

# An Implementation of Virtual Touch Screen using Kinect

Ayush Jain<sup>1</sup> and Monika Verma<sup>2</sup>

<sup>1,2</sup>HMRITM, DELHI

E-mail: <sup>1</sup>ayush19941994@gmail.com, <sup>2</sup>monika13verma@yahoo.com

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**Abstract**—Virtual Touch Screen using Kinect is a projection system that allows one to implement interactive touch applications. It provides the functionalities of a mouse. Touch screen surfaces are gaining more popularity, since they are capable of providing a more interactive interface. Our project defines a practical solution to achieve touch on any planar surface based on mounting a single commodity depth camera that is a Microsoft Kinect above a horizontal surface and using a projector for projection purpose. This allows to generate a response to touch. Kinect provides a cost effective and interactive way to obtain a virtual touch screen.

## 1. INTRODUCTION

A virtual touch screen (VTS) is a user interface system that augments virtual objects into reality either through a projector or optical display using sensors to track a person's interaction with the object. For instance, using a display and a rear projector system a person could create images that look three-dimensional and appear to float in midair. Some systems utilize an optical head-mounted display to augment the virtual objects onto the transparent display utilizing sensors to determine visual and physical interactions with the virtual objects projected.

In today's modern society it is difficult to imagine a world without the touch screen. It can be found in cell phones, computers, tablets and there is also research in flexible and curved touch screens. At first the input was done with help of a stylus, the screens were black and white, but now we have touch screens that spread over several meters. Touch screen has become popular because it is easy to use, allows the user to understand or know something without any reasoning process. The last decade cell phones had no buttons thus to type a text message a person had to click the same button several times to get the right letter but with the introduction of touchscreens it is possible to get all the alphabets on different buttons by using a qwerty keyboard. Touch screen has helped in reducing the users work thereby creating an innovation for developing applications (apps). Now days, there are apps that open on a single click of a button i.e. mails and news. However touch screens have many limitations. It can break into pieces when dropped to the ground also they cause scratches on the screen. The main question that arises in our

minds is what will the future bring? One of the possibilities are smart surfaces. Smart surfaces are a combination of a screen and a surface. This means that all the surfaces in the environment can behave like touch screens.

With the use of the developed application created using hand gestures in front of the projection.

Kinect and projectors are calibrated to 3D real world coordinates, allowing for projection of graphics correctly onto any surface visible by both camera and projector. Selective projection of the depth camera data enables emulation of interactive displays on un-instrumented surfaces (such as a standard table or office desk), as well as facilitates mid-air interactions between and around these displays. For example, after performing multi-touch interactions on a virtual object on the tabletop, the user may transfer the object to another display by simultaneously touching the object and the destination display. Or the user may "pick up" the object by sweeping it into their hand, see it sitting in their hand as they walk over to an interactive wall display, and "drop" the object onto the wall by touching it with their other hand.

Using sensing and display technologies like kinect to enable interactions directly above the interactive surface, but these are confined to the physical extent of the display. Virtual and augmented reality techniques can be used to go beyond the confines of the display by putting the user in a fully virtual 3D environment or a mixture of the real and virtual worlds. Unfortunately, to be truly immersive, such approaches typically require cumbersome head mounted displays and worn tracking devices.

## 2. SETUP FOR IMPLEMENTATION

### 2.1 The Interaction Zone

With the Kinect for Xbox 360 sensor, the program has calibrated a 1-3 inch interaction zone, depending on how far away the Kinect is from the display. Whenever your hand enters the interaction zone, it triggers the interaction. However, people with Kinect Xbox 360 sensors do not need to think about the interaction zone in order to have smooth

interactions. With the Kinect for Windows v2 and Kinect for Xbox One sensors, this interaction zone is less than an inch because the depth sensor in these cameras is more precise.



**Interaction zone**

The interaction zone is created by modeling 3d axis of the projection in the program and setting up the whole setup at particular readings of x y and z axis of the hand position of the projection.

#### Calibration

One-to-one mapping is present in traditional multi touch surfaces between the physical location that is being touched and the digital location on the display. This provides users with the feeling of directly manipulating the digital content underneath their fingers. To facilitate a similar interactive experience in the depth camera-based approach, map the depth camera scene to the projected display area.

Find the nearest neighbor between points in the frames and associate touch points in consecutive depth frames. Since the Kinect can record at a maximum rate of thirty frames per second, not all depth frames are necessarily used in tracking touches. Our system intelligently discards outlier depth frames thereby increasing robustness

Following are the computed distances for the setup Of projection display and kinect.

Max Screen Size	Kinect Distance
40.5 inches	30 inches
50 inches	40 inches
59.5 inches	50 inches
69 inches	60 inches
78.5 inches	70 inches
88 inches	80 inches

## Setup for touch projection

### 2.2. Power Point Presentation Control

One of the application areas of the gesture-based HCI interface developed in this paper is in presentation control. The simulation of the right-arrow and the left arrow of keyboard allow the presentation to move forward or go backward. Using the tracked X,Y,Z position of the head, the right hand and the left hand, two predefined gestures (Swipe\_Left and Swipe\_Right) are used for this keyboard simulation.

The Swipe\_Left gesture is recognized once the left hand is diverged 45 cm from the head which moves the presentation one slide backward while the Swipe\_Right gesture which moves the presentation forward is recognized once the right hand is diverged 45 cm from the head.



#### Results

## 3. CONCLUSION

From our research and tests we come up with the following conclusions. Firstly when working with the Microsoft Kinect the operating range of the Kinect needs to be kept in mind. If the Kinect is too far from the surface there is lack of precision. For this reason the Kinect is placed at a distance varying from 0.8m to 4m. Secondly, the Kinect cannot be very close to the surface otherwise the skeleton model received will not be very accurate and precise. The result is that the coordinates of the joints will fluctuate and thus it will be very difficult to place any application on the surface.

Another conclusion that can be drawn is that while calibrating it is possible to get accurate and precise transformations from camera coordinates to projection coordinates.

## 4. FUTURE WORK

The calibration can be changed to a calibration process which takes in account that hovering might be a possibility. Another change that would be a great improvement would be that the application adapts to the surface. If for example there is a round surface, that the application could appear as if it is glued to said surface. Another area that could improve is the hardware. At the time of writing, the release of the Microsoft Kinect 2 has been announced. If a better camera is used or if the camera were placed at a further distance from the surface, more precise interaction can be done. This would result in a

more suitable environment for several users to work on the same virtual touch screen. Another option which promises a bright future is 3D. At the moment there are 3D televisions, 3D computer screens, even 3D movies in the movie theatres. A smart surface with 3D would allow more interaction and intuitively. For example an architect is drawing a plan of a house on a virtual touch screen. It would probably greatly help the architect if he/she could see the building in 3D in or on the touch screen.

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