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Touchless Screen Technology

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Abstract **— Before the Touchless Screen there was Touch screen technology which initially created a great furore. The Touch screen enables the user to interact directly with what is displayed, rather than using any other intermediate device. But it has some demerits like screen may get damaged. Also the frequent touching to a Touch screen display with a pointing device such as a finger or stylus can result in gradual de-sensitization of Touch screen to input & can ultimately lead to failure of the Touch screen. To avoid these problems, a simple user interface is developed for Touchless control of electrically operated equipment. Elliptic Labs innovative technology have developed gadgets like Computers, MP3 players or mobile phones without touching them. Unlike the other systems which depend on the distance to sensor or sensor selection, this system depends on hand or finger movements, a hand wave in a certain direction, or a flick of the hand in one area, or pointing with one finger i.e. according to user's gesture. The device is based on optical pattern recognition using a solid state optical matrix sensor to detect hand motions with the help of lens. This sensor is then connected to a digital image processor (DIP). DIP interprets the patterns of motion and outputs the results as signals to control fixtures, appliances, machinery, or any other devices which are controllable through electrical signals.**

Key Words **— Touch screen, UI, SDK, Display, Screen, Technology, Touch.**

I. INTRODUCTION

Touchless screen enables you to turn any suitable surface into a multi-touch but without actual touching the surface by harnessing the power of the cameras on the Kinect or Primesense (OpenNI) sensors. It requires maximum of four sensors to extend the size of the touchable area and to increase accuracy when many people are using the same surface. Possible usages includes adding a touch screen support for a front/rear projected screen, by making a projected white board touch-enabled, or for a cheaper way to enable touch support on large format displays. For most of the applications only a single sensor is required. For larger multi-user and multi-touch applications you may find the need of more than one sensor. One sensor can detect all 128 touch points but this is probably physically impossible, thus the user need support for upto 4 sensors. The software does not mind which sensors are installed, so that you can have a combination of different compatible hardware**.**

The touchless 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 the TouchKo with White electronics Designs and Grope 3D. The touchless screen resembles the Nintendo Wii without the Wii controller. Actually with the use of touchless screen our hand doesn't have to come in contact with the screen at all, it works by detecting our hand motions in front of it. In this technology, we have to simply point our finger in the air towards the device and move it accordingly to control the navigation in the device.

II. LITERATURE REVIEW

The Age Of Touchscreen Is Soon To Be Over.

About six-seven years ago, HP began working on a ginormous touchscreen display for their PR firm's Manhattan offices. Their resulting product, called the Wall of Touch, was such a hit that it has found its way into the workplaces of other selected clients, with more on the way. Ironically, despite its name, one more things that makes the Wall unique is that users don't have to actually touch it.

The Wall of Touch is made up of maximum nine 43 to 46-inch, 1080p panels. As only one big panel would require rear projection and also a translucent screen material that would compromise resolution, HP decided not to go with that. The Wall is driven by an HP Z800 workstation, essentially making the wall a huge HP Touch Smart computer. Built-in optical cameras and a magnetic strip helps to detect if the users are nearing to it, thus the lack of needing to actually touch the screen. If users can't reach the corners, it still works with the help of a mouse or keyboard.

The best and the most common technology that we have so far is the touchscreen technology. And soon it became more popular. The popularity of smartphones, tablets, laptops and other different types of electronic gadgets were the main reason behind driving of demand and acceptance of common touchscreens for portable and functional electronics. Everyone loves the touchscreen and when you get a gadget which operate with touchscreen the experience is really exhilarating. When the I-phone was introduced, everyone felt the same but gradually the exhilaration started fading. While using the phone with finger tip or with the stylus, the screen started getting lots of finger prints, scratches, damaging of screen, etc. Thus the idea was develop of making the screen touchless and controlling the navigation in device without touch by simply pointing the finger in air. Now it seems like the touchscreen will soon be taken over with the touchless technology. This was proved with Microsoft releasing their kinect technology. No one ever thought that this would be big enough to compete

with the touchscreen technology. According to the latest news, the opinions are beginning to change.

According to the BBC, XTR3D, an Israeli company is now planning to launch smartphones and tv's with a touchless technology. With this new technology people will be able to change channels of their TV by just making a gesture with the hand without using any kind of remote controls. According to a XTR3D spokesperson, XTR3D's technology has all the advantages of a 3D camera – it can work in broad daylight, is much cheaper and uses a lot less power. It can be installed on any consumer electronics device. And the best part is, this is not just a research, the company is expecting to release the first motion control smartphone to the market, early next year.

III. PROPOSED SYSTEM

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

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. Touchless interface does not require that we have to wear any special sensors on our hand for navigation control. We have to point fingers at the screen and manipulate object in 3D.The best part of Touch less touch screen is that the technology will be easily small enough to be implemented into mobile and everywhere.

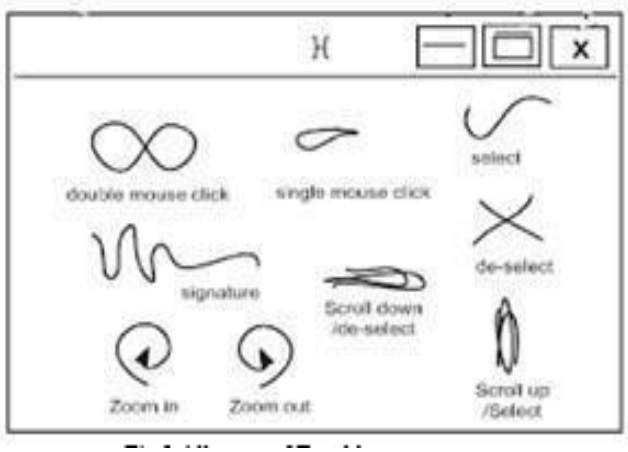
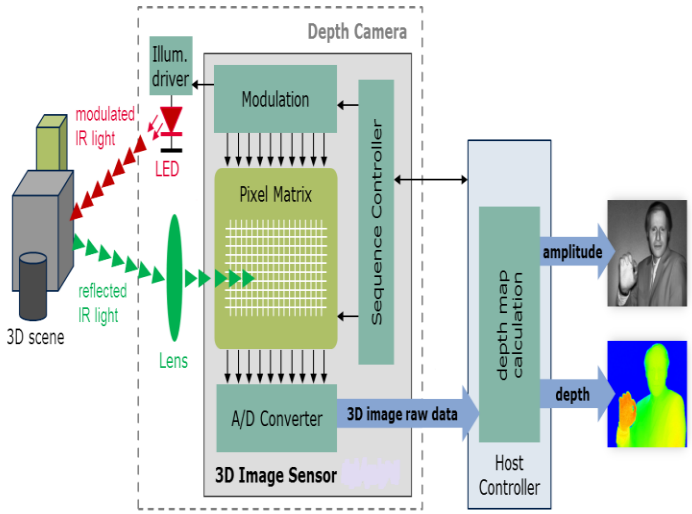


Fig A. 3D Navigation of Hand Movements in Touchless Screen

Sensors are mounted around the screen that is being used, by interacting in the line-of-sight of these sensors the motion is detected and interpreted into on screen movements. The device is based on optical pattern recognition using a solid state optical matrix sensor to detect hand motions with the help of lens. This sensor is then connected to a digital image processor, which interprets the patterns of motion and outputs the results as signals to control fixtures, appliances, machinery, or any other devices which are controllable through electrical signals. You just point at the screen (from as far as 5 feet away), and you can manipulate objects in 3D.

BLOCK DIAGRAM :

It consists of a IR sensors which are mounted near the screen. When the light strikes to the 3D object, the light gets reflected. It consists of a solid state optical matrix sensor with a lens which recognizes the optical pattern the hand motions with the help of that reflected light. In each of these sensors there are matrix pixels. Each pixel is coupled to photodiodes incorporating charge storage regions.
The reflected IR light enters to the sensors and hits the pixel matrix.



When the photon of sufficient energy present in the light strikes the photo diode, it create electron-hole pair. If the absorption occurs in depletion region, this carriers are swept from the junction by the built-in electric field of depletion region. Thus holes move towards the anode and electrons towards the cathode, and current is produced which results in the electric charge. Which is given by,

$$I = Q/t$$

Where,

I = Current
Q = Charge
t = time

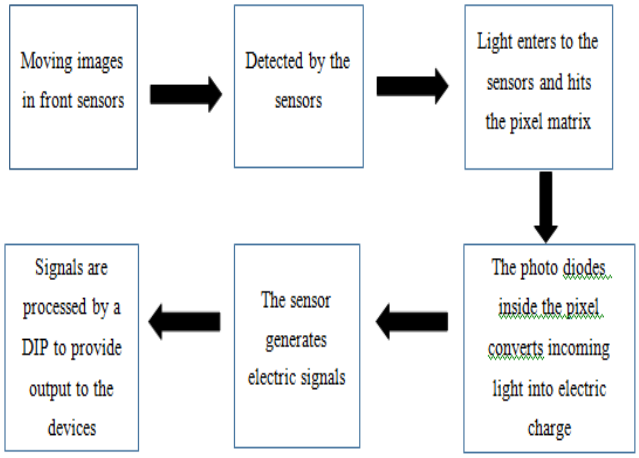
Thus, the sensor generates electric signals. This signals are in the form of analog. Thus these signals are converted into digital signals with the help of analog to digital converter for further processing.

The digital output of ADC (Analog to Digital Converter) is given to the host controller (HC). The host controller controls the transmission of packets on the bus. Frames of 1msec are used. At the start of each frame the host controller generates a Start of Frame (SOF) packet. To synchronize the start of the frame and to keep track of the frame number SOF packet is used. It also controls depth map i.e. an image that contains information relating to the distance of the surfaces of scene objects from a view point

Host controller gives its output to the sequence controller. Sequence controller controls the user actions and computer logic that initiate, interrupt, or terminate transaction. Sequence controller allow users to take initiative and control their interaction with the computer; try to anticipate user requirements and provide appropriate user control options and computer responses in all cases. The output of sequence controller is given to the both pixel matrix and modulator for controlling the action.

The digital modulator maps the input binary sequence of 1's and 0's to analog signal waveform. It modulates the digital output of sequence controller. Thus the 3D movement are detected and interpreted into the electric signals which are processed by the digital image processor to provide output to the devices, thus controlling the navigation according to the user's hand gestures. In this way the touchless screen technology works.

WORK FLOW :



IV. ADVANTAGES

- Screen would be durable for long period of time.
- Since the screen is touchless, it will always be clear, thus giving a clear display.
- The GUI requires lies space since commands are accepted using sensors like verbal or hand-gestures. So, the touch area is minimized; thus increasing the screen text content.
- If not using the verbal sensors, touch sensors are placed so that the device gets instructions by specific movements of hand/fingers.
- It makes the work simplest when it comes to drag and drop the files to specific locations.
- When heavy games are played that require continuous screen touch, the risk of screen damage in this case is lowered to greater extent.
- 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.

V. DISADVANTAGES

- Proper ambiance is required.
- Public interaction has to be monitored.
- Initial cost is very high.
- Used in sophisticated environment.

VI. APPLICATIONS

The applications of Touchless Screen Technology are :

- Touchless Monitor
- Touch Wall
- Touchless UI
- Touchless SDK

1. Touchless monitor :

It is specially designed for the 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 and software translates these gestures into the screen commands. The monitor screen is based on technology from TouchKo which was recently unproven by White Electronic Designs and Tactyl Services at the CeB. Touch Screen interface is boundless, but it needs actual touching to the screen which can be little bit of a effort. The input method is well in the thin air.

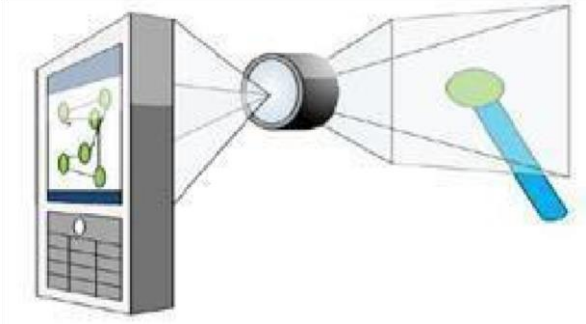


Fig1.1 Touchless screen projection

The technology detects motion in 3D. It does not require special worn sensor for operation. By simply pointing a finger towards the screen user can manipulate the object being displayed in 3D. In touchless screen, sensor is neither hand mounted nor present on the screen. It can be placed either on the table or near the screen and the hardware setup is much compact thus it can be connected into the tiny device such as iPod or MP3 player or a mobile phone.

1. Touch wall :

It consists of a touch screen hardware setup itself. The corresponding software require to run the Touch wall is built on a standard version of vista, 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. 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.

Fig2.1 Touchless wall

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.

2. Touchless User Interface (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.

Fig3.1 Touchless UI

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.

4. Touchless Software Development Kit (SDK) :

SDK stands for software development kit. It is typically a set of software development tool. It allow the user in creation of any 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 many 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 color 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".

Fig4.1 Touchless Software Development Kit

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.

CONCLUSION

Today's thoughts are again around user interface. Efforts are being taken to better the technology day-in and day-out. The Touchless screen technology can be used effectively in computers, cell phones, webcams, laptops and any other electronic devices. May be after the few years, our body can be transformed into a virtual mouse, virtual keyboard or 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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