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Virtual Musical Instrument Based on Kinect: A Review

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ABSTRACT: Now-a-days, Human Computer Interaction is moving fast forward to the sixth sense technology and it also progressing rapidly. So using Touch technology in this paper, we present an application that create music using Microsoft Kinect sensor and to make a visual instrument for somebody who interested in music. The purpose of this paper work is to create a feasible interface for a large-scale surface touch screen on which we can create the virtual musical instrument and playing it by touching the surface. This paper analyses the mechanics of music conducting and to take experience of dealing a piece of music. This paper examines the sensors ability to accurately track touch motion across the screen. The Kinect sensor could recognize where the user was touching the surface and by using information of touch detected it produce sound of selected instrument. it will execute the code written for making sound of that particular musical instrument will control how the projection responded to the touch. This paper presents a review of playing music through Kinect and will guide as a source to the researchers.

KEYWORDS: Human Computer Interaction (HCI), Microsoft Kinect, depth camera, touch.

I. INTRODUCTION

Now a days, the development of human computer interaction technology expanding rapidly in various area such as industries and in day to day human life. Interaction between human-computer is very important and interaction in natural way is also spreading widely. There is requirement of interface which is intuitive and can also allow user to employ there potential. The matter of research is that which interface one should choose. The goal of this paper is to introduce with such technology and interfaces and also provide prototype for such interactive devices.

As Human Computer Interaction is now becoming a big thing in computer related fields which allows the human to communicate with machines [1]. Today we can use computers to do lots of things like play music, animations and games. Human-Computer Interaction (HCI) is a very popular subject all around the world. Human not only use a keyboard or mouse, but also use sensors to control computers. It explores the dimensions of research in which composition of music based performance with more advanced sensing device. And it is also sizzling topic of research and promising application area for music entertainment market.

Musical instrument can trace back to very long time ago when humans first make a simple flute. Now we can play lots of music instrument like guitar, bass, piano, etc. We can use Kinect sensor to create a new visual instrument by combining with MIDI technology, which can generate music or sound by a computer [2]. When human at specific position trigger an event to computer and computer play MIDI notes or melody. We can use Kinect sensor to create a new visual instrument by combining with new technology, which can generate music or sound by a computer.

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Touch Technology is also used for HCI to communicate with machine. In this project we use touch technology to play a different music instruments by making any flat surface a touch screen with the help of Depth camera [3]. With this Kinect Multi touch platform, it is possible to create a simple and affordable hardware system that detects not only multi touch input on the surface of the screen, but also detect hover hand gestures and distinguish individual users' inputs. Virtual Musical Instruments now become very popular since Kinect device had been created.

II. RELATED WORK

Ideally many researchers gave informal yet informative description on apparent relation between music and touch. Playing music in digital world is really a crucial step which specifies that all parts of world will want to be a part of digital world. Earlier playing musical instruments on screen with the help of keyboard buttons or mouse are carried out. Those applications are also very attractive as we used them in our comfortable place without any disturbance. Virtual instruments are computer programs that interact with real world objects by means of sensors and actuators and implement functions of real or imaginary instruments. In the field of music, the concept of emulating actual musical instruments is not exactly new. Since the 18th century, electronic musical instruments have become both more sophisticated and complex [9].

A. ELECTRONIC DRUMS

Drum kits, like many instruments, are too loud to play in most living environments. Drum sets are often large and cannot easily be transported. Currently there is existing solution to this problem is an electronic drums. Electronic drums, such as those shown in Figure 1, substitute drum pads for standard drums and produce sound electronically. Since electronic drums can be used with head-phones, they do solve the noise issues, but they take up just as much space as a real drum kit and are generally quite expensive.

Figure 1: A Roland electric drum kit.

B. REACTABLE MUSIC TABLE

In later rasearch reacTIVision software is used to create the music. reacTIVision which is a framework that sense component for reacTable like tangible electro-acoustic musical instrument[5]. For that it uses special design visual markers (fiducials) which are attached to physical object. When the fudicial block is kept on the table it will capture by

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the camera and then the captures image and give it to software called reacTIVision, then the reacTIVision detect that image as fudicial and then match it with the dictionary and identify the number on the fudicial then it given to the TUIO to further navigation on the basis of fudicial number the assigned music will get played[5]. Additionally, it attempts to create a real and rich synthesized sound as well as providing digital effects in order to further enhance the user experience.

Figure 2: reacTable music table with fudicial block placed on it.

III. PROPOSED METHODOLOGY AND DISCUSSION

The objective of this paper is to develop a new approach to the current problem of music playing. Microsoft Kinect sensor is used as the main interaction tool between human player and the surface to which we want to make a touch screen. As we have seen in above section, music in digital world will live in great impact.
This work should satisfy various conditions which are not fulfilled by other techniques:

- Usually the hardware required for detecting touch on any surface either costly or requires a lot of space. Our goal was to produce a product that fits between these two solutions. Our virtual drum kit would mimic a real-life drumming experience as closely as possible, while minimizing the cost and space constraints.
- When we use digital instruments within digital world it will force to stick with some equipment to use them like keyboard or mouse. Kinect based musical instrument is free of any other equipment.
- If we used the Fudicial based music it also need to have a physical block on which different music code was implemented to play the music. For that we have to need another better approach to connect with music like human natural behaviour.

The work proposes a new human computer interaction system, which uses finger touch as input for playing and experiencing music. This paper work is an attempt to create a music by simply touching the instrument on touch screen which requires single hardware device and any surface to create a virtual touch screen. OpenNI (Open Natural Interaction) framework allows developer to write applications based on natural interaction. In this study, the Kinect (Microsoft Corporation), along with readily available libraries is used to control the human behaviour for

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communicating with computers. This device functions are emitting infrared beams and reading reflected beams from a human body.

Kinect Hardware:

Kinect is a sensor which is capable of capturing depth and colour information of the user in front of it using an array of RGB and infrared cameras. Further it is capable of capturing the sound input though an array of microphones. Depth Sensor technology introduces a possibility of a more cost efficient touch screen. Kinect depth sensor camera will helping to create the any surface a touch screen by calibration process[2]. The Kinect essentially uses a range camera technology developed by PrimeSense that interprets 3D scene information from a continuously projected infrared structured light. The depth sensors in Kinect consist of an infrared laser projector combined with a monochrome CMOS sensor, which captures video data in 3D under any ambient light conditions.

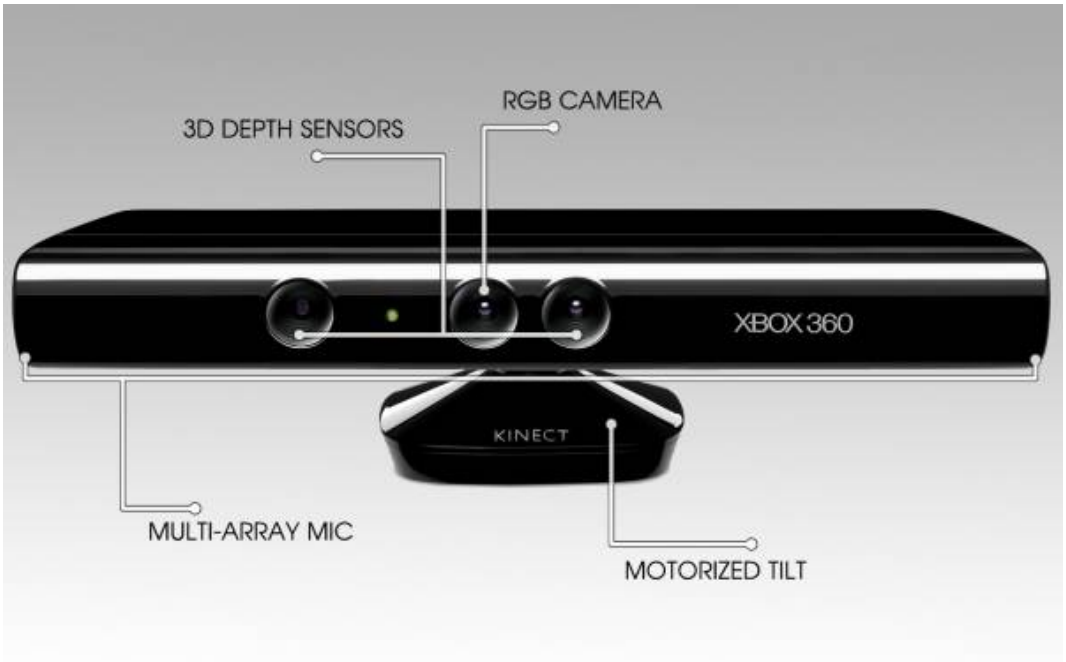

Figure 3 Kinect Device

Fig. 3 shows the arrangement of a Kinect sensor, consisting of an infrared (IR) projector, an IR camera, and a colour camera.

Each component of the Kinect hardware is described below:

1) ***RGB Camera*****:** It delivers three basic colour components of the video. The camera operates at 30 *Hz*, and can offer images at 640×480 pixels with 8-bit per channel. Kinect also has the option to produce higher resolution images, running at 10 *frames/s* at the resolution of 1280 × 1024 pixels [9].

2) ***3-D Depth Sensor*****:** It consists of an IR laser projector and an IR camera. Together, the projector and the camera create a depth map, which provides the distance information between an object and the camera. The sensor has a practical ranging limit of 0.8m − 3.5m distance, and outputs video at a frame rate of 30 *frames/s* with the resolution of 640 × 480 pixels. The angular field of view is 57◦ horizontally and 43◦ vertically [8][10].

3) ***The Motorized Tilt*****:** It is a pivot for sensor adjustment. The sensor can be tilted up to 27◦ either up or down [8].

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Touch Technology

In today's modern society it is difficult to imagine a world without the touch screen. Touch screen has become popular because it is easy to use, allows the user to understand or know something without any reasoning process. By using touch screen technology the user is able to manipulate a digital environment by only the touch of their fingers or any input devices. Touch Screen is any electronic visual display that the user is able to control through simple by touching the screen with one or more fingers [3]. Since this is the most natural way to communicate humans with a machine the most common haptic technology is touch screen. Kinect device is way to make either single touch screen or multi touch screen. Touch screen has become popular because it is easy to use, allows the user to understand or know something without any reasoning process[7] [4]. As times passes these all technology important because it had Optical touch screen capability as multi touch [5]. With this Kinect Multi touch platform, it is possible to create a simple and affordable surface touch screen that detects not only multi touch input on the surface of the screen but better operations which will conducted by touch[6].

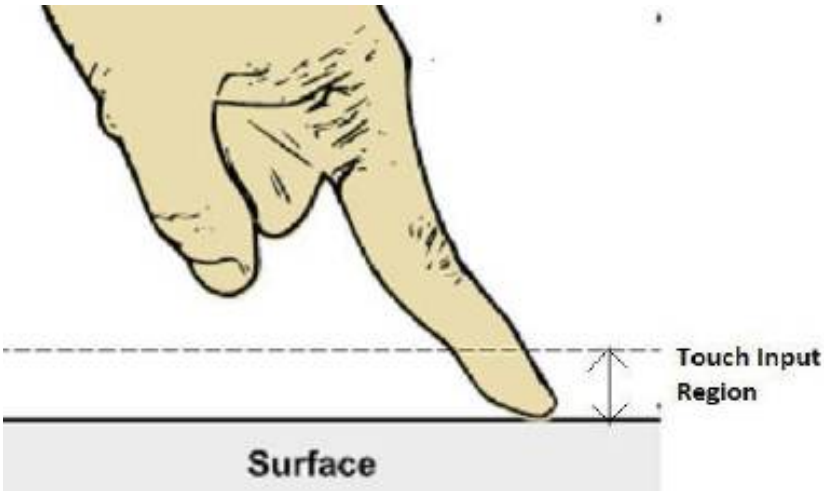

Figure 4. Touch Input Region

IV. CONCLUSION

Overall Our aim is to review by applying the new technology for making virtual musical instrument we came to know that what are advantages of it with real-time performance. And also we came to know that what the other old technologies can do. This work will make virtual musical instrument which would mimic a real-life drumming experience as closely as possible, while minimizing the cost and space constraints. Here we review the design of the musical instrument with the help of Kinect's depth camera. Musical industry has great scope in future. Because of calibrating the surface it is possible to get accurate and precise transformations from camera coordinates to projection coordinates. This approach will provide a responsive controller for musical Performance. The tracking performance is robust regarding the speed; expressive music performance is also reliable.

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