ISL DETECTION USING LEAP MOTION TECHNOLOGY

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ABSTRACT

The conventional methods of providing an input to the computer, The Leap Motion technology offers user to present the input by the progression of fine grained gesture reorganization and Hand Tracking. The Leap Motion is an innovative, 3D motion capturing device designed especially for hand and finger tracking with precision up to 0.01mm. The Leap motion technology is useful in many applications which can be scheming, modeling, melodious interaction and expression etc. In this paper, we hereby present an analysis of the system, its working, implementation and its related aspects. The result implements in promising in their contexts but requires a variety of changes due to its physical as well as logical challenges to be conquered. The gestural implementation of this system is an advantage by which various applications to be accessed.

Keywords: Gesture Reorganization, Grained Gesture, Hand Tracking, Designing, Modeling, Musical Interactions.

I.   INTRODUCTION

In today's world the Leap Motion technology is a best fit to modernize the daily operations computing. Leap Motion is a 3D motion sensing technology perfect for use for various purposes of input. The technology is encapsulated in a small device comparable to the size of a USB flash drive. The leap motion controller is associated to the system by using USB and utilized by means of free software found online.

Due to its simplistic design, Leap Motion technology would be easy to integrate with the existing technology. While it would be simple to implement, it would drastically improve the current capabilities of the input devices.

Have you ever wondered what it would be like if you could simulate a surgery for students using your very own hands but not incurring the cost of surgical Equipment? Or even you may have not imagined ever of checking out all the modules of a machine just by simulating its design and not paying the cost if the damage caused. The major focus of using this technology is that you will be able to do all the things by your own hands. This is the exact place where the Leap Motion technology comes into picture. Simply by using 3 infrared LEDs and cameras, the device pinpoints the location of not only all 10 fingers, but also the joints and palms of the hands to 1/100th of a mm [1]. The location and movement of the hand is then tracked at 200 frames per second and relayed to the attached computing device. The user can move their hands within 8 cubic feet of the device in up and down, side to side, and in and out motions likewise in real life.

Purpose

The main purpose of the system is to reside the conventional method of inputs such as input by keyboard, mouse, joystick etc. should be switch to the real world input processing such as input by hands. Using the real life input methods in the implementation of the process of computing was the initiative. On other hand, implementing such technology in various applications so that human interaction is made to be achieved was the another aspect. The upcoming technologies at that time were holding the concepts like gestural interface, 3D gaming, human interaction etc. so on that concepts, The Leap Motion technology was the best idea to be developed [1][4][5].

Scope

We can state that technology's true potential is good, and that it is progressing gracefully. But as there exists a new research or a new technology, its good as well as bad impacts are always the points to be considered. In this technology, regarding the arm fringe, the motion sensitivity of the controller and other issues has grown up. But as the company is aware of it and as working on those issues, we may state that this technology has a very great future [1]. Leap Motion is taking steps forward regarding various issues like app development,

hardware improvement, pattern and gestural issues etc. Thus we may say the technology will reach its standards soon[9].

Model Diagram
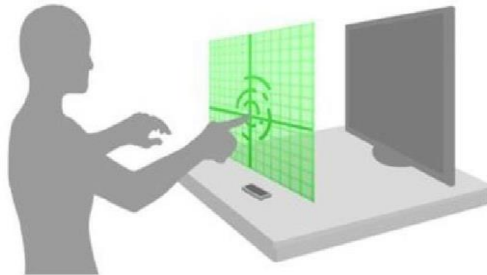
Figure 1: (Courtesy - Internet): Model Representation of Leap Motion Controller

II.   OVERVIEW

The technology specifies the use of Leap Motion controller for various fundamental applications of computing. The Leap Motion sensor is the core of the Leap Motion Controller. This senses the input provided even by the conventional input methods. The pattern for the given input is matched accordingly the gestures as applied and the system performs the desired work accordingly. Swiping, pinching, sliding, clicking, pointing, dragging, dropping, and other simple gestures are included in such gesture reorganization technologies. This technique offers a wide range of uses. The response given by the system is pretty good enough. But there exists still more improvisation to be done. Various examples on which the technology has been tested are as:

Leap Motion may be used effectively in games like Cut the Rope and Cyber Science Motion. If you haven't heard of Cut the Rope, it's a game in which you break ribbons to swing a piece of chocolate into mouth of a miniature green monster. I had a lot of fun and was able to beat the game once I figured out how much I needed to move my hand to cut away. Similarly, with Cyber Science Motion, I figured out how to manipulate the on-screen 3-D skull so I could view it from various perspectives, zoom in and out, and select and remove bits (including individual teeth).

III.   SYSTEM ANALYSIS

A. Existing System:

The existing systems include various related technologies that are used for these prospects. Like keyboards, mouse, joysticks, light pen, and touch input using various touch screen technologies. This includes use of these devices by users in interconnection to these devices [4]. For examples: When a user has to sketch a graph, it is done by using the clicking and dragging applications of the mouse. Or when the user wants to play a 3D game on a computer, the joystick needs to be connected for the better improvisation in the input. Even in various applications like presentation, the user may require to use multiple devices for single application. So Leap Motion has invented a device working on these aspects.

B. Disadvantages:

The existing systems of the inputs are having some disadvantages due to which some of the users may feel inconvenience of using it just because of some considerable aspects like time, reliability, methods of input, and other activities. This overcomes the invention of the technology like Leap Motion [4].

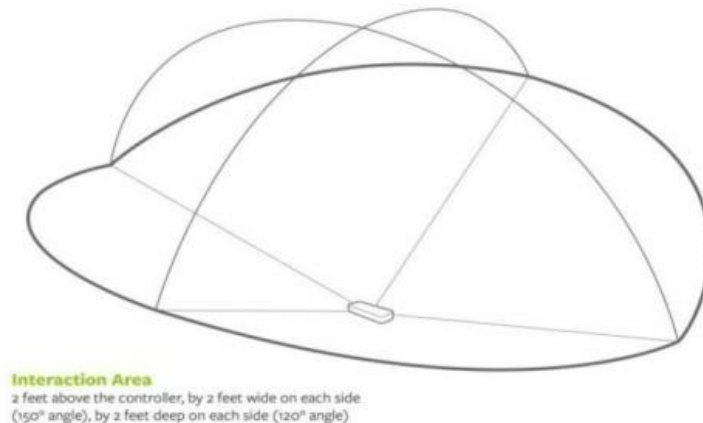Some of the major disadvantages accordingly the users are found to be as:

- The conventional hardware size is large.

- Primarily decoding for the combination is done, which is time consuming.

- Graphical inputs are not that handy and convenient as per the user requirement.

- Reliability of the existing system.

C. Proposed System:

The Leap Motion Technology allows the users to use the Leap Motion Controller which permits the input by means of some gestural interface by the users. The controller is actually the small rectangular device, no bigger

than a mouse, can be easily plugged into a computer system by means of the USB 3.0 interface. This controller becomes completely functioning after downloading a required software program onto your computer system [8].

This controller is able to recognize the position and movement of the user's hand. This gives user a functionality to give an input to the system using gestures. The controller detects the position and motion of the user hand with a precision of 0.01mm within an eight cubic foot volume of the space. This means every finger's motion can be detected above the device within a space the size of 33 inch screen in a square box. The controller may recognize any gesture selected by the respondents with their fingertips, wrists, or pinching, waving, and any other action, as well as other distinct components like pens and pencils. The actual computer software then translates these motions into actual commands used for the further computing purpose [1][3].

Interaction Area
2 feet above the controller, by 2 feet wide on each side
(150° angle), by 2 feet deep on each side (120° angle)

Figure 2: (Courtesy - Internet): Leap Motion Controller's interaction area.

The required software, its related applications etc. can be easily downloaded from the app store of Leap Motion website. Air space store allows you to download all the essential aspects like applications, software for functionality of the controller, and even a development kit for the programmers which allows the programmers to develop and invent new applications for the Leap Motion Controller [1].

D. Advantages:

There exist many advantages of this Leap Motion Technology out of which, some are as:

- This is the most affordable technology from the early years of 2013.

- Uses USB 3.0 interface which makes its connectivity easier.

- More accurate than mouse.

- As reliable as keyboard.

- Gives user a 3D control with natural hands and gestures.

- Nearly 200 times more sensitive than a touch screen interface.

- Works with Windows vista/7/8 and even with Mac OSx and Linux.

- Leap Motion Controller device is 200 times accurate than any other device available in the market [4][9].

IV.   SYSTEM COMPONENTS AND OTHER ASPECTS

A. The Leap Motion Controller:

After looking forward to this technology, the considerable thing was the user interaction about the Leap Motion Controller. The controller actually is "bent-sheet- metal-and-beige-plastic" aesthetic. This is actually brushed aluminum minimalist design. Externally the controller has LED window at a side end and data port at other end.

The top surface of the controller is of a smooth plastic which attracts the smudge. But the software warns the user to clear the smudge if there exists any. And at the underside of the controller, a rubber coating on which Company Logo and other things like warning are printed[6].

Figure 3: (Courtesy - Internet): Components of Leap Motion Controller

So now let's get into the detailed analysis for the hardware components of the controller. The dimensions specified for the controller are 6.2mm thick, 75mm long, and 25mm wide. The controller is connected via a USB 3.0 port having a micro-B connector. In reality, connecting the controller to the system via the USB 2.0 port may have no effect on anything other than the frame rate. Three LEDs are placed inside for the wide coverage of the area covered for user interface. The controller has a function called dynamic LED driving that prevents the imagers (users) from being saturated and maintains great data quality. This feature allows the LEDs to dim as the user gets closer.. The LEDs in the controller are visible barely to the naked eyes. The current ranges from 200mA to 32mA in Leap Motion Controller [6].

In addition to these two LEDs, the controller contains two sensor elements and an IC. The IC is just a 32Mbit serial NOR flash in an 8 pin SOIC package. Underneath it, there is a PCB together fixed with the LEDs. In upper left corner, there is a three point serial port RX, TX and GND with a signal 3.3V. At upper right corner, the power circuit supply is provided. The back side of the PCB has fewer but the larger components. There are two tantalum capacitors, a large surface mount MOSFET, a fine pitch dual row connector to the second PCB and the brains of operation [6].

Figure 4: (Courtesy - Internet): Leap Motion Controller PCB

A. How the Technology Works:

As we all now know the Leap Motion Technology is an interface between the user and the computer system for the various input purpose. So let us now understand how this technology actually works? And how this technology turns into its implementation. So at very first the controller is bought up and plugged in to the computer system. After it, the essential software are installed to the system. So now after installing the software, the system is in coordination with the controller and the user for accepting the inputs [6][8].

The heart of the device has two cameras and three infrared LEDs. These track the infrared light with a wavelength of 850nm. And this wavelength is actually outside the visible light spectrum. Due to the wide angle lenses, the device has interaction space of about eight cubic feet which can be considered to take a shape of an inverted pyramid. Due to the LED light propagation through space, the controller's viewing range has a limit if

60mm (2 feet) [8].

The device's USB controller reads the sensor data into its local memory and performs the necessary resolution if required. The data is then streamed through the USB to the motion tracking software [8].

For the required output, substantial mathematical operations must be done on the data once it has been transmitted to the computer. The raw sensor data is processed by the Leap Motion Controller using a sophisticated algorithm. The Leap Motion Service is software on a computer which processes the images after compensating the background objects. The tracking layer matches the data at next to extract the tracking information such as fingers and tools. The tracking algorithm does this correctly with analyzing the position of the objects. The Leap Motion approach feeds the outcome after using several filtering procedures in the forms of snapshots, or series of frames containing all the data into transport protocol through which the services connects to the Leap Control Panel and the native web client libraries, using a local socket to get in connection with leap.. This data is then organized into an API so that further oriented results are to be generated. So by this process, the Leap Motion Controller works and generates the output results accordingly the user inputs [5][6][8].

V.   APPLICATIONS OF THE LEAP MOTION TECHNOLOGY:

There exist various fields onto which we can apply this technology. But some of which, where this technology is really applicable can be given as:

a. Medicine:

The Leap Motion Controller is compatible with high-tech medical computers. By calibrating the equipment, doctors are able to undertake exceedingly intricate and delicate operations. This can also be used to guide remote cameras across sensitive parts of the body without having to touch or exert mechanical pressure on the patients. [1][9].

Figure 5: (Courtesy - Internet): Leap Motion Technology in Medical implementation

b. Household:

General household operations such as turning on and off the lights, accessing the television and other electronic gadgets etc. can be easily performed by having a set up environment of the Leap Motion technology at the house [1][9].

c. Entertainment:

By considering the real potential of the Leap Motion Technology, this device is very useful in the various entertainment purposes like gaming. The Leap allows users control characters in AR gaming by combining the controller with augmented reality. Controlling the radio devices like cars, bikes, boats, planes etc. in AR gaming becomes physical which gives more accuracy [1][9].

d. 3D Modeling & Graphics:

Leap is the only device that supports a full-fledged control of a 3D object on all the three axes. For the purpose of the 3D modeling and designing purpose, the Architects and Designers have been benefited by this technology. They can turn, transform and even interact with the models of their designs without using a 2D controllers like keyboards and mouse [1][2][9].

Figure 6: (Courtesy - Internet): Leap Motion Technology in 3D Modeling

e. Manufacturing:

This technology is really helpful in the industries that do not rely on fully automated methods. Leap Motion Controller can allow better control, improved accuracy, and finer details for operating heavy machinery and robots in an industry[1][2][9]

VI.   CONCLUSION

Thus at the end of this research, a conclusion is meant to be done as The Leap Motion Technology is the one of the best Motion Control Gestural Interface Technology. The technology thus uses the Leap Motion Controller as a Hardware interface and Leap Motion Software Environment for its operational purposes. There exists a verity of applications and supports for this technology and further implementation and changes being performed. The technology was proposed at first by an American company Leap Motion Inc. by the founders Michael Buckwald and David Holz in 2010. The technology is rising upon its potentials and is being accepted drastically by the users. This technology is a new step in the field of Virtual Reality and has a better scope. The developer's support and development facility provided by the company is one of the major aspects to be considered.

VII.   REFERENCES

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