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TOUCHLESS TOUCH SCREEN USER INTERFACE

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Abstract— **Touch screens were responsible for creating a great future to the technology at an alarming rate. We have to face many problems while working with the touch screen and end scratching up on the screen. The result, by frequently touching a touch screen display with the help of a touching device is that it depicts that there is a gradual dullness or de-sensitization of the touch screen to the input. This could result in a failure of the touch screen. To avoid this problem a simple user interface is being developed for Touch less control of electrically operated equipment is being developed. Elliptic Labs innovative technology lets us to control our gadgets like computers, Mp3 players or mobile phones without touching them. A simple user interface for Touchless Control of electrically operated equipment. Unlike other system which gradually depends on the distance from the sensor or this system depends on the hand, finger motion, a hand wave in a certain direction, or a flick of the hand in one area, and holding the hand in one area towards which we are pointing with one finger for example, The device is based on optical pattern recognition using a solid state optical sensor with a lens to detect hand motion. This sensor is then connected to a digital image processing; this interprets the patterns of motion and output the result as signal to control fixtures, applications, machineries, or on any other device which is controllable through electrical signal. In this paper, we are introducing about various touchless touch screen technology methods and its various types and discussed about one of the implemented touchless touch screen technology i.e. leap motion Controller is a device that connects with a user's interface to Manipulate digital objects with hand motions. Working with other hardware the controller adds a new way to interact with the world.**

Index Terms— **Touch Screen, UI, GBUI, SDK, Display, Screen, Technology, Touch, Leap Motion Controller.**

I. INTRODUCTION

The touch less touch screen sounds like it would be nice and interesting, however after closer testing it looks like it could be quite a trial. The unique screen is made by TouchKo, White electronics Designs, and Grope 3D. The screen resembles the Nintendo Wii without the Wii controller. With the touch less touch screen our hand doesn't have to come in contact with the screen at all, it works by detecting our hand movements in front of it. This is a pretty unique and interesting invention, until we break out in a sweat. Now this technology doesn't compare with the hologram-like IO2 technologies Helio display M3, but this is applicable for anyone who has 18,100 dollars laying around. Most of the time we have to wipe the screen to get a better modest view of the screen. In this technology we have to simply point our finger in the air towards the device and move it accordingly to control the navigation of the device.

Fig 1-Touchless gesture

II. WHAT IS TOUCHLESS TOUCH SCREEN

It is also called as "Touch-me-not" technology. The screen resembles the Nintendo Wii without the Wii controller with the touch less touch screen with the help of our hand. We probably would not see these screen folk stores in recent times . Everybody loves a touch screen, the experience is really exciting. When the I-phone was introduced, everyone felt the same. But gradually, the excitement started fading. While using the phone with the fingertip or with the stylus the screen started getting lots of finger prints and scratches. The system is capable of detecting movements in 3-dimensions without putting our fingers on the screen. Their untested touch less interface doesn't require any special sensors that we wear on our finger or either on our hand . We have to just point at the screen (from as far as 5 feet away), and we can easily manipulate objects in 3D.

III. ANALYSIS

It obviously requires a sensor but the sensor is neither hand mounted nor it is present on the screen. The sensor cam is to be placed either on the table or near the screen. And the hardware setup is so compact that it can be fitted into a tiny device like a MP3 player of an object from as 5 feet.

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IV. WORKING

Sensors are mounted around the screen that is being used, by interacting with the line-of-sight of these sensors the motion is detected and interpreted into on-screen movements. There is a stop unintentional gestures being used as input that are not completely clear, but it looks promising nonetheless. The system is capable of detecting movements in 3-dimensions without ever having to put your fingers on the screen. Their patented touch less interface does not require that we have to wear any special sensors on our hand . We have to point fingers at the screen and manipulate object in 3D.The best part of Touch less touch screen is elliptical lab that the technology will be easily small enough to be implemented into mobile and everywhere.

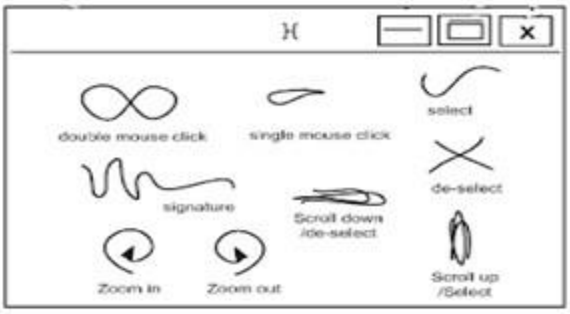

Fig 2 All types of Touchless movements

V. TOUCH LESS MONITOR

Designed for applications where touch may be difficult, such as for doctors who might be wearing surgical gloves, the display features capacitive sensors that can read movements from up to 15-20cm away from the screen. Software translates gestures into the screen commands. The monitor based on technology from TouchKo was recently unproven by White Electronic Designs and Tactyl Services at the CeB.Touch Screen interface are boundless, but all that touching like foreplay, can be little bit of a effort. The input method is well in the thin air.

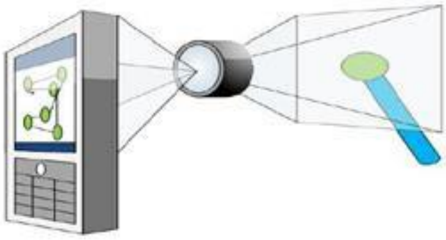

FIG. 3 TOUCHLESS SCREEN PROJECTION

The technology detects motion in 3D and requires no special worn sensor for operation. By simply points to the screen of users and user can manipulate the object being displayed in 3D. In touchless touch screen sensor is required but the sensor is neither hand mounted nor present on the screen The sensor can be placed either on the table or near the screen and the hardware setup is so connected to the tiny device such as iPod or MP3 player or a mobile phone.

VI. GBUI

We have seen the futuristic user interfaces movies like Minority Report and the Matrix Revolutions where people wave their hands in 3 dimensions and the computer understands what the user wants and shifts and sorts data with precision. The GBUI as seen in the Matrix. The GBUI as seen in minority report Microsoft's vision on the UI in their Redmond Headquarters, it involves lots of gestures which allow us to take applications and forward them on to others with simple hand movements.

Fig 4Touchless GBUI

VII. TOUCHLESS UI

The basic idea described is quite clear , that there would be sensors arrayed around the perimeter of the device capable of sensing finger movements in 3-D space .The user could use his/her fingers similarly to a touch phone ,but actually without having to touch the screen, thats why it is so interesting.

Future technologies and research in human-computer interaction indicates that touch interaction and mouse input will not be the only broadly accepted ways clients will engage with interfaces in the future. The future will also be touch less. These emerging technologies will enable varieties & brands to create new forms of media and interfaces to capture the attention (and imagination) of their audiences. They will facilitate increased interaction with their products and media in new ways, helping drive brand awareness, adoption and commerce.

VIII. TOUCH LESS SDK

SDK stands for software development kit, it is typically a set of software development tool that allow the creation of application for a certain software package, software framework, hardware platform, computer system, video game or similar development platform to enhance application with advanced functionality, advertisements, push notification and more.

The Touch-less SDK is an open source SDK for .NET application. It enables developers to create multi-touch based application using a webcam i.e camera for input. As colour based markers defined by the user are tracked and their information is published through events to clients of the SDK. That enables "Touch without touching".

Using the SDK, developers offers the user a new and convenient way of experiencing multi-touch capabilities, without the need of expensive hardware or software. All the user need is a camera to track the multi-colored objective as defined by the developer to use any webcam.

IX. TOUCH- WALL

Touch wall refers to the touch screen hardware setup itself, the corresponding software to run Touch wall which is built on a standard version of vista, is called Plex. Touch wall and Plex are superficially similar to Microsoft Surface, a multi-touch table computer that was introduce in 2007 and which recently became commercial.

It is a fundamentally available in select AT&T stores. Simple mechanical system, and is also significantly cheaper to produce. While surface retails around 10,000 dollars to the hardware, to turn almost anything into a multi-touch interface for Touch wall is just hundreds of dollars.

Fig 5 Touchless wall

Touch wall consists of three infrared lasers which scan a surface. A camera notes when something breaks through the laser line and feed that information back to the Plex software. Earlier prototypes were made which is simple on a cardboard screen. A projector is used to show the Plex interface on the cardboard, and a system works fine with that. Touch wall certainly isn't the first multi-touch product we have seen in iPhone. In addition to surface and of course there are a number of early prototypes emerging in this space Microsoft has done with a few hundred dollars' worth of reality available hardware is spectacular. It is also clear that the only real limit on the screen size in the projector which is the entire wall, can easily be turned into a multi touch user interface. Scrap those white board in the office and makes every flat surface into a touch display.

X. NINE MINORITY REPORT INSPIRED TOUCH LESS TECHNOLOGY:

A. Tobii Rex:

Tobii Rex is an eye-tracking device from Sweden it is a new technology, which is used to sense the user's eye which works with any computer running on Windows 8. The device has a pair of infrared sensors built in that will track the user's eyes.

B. Elliptic Labs:

Elliptic Labs allows us to operate our computer without touching it with the Windows 8 Gesture Suite.

C. Air writing

Air writing is a technology that allows us to write text messages or compose emails by writing in the air.

D. Eyesight

Eyesight is a Gesture technology which allows us to navigate through our devices by just pointing at it.

E. Mauz

Mauz is a third party device that turns our iPhone into a track pad or mouse.

F. Point Grab

Point Grab is something similar to eyesight, which enables users the to navigate on their computer just by pointing at it.

G. Leap Motion

Leap Motion is a motion sensor device that recognizes the user's fingers with its infrared LEDs and cameras.

H. Myoelectric Armband

Myoelectric armband or MYO armband is a gadget that allows us to control our other Bluetooth enabled devices using our finger or hands.

I. Microsoft Kinect

It detects and recognizes a user's body movement and reproduces it within the video game that is being played.

XI. LEAP MOTION TECHNOLOGY

The Leap Motion controller is a sensor device that aims to translate hand movements into computer commands. The controller itself is an eight by three centimeter unit that plugs into the USB on a computer. Placed face up on surface, the controller senses the area above it and is sensitive to a range of approximately one meter. To date it has been used primarily in conjunction with apps developed specifically for the controller. One factor contributing to the control issues is a lack of given gestures, or meanings for different motion Controls when using the device, this means that different motion controls will be used in different apps for the same action, such as selecting an item on the screen. Leap Motion are aware of some of the interaction issues with their controller, and are planning solutions. This includes the development of standardized motions for specific actions, and an improved skeletal model of the hand and fingers.

A. A LEAP MOTION EXPLORATION

A Leap Motion controller was used by two members in conjunction with a laptop and the Leap Motion software development kit. Initial tests were conducted to establish how the controller worked and to understand basic interaction. The controller is used to tested for the recognition of sign language. The finger spelling alphabet was used to test the functionality of the controller. The alphabet was chosen for the relative simplicity of individual signs, and for the diverse range of movements involved in the alphabet. The focus of these tests is to evaluate the capabilities and accuracy of the controller to recognize hand movements. This capability can now be discussed in terms of the strengths and weaknesses of the controller.

B. THE STRENGTHS OF THE LEAP MOTION CONTROLLER

Strength of the Leap Motion controller is the accurate level of detail provided by the Leap Motion API. The API provides access to detection data through a direct mapping to hands and fingers. Data provided by the API is determinate in that a client application does not need to interpret raw detection data to locate hands and fingers.

Fig 6 Leap API Output data

The API recognizes one hand with five digits. This contrasts with other available 3D sensory input devices, such as Microsoft Kinect - where sensory data is returned in a raw format, which must then be cleaned up and interpreted. The benefit of strong API preprocessing is that error reduction can be abstracted away from client applications meaning client applications can be built faster and with consistently accurate data. The granularity of the Leap Motion controller is an asset toward detection signs. The controller can consistently recognize individual digits in a hand .Being able to identify, address and measure digit and fingertip location and movement is critical for accurately tracking of sign language motions. The controller is also capable of tracking very small movements, another essential capacity for accurate sign language recognition. While the technical specifications for the Leap Motion controller cite a range of up to one meter, in our testing we found that the device performs accurately within a field-of-view approximately 40-45 cm from the front and sides of the device. Many signs depend on hand movements around the upper torso, and the closeness and field of view for the controller is an asset for this need.

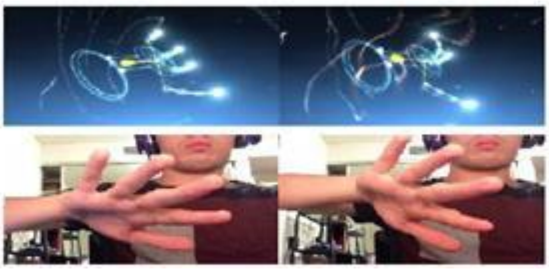

Fig 7 -Line of sight problems

Fig 8- Hand on side

When the hand is tilted completely on its side, the controller is unable to detect it, as shown in Figure8.

Accurately tracking of even the most basic of signs is difficult as this requires assumed the position of fingers that have an indirect or obscured line of sight for the Leap Motion controller. The controller loses recognition capabilities when two fingers are pressed together, come into contact or are in a very close proximity. The closer two fingers become the more inaccurate and jumpy the overall detection becomes.

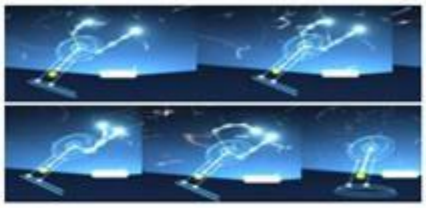

Fig 9- Progession of pinching movement

Figure 9 illustrates detection of a thumb and finger pinching together on the left hand. Initially (in the first two frames) detection is smooth, but as the finger tips get closer together the finger's detected position jumps erratically (frames 3 and 4). Finally when the fingers touch they are unable to be detected at all, leaving just a fingerless hand in detection. This limitation makes it extremely hard to make an accurate recognition of a sign. Within the alphabet, only one of the 26 characters does not involve touching fingers (the letter C). As mentioned previously, we found that the Leap Motion controller operates in a 3D box of around 40cm around the device. It is notable that accuracy of the detection is lost closer to the edge of the detection area. Many signs require complex combinations of hand actions as well as gestures that involve parts of the body and face. Leap Motion API can be limiting and underdeveloped at times. While the API supports multiple platforms, without multiple iterations of the platform or a significant time in the marketplace, API functionality and data is often limited. A specific API issue is that hand data is non-modifiable. The API stores detected information in a constructed data type called Leap Hand. Leap Hand is not modifiable and as such there is no easy way to potentially correct detected data. A client application would need to create a custom cloned Leap Hand data type to store modifiable data that the client application could then use.

C. FUTURE POSSIBILITIES

1) Inferencing

In an attempt to overcome the device's limitations particularly in regards to hand rotation and digits
touching, it may be possible to infer the location of fingers, fingertips and movements in periods where we are able to assume the fingers are still present but the controller is failing to detect them. For example, if we're making the sign for 'A' by touching the right index finger to the left thumb, at the point of contact the device would lose sight of both the index and thumb, however the other digits being detected would remain relatively stationary. At the point when contact is broken detection of the index and thumb would resume fairly close to where it was lost at the point of contact.

Downside of this strategy is that sign recognition would need to be delayed until after the fact when we have assessed inferences like digits touching and digits dropping in and out of signal, potentially delaying real time feedback.

D. USING AN ARTIFICSL NEURAL NETWORK

Using an Artificial Neural Network with the controller to recognized symbols is possible provided that each symbol is trained before use and attempted recognition. The network would then be able to assess a symbol and output with a degree of certainty that a particular sign is correct (between 0 and 1).

This is a good way to assess data provided by the Leap Motion API as the network will input training data without finite limits or expectations on the data format, or recognition state and end points, instead considering only the differences in training data. An obvious drawback is that a training data set is required and additionally that a user not proficient would be unable to train the network with accurate signs for later accurate recognition. It may be a possible solution in a school setting, where a teacher could provide the training data set. Using a training set would require a defined start and stop point for gestures (perhaps an idle hand position). While this is acceptable when recognizing signs individually, it would not be able to be used in a conversational setting, where many signs can often be strung together without clearly defined start and stop positions.

XII. ADVANTAGES OF TOUCHLESS TOUCH SCREEN

a. Screen would be durable for long period of time.

b. Since the screen is touchless, it will always be clear, thus giving a clear display.

c. The GUI requires lies space since commands se accepted using sensors like verbal or hand-gestures. So, the touch area is minimized; thus increasing the screen text content.

d. If not using the verbal sensors, touch sensors are placed so that the device gets instructions by specific movements of hand/fingers.

e. It makes the work simplest when it comes to drag and drop the files to specific locations.

f. When heavy games are played that require continuous screen touch, the risk of screen damage in this case is lowered to greater extent.

g. And most importantly, in weathers like rainy and winters, hand being wet or with gloves won't matter,since the hand and finger judgement is sensed by the sensor.

CONCLUSION

Today's thoughts are again around user interface. Efforts are being put to better the technology day-in and day-out. The Touchless touch screen user interface can be used effectively in computers, cell phones, webcams and laptops. May be few years down the line, our body can be transformed into a virtual mouse, virtual keyboard Our body may be turned in to an input device! It appears that while the device has potential, the API supporting the device is not yet ready to interpret the full range of sign language. At present, the controller can be used with significant work for recognition of basic signs, However it is not appropriate for complex signs, especially those that require significant face or body contact. As a result of the significant rotation and line-of sight obstruction of digits during conversational signs become inaccurate and indistinguishable making the controller (at present) unusable for conversational However, when addressing signs as single entities there is potential for them to be trained into Artificial Neural Networks.

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