

# Leap Motion Based Gestural Interface for Local and Remote Device

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**Abstract-** The project “Leap Motion based Gestural Interface for local and remote device” aims at creating a Gestural User Interface for a local or remote device. This Gestural User Interface will be created using a Natural User Interface (NUI) device which is the leap motion controller. The leap motion sensor can recognize and track both hands and all the fingers of a user and thus, distinct gestures can be defined for interaction with the files on a remote or local device. A 3D environment will be created wherein controls such as an Air Keyboard will be provided to perform file manipulation and other interaction with the remote or local device. A Virtual Reality (VR) viewer or Oculus Rift will be required to create a perception of immersion into the virtual world.

**Keywords –** VR viewer, leap motion, gestural interface, 3D environment, NUI.

## I. INTRODUCTION

In 1950's punched cards were used to enter data and commands into computers, then came the light pen in 1951, trackball in 1952, teletype keyboards in 1960's and the mouse in 1963. The Xerox star 8010 was the first commercial computer system to come equipped with a mouse and a bitmapped window based Graphical User Interface (GUI) featuring icons and folders making Human Computer Interaction (HCI) much simpler. The Gestural User Interface is created for Oculus Rift. Oculus Rift started as a kickstarter campaign. Soon, the project started receiving great amount of funds. Using this device, one can experience being in a virtual world interacting with virtual objects as if they're physical objects of the physical world. The advantage of a virtual environment is that the user can personalize his own space to whatever environment he/she is comfortable with. A 360 degree view allows the user to get a completely different experience. One can experience sitting in a theatre while watching a video or have multiple keyboards for input. Web pages need not be confined to a 2 dimensional space. One may develop a 3 dimensional web page or even a 3 dimensional video with the user located at the centre.

This project aims at developing a different way to use a device by using only gestures to control a computer. This computer can be a local or remote computer. Thus, using this gestural interface user will be able to interact with the computer using only the predefined gestures hence, eliminating the need of a mouse and keyboard. Such an interface is called a Natural User Interface (NUI). This gestural interface will be made possible by the use of a NUI device i.e. the leap motion controller<sup>[1][2][3]</sup>. Users can seamlessly interact with the files and folders on a device through predefined gestures which will be tracked by the leap motion controller.

Thus, this project aims at creating a Virtual Reality (VR) application for providing a gestural interface to the user to access and handle files in a remote as well as local device in a local network.

## II. EXISTING SYSTEM

Currently, many remote connection applications exist such as TeamViewer, Remote Utilities, UltraVNC, AeroAdmin, etc. All these applications use a GUI.

For instance, TeamViewer is a proprietary computer software for remote control, desktop sharing, online meetings, web conferencing and file transfer between computers. TeamViewer uses one of the servers of TeamViewer.com to start the connection and the routing of traffic between the local host and the remote host machine. In most of the cases, a direct connection is established via UDP or TCP is established after handshake<sup>[6]</sup>. Currently, all of the interfaces have been developed for the conventional computer system i.e 2 dimensional interaction spaces. The main purpose of this project is to create a 3 dimensional interface which will increase the interaction space for a user.

## III. PROPOSED SYSTEM

The project aims to create a VR application that provides a gestural interface to interact with a remote or local device in a local network. This application enables users to access and handle files on a remote as well as local device and perform operations on it in a virtual environment. A 3D environment will be created wherein the user will be provided controls<sup>[5]</sup> such as an Air Keyboard and certain predefined gestures to access the files and perform operations on them. This 3D interface is being created for VR devices like Oculus Rift.

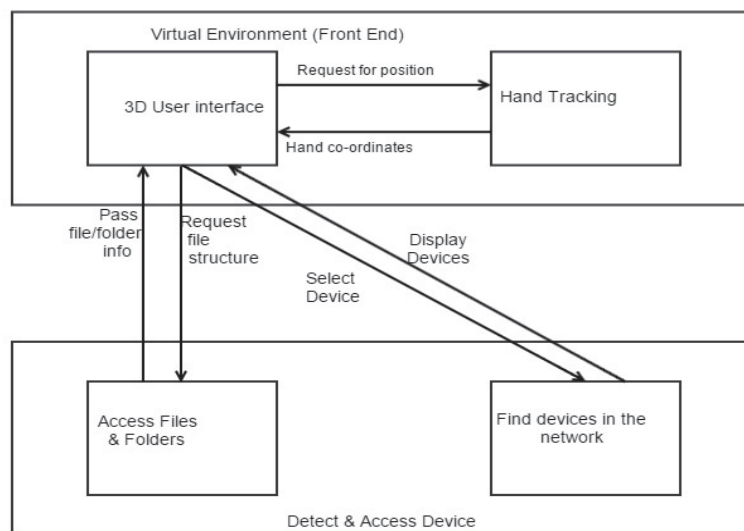


Fig. 1 Block diagram

The 2 main modules are the Virtual Environment and the Detect and Access Device modules. These two modules have two sub-modules each.

The 4 important sub-modules as shown in fig. 1:

- A. 3D User Interface
- B. Hand Tracking
- C. Find devices in the network
- D. Access files or folders

These modules interact in order to provide a gestural interface to the user. The Virtual Environment comprises of the 3D User Interface and Hand Tracking modules. The 3D User Interface module updates the interface based on input received from the Hand Tracking module. The Detect and Access device module has 2 sub-modules, Find devices in the network and Access files or folders. The 3D User Interface Displays the available devices on the network based on the input from Find devices module and enables user to select the device with which the user intends to interact. The Access files or folders enables the user to access the files as well as folders on the chosen device through the 3D User Interface. These 4 sub-modules are further explained below.

### A. 3D User Interface

A 3 Dimensional environment will be created to provide an immersive experience to the user. A VR viewer is required to view this 3D environment, shown in fig. 4. Virtual objects will be created in the 3D environment and

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controls<sup>[5]</sup> such as an Air Keyboard will be provided for the user to perform operations on those virtual objects which are files saved on the remote or local device. This 3D environment will be created using Unity<sup>[4]</sup> which is a development platform. The design of the interface is a very important aspect of this project. The aim is to create an environment that can be easily interpreted by the users.

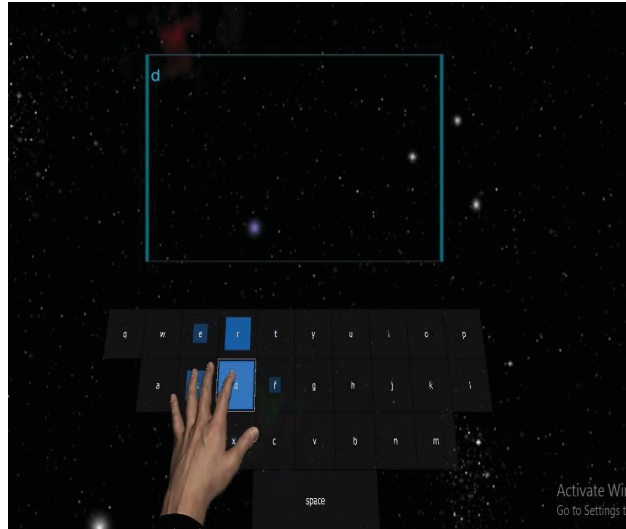


Fig.2 Air Keyboard

***B. Hand Tracking***

This module is responsible for sensing and tracking the hand gestures made by the user. The component used for this purpose is the leap motion controller<sup>[1][2][4]</sup> which tracks hand and finger movements in 3 dimensions. The controller is capable of detecting the distance of the finger from a virtual surface and thus, will be used to track hand motion to interact with virtual objects in 3D environment. The 3D environment is correspondingly updated based on the input provided by the leap motion controller to the 3D User Interface.

***C. Finding devices in the network***

In order to access files on a remote device a connection has to be first established with the remote device. This can be achieved using windows network framework. Net command can be used for detecting devices present in a network. The command “Net view” can be used to view all the computers in the network. It must be noted that all the systems must be present in the same workgroup. After getting list of systems, the command “Net view <pc name>” will get a list of shared resources on the system. Thus, this module will be concerned with discovering remote device(s).

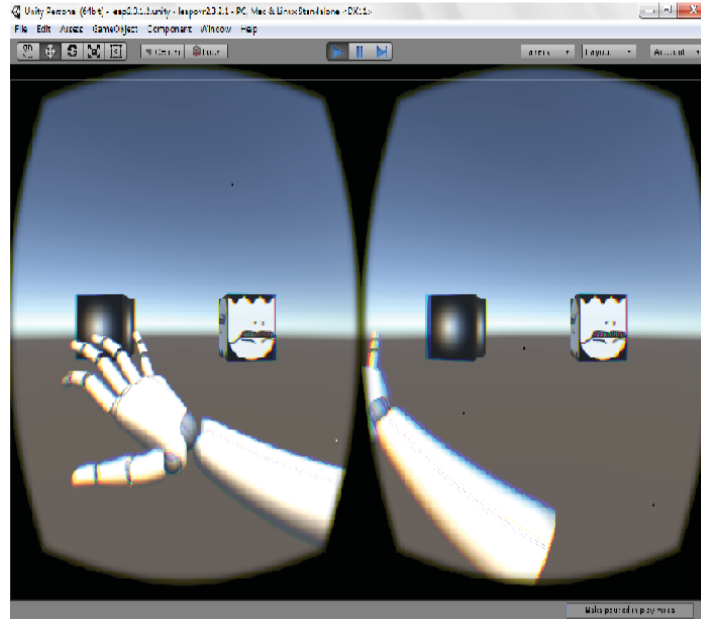


Fig. 3 Dual Display for VR viewer



Fig. 4 Virtual Reality Viewer (HMD)

#### *D. Accessing files or folders*

To view and modify data in a remote computer or local computer, it is necessary to communicate with the device by sending and receiving information. In our project, information such as the basic file structure and hierarchy of the system will be retrieved. This information will then be converted into 3D models and displayed in the 3D environment where user can interact and modify them. Information transfer can either be for a local device or shared files on a remote device. This module is concerned with handling the different kinds of files like text documents, music files, audio files etc.

## IV. WORKING

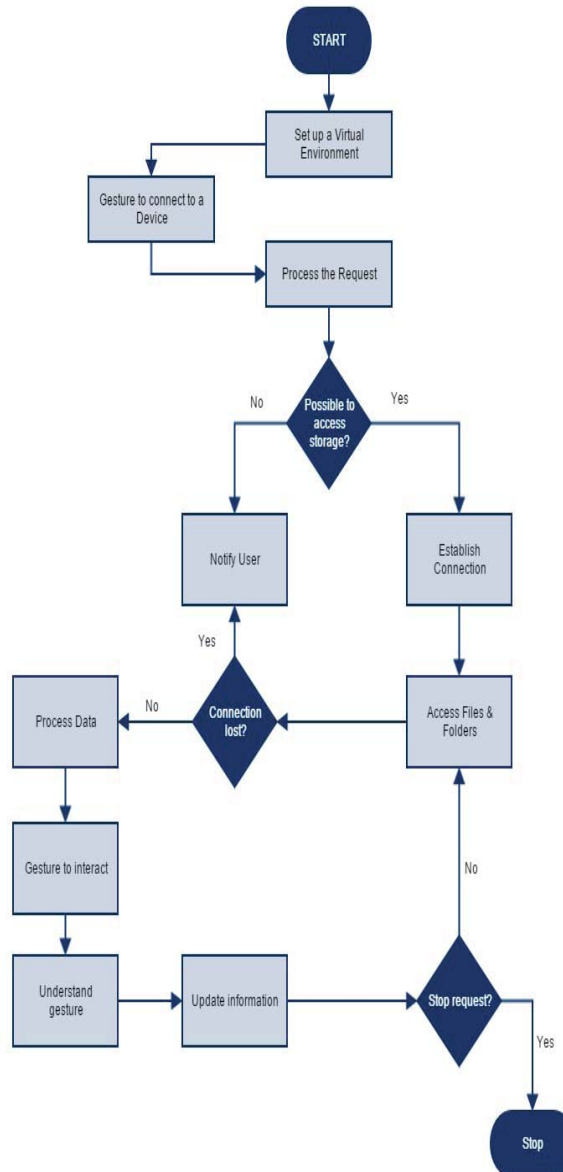
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Fig. 5 Flowchart

As shown in fig 5, first a virtual environment is set up. Then the user gestures to interact with the local/remote device. If the user wishes to interact with the remote device then a connection needs to be established. The processing device is responsible for establishing the connection with the remote device. If connection establishment is not possible then the user is notified else, user can further gesture to interact with the remote device. The user can interact with the help of various predefined gestures for accessing and handling those files.

**V.DESIGN DIAGRAM**

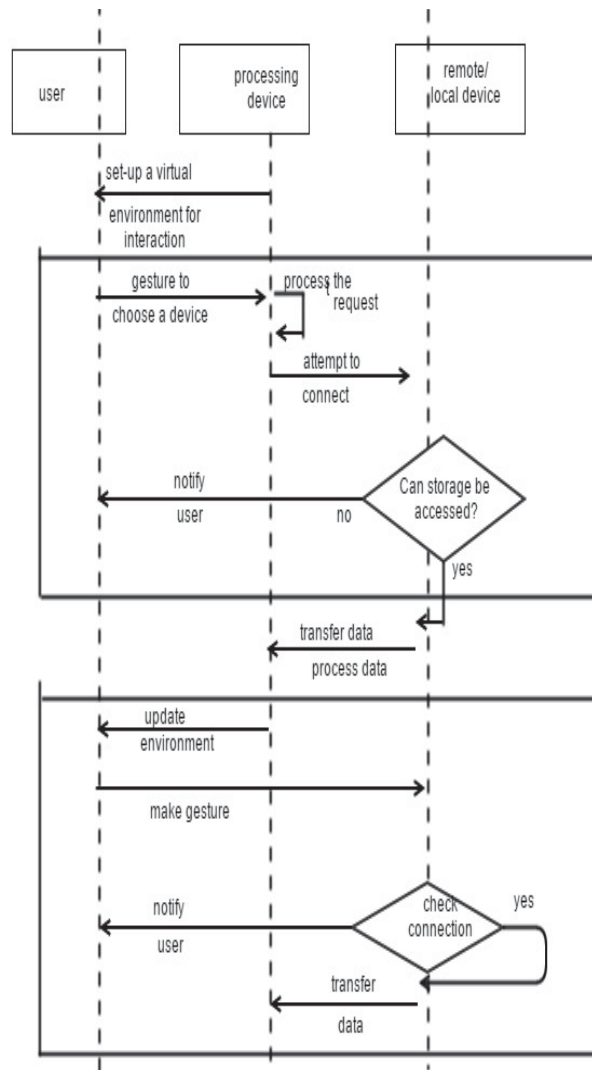


Fig.6 Sequence Diagram

The above figure illustrates the sequence of activities that occur between the user, processing device and the remote/ local device. Initially, the processing device sets up the virtual environment for the user. The user gestures which remote device he wants to access and the processing device processes the user's request. If connection establishment is successful then the transfer of data takes place and the 3D environment is correspondingly updated. User can then interact with the remote/ local device using gestures in a 3D environment that gets updated correspondingly. The connection can be terminated using gestures.

## VI.CONCLUSION

The project thus comprises of 2 main modules i.e. virtual environment with a VR viewer for an immersive experience and the detect and access device modules. These modules in turn have 4 sub-modules, 3D user interface comprising of 3D objects representing the files and folders of a device, hand tacking module consisting of leap motion controller which tracks the gestures made by the user, finding devices on the network that searches and displays all the devices connected on a local area network and the access files and folders module for information retrieval, processing the data and performing file operations.

This 3D gestural interface is being created for the VR devices like Oculus Rift. Currently, Oculus Rift does not have it's own processor or memory and therefore, needs to be connected to a computing device. However, research is going on in this field to make the Oculus Rift an independent computing device. If the Oculus Rift becomes an

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independent device, this leap motion based gestural interface can then be the intermediary between the user and Oculus Rift much like an operating system.

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