Streaming service required a good connection to make streaming session far from delay or latency. It will affect the user experience when there is a delay while streaming the UAV. In this proposed system 5G LTE will be used as the network that connect between Microsoft HoloLens and UAV. The main focus of 5G is to provide large data rates with very small end to end latency between devices [6]. The end-to-end device latency can be estimated by considering the processing speeds of all the intermediate nodes when data streams pass through them.

II. Application Design

The goal of the proposed system is to make the user of the HoloLens capable to see multiple UAV view while the UAV is flying. The figure of our proposed system can be seen in Figure 1. All of the UAV is connected to the same connection and assumed it is connecting to the same controller. In here 5G LTE connection will be used which we assume will make a faster data transfer and will lead to a good experience for the end user. After the UAV is connected and controlled with the same base, multiple HoloLens will connect to the same networking service and access the IP Address of the base.

After the UAV is connected to the network, the view could be displayed to HoloLens in two kind of view. First is the normal view of the UAV camera and the second one is a view that have another function like object recognition and object detection, named as additional view. The normal view can be directly accessed from the HoloLens from an http view or application view. The additional view required a server to access and do all the object recognition and object detection then it will be displayed to HoloLens with an http view and or application view.

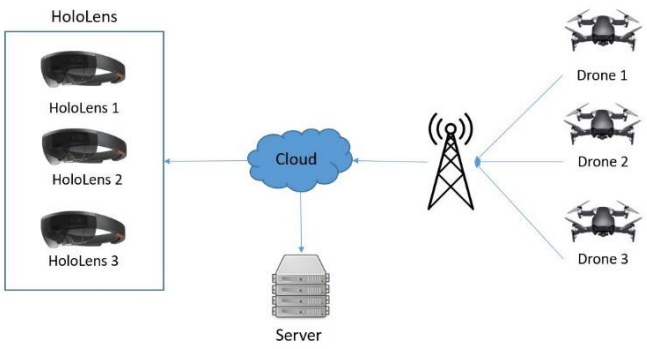

Figure 1. Proposed System

III. System Implementation

For the system requirement, application will be developed for two based operating system. Ubuntu 16.04 Kinetic using Jetson TX2 to control the drone from ROS (Robot Operating System) and Windows based software called Unity that has been used to develop in multiple device. The drone part, the Robot Operating System (ROS) is a flexible framework for writing robot software that have a collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms [7]. While, Unity is a cross-platform game engine developed by Unity Technologies [8]. Unity can be used to develop a software for multiple target devices. This time Unity will be used to deploy a HoloLens streaming application. C-Sharp language is used for developing the HoloLens stream application.

When the streaming session start, the HoloLens user can choose to access which drone that they preferred to display on their screen. Multiple HoloLens can stream one drone at the same time they also can stream for different drone at the same time. What makes a difference of one drone with other drone is on their displayed IP Address. Accessing different IP Address that displayed can make the HoloLens stream other drone perspective view.

Figure 2. HoloLens Device

Figure 3. Drone (Bebop 2) and Jetson TX2

IV. Conclusion

Conclusion, In this paper we tried to give an idea about making a multiple streaming system from Unmanned Aerial Vehicle (UAV to HoloLens. This system can help multiple HoloLens user to see multiple view that drone could display based on each drone perspective.

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