ExLeap: Minimal and highly available telepresence system creating leaping experience

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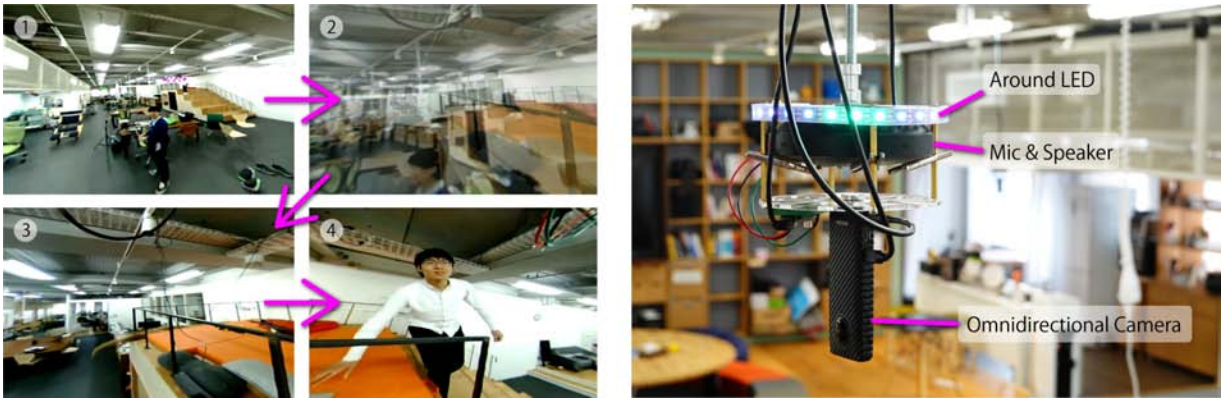

Figure 1: (L) The sights user sees while moving between nodes. (1) Look the target node (2) start leaping (3) finish leaping (4) look around and talk with someone. (R) A camera node

ABSTRACT

We propose "ExLeap", a minimal telepresence system that creates leaping experience. Multiple "nodes" with an omnidirectional camera, mic and speaker transmit the video to clients, and on the client, videos are rendered in 3D space. When moving to another node, by crossfading two videos, the user can feel as if she/he leaps between two places. Also, on each node, the user can talk with people in that place. Each node consists of very simple hardware, so we can put them on multiple places we want to go to. Moreover, because the system can be used 24/7 by multi-user simultaneously and is very easy to use, it creates various types of chances of communications.

Index Terms: Human-centered computing—Computer supported cooperative work; Human-centered computing—Interaction design; Information systems—Web conferencing;

1 INTRODUCTION

Related Work

Considering the popularization of the internet, overcrowding of living in cities, diversification of work, and so on, we are hoping that simpler remote communication and remote work that we can use every day will be achieved.

There are telepresence researches aiming for achieving a working and communicating with a high sense of reality as if users were in the place by using robots having a body and sensory input close to humans [4, 6], but because the system and operation are very complex, it is still not being used on a daily basis. Telepresence robots are starting to be actually used as a service by taking out a part of the functions such as moving and turning from the concept of very extensive Telepresence. [3]

As research pursuing high reality, Raskar et al showed a vision that we will work together in connected space, in the research series "The Office of the Future" by transmitting and reconstructing space three-dimensionally each other in real time [5]. Such research requires large-scale equipment and calculation resources, so it is difficult to spread for general users today.

There are some live streaming or virtual travel services that users can freely look around using omnidirectional cameras and HMDs. There are also live streaming services that are consisted of multiple cameras [2], but none have discussed the transition between cameras. Google Street View realizes the experience that we walk in a city by combining still images from a large number of viewpoints. However, it is limited to images recorded in the past. [1]

Concept

We believe that it is necessary to research to make it possible to enjoy remote communication and high-presence experiences drawn by these studies in our daily life. Many researches pursue the realism of short time telepresence experience. However, in order to utilize telepresence as a part of every day and gain profit, it is equally important to make it possible that "we can go anywhere we want to go even without a big deal any time and any number of times."

To realize that, we need to be able to install the devices in many places, so the cost reduction and installation easiness of the system becomes essential. It is also important to be able to use it any time, to be able to use it at the same time while others are using it and to be able to be operated stably. [7]

"ExLeap" proposed in this paper is a system that allows users to communicate with people while leaping between places like teleportation. Based on the concept as above, it is designed to be easy to use and enable informal communication with quickly moving around experience. Also, it is designed to achieve high spreadability and availability. In the next section, we describe the details of the system.

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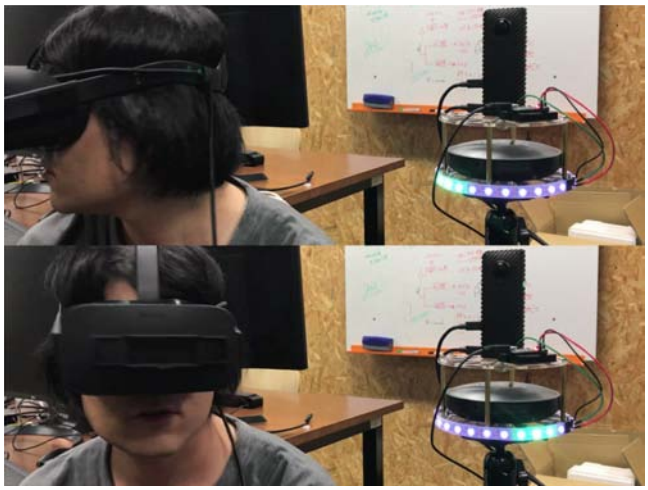

Figure 2: LED shows the existence of users and the direction they look at

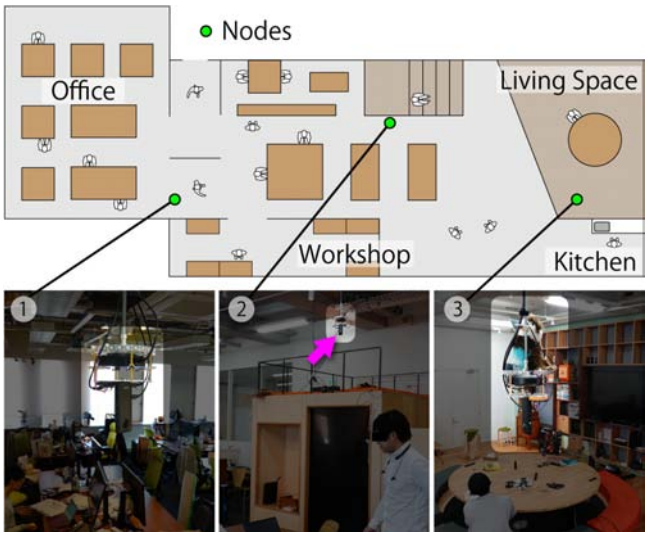

Figure 3: Placement of 3 camera nodes in preliminary experiment

2 System Description

Based on the concept described in the previous section, ExLeap has following features.

- By using no mechanical parts, breakdown risk and cost is reduced.
- By using omnidirectional cameras, users can look around in one place, and the cost of the system is decreased. Each node has no function to move, but users can go to many places by putting camera nodes in many places.
- By using omnidirectional cameras, the system can be used by many users at the same time.
- Users can obtain an immersive experience by using the HMD, but they can also use this system with normal display and mouse very quickly and easily.

The camera nodes designed with these guidelines are shown in the Figure 1(R). There is no display device on nodes of ExLeap. Instead, attaching the LED to wrap around the node, they present the local user with the sign of the existence of the remote user and the direction she/he is looking(Figure 2). It reduces anxiety of monitored and facilitates communication.

In our preliminary experiment, we placed three nodes in our room (Figure 3). Each node is placed about 10m apart. While traveling in the room, users can communicate with people differently depending on their location. Some unpremeditated discovery occured and informal communication wa promoted.

The clients and the nodes communicate using WebRTC, and the client viewer is implemented using WebVR. The client is not limited to one specific platform, for example, we can use this system from away from home with a smartphone. By using WebRTC server, our system can increase the number of nodes.

Figure 1(L) shows the sights users see while moving between the nodes. The target marks are drawn where users can go, and they can jump there just by pressing the button while looking at the target mark. By crossfading two videos while moving the viewpoint in three-dimensional space on the line connecting the two points, it creates a visual experience as if their body had continuously transferred.

3 User Experience

We can use this system in various scenes. Utilization in the remote office scenario is very reasonable. But, the client does not need to be remote. We can use it to move from our desk to another location in the same office to take casual communication. Because users can move more easily than walking with the body, it accelerates informal communication.

It is also suitable for watching sports such as football and horse racing. It must be an exciting experience to go ahead of the moving subjects. It goes without saying that it can be used for virtual travel.

On the research demonstration in IEEE VR 2019, we will place 3 or 4 camera nodes on the venue and provide participants an experience of leaping around easily.

Acknowledgments

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