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NUITECH – NATURAL USER INTERFACE TECHNIQUE FOREMULATING COMPUTER HARDWARE

[1]K.Sudharson, [2]Ahmed Mudassar [3]Ali, N.Partheeban
[1]Assistant Professor, Department of Information Technology, S.A. Engineering College, Chennai-77.
[2]Research Scholar, Department of CSE, Bharath Institute of Higher Education and Research Bharath University, Chennai, 600073.
[3]Associate Professor, Department of Information Technology, S.A. Engineering College, Chennai-77.
Email: susankumar@gmail.com

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Abstract

NUI is an invisible user interface which interacts with the movements and gesture of the user. Kinect is one of the voice movements and gesture recognition device which captures our movement and perform the various operations without any physical contact with the device. The main aim is to create Natural User Interface (NUI) as a replacement to conventional input devices, thus enabling gestures as an input for computers. So we propose a methodology in this paper which allows user to work with computing system without any peripherals. Interface function should be created between the system input and the user controlled action sequences. During this sequence this device will sense the physical movements and it emulates mouse and keyboard like functions. Thus this allows physically challenged people to access computer system without anyhindrance.

Keywords: NUI; Kinect.

1. Introduction

Kinect is becoming the most important development of the human races. The Kinect uses the most advance technology like artificial intelligence in recognizing the movements of the body through sensors. Kinect is the most advanced technology used by the Microsoft to run various applications through the effectively invisible methods which is highly helpful for the upcoming societies and the physically challenged people. They are effective in ways such as they can be easily communicated with the user environment and feels they are not inferior to anyone[1].Kinect is a motion sensing input device which is completely based on the sensing the gestures or the movements of the body. Kinetic enables

complete control over the user and the system. It provides Kinect capabilities to developers to build applications with C++, C#, or Visual Basic by using Microsoft Visual Studio 2010 and some other features like Raw sensor streams, Skeletal tracking, audio capability[6]. Kinect helps in establishing the total security of the system and for a replacement over the mouse and the keyboard i.e. to provide a successful gesture controlling. During this sequencethe skeletal tracking device will sensor the movements and relate to interface. It is possible to hang out with just a notebook in our hand.

There have been many research works and articles done on using NUI with Kinect. The existing system of Kinect NUI is primarily used for gaming console in XBOX 360 as per [1]. Kinect can be programmed and interfaced easily with windows 7 and is given by [5] and [6]. Our idea is to develop a NUI for windows using Kinect as a complete alternative for conventional input devices in future. It can be used to handle keyboard and mouse events efficiently.

2. Proposed System

The main aim is to create a unified control device for the computer. Using this technology we have to improve traditional interface devices such as keyboard and mouse into new generation interface. Kinect should ensure hassle free working environment that carries intuitive interface to the user. It should be of great use to non-technical users of computer and should provide better technology than touch screens. It should control multiple monitor devices without anydifficulty.For designing NUI using Kinect, various modules are required to interface with the system. They are Kinect SDK module, Interfaced design initialization Module, Sensor Data Module, Gesture Recognition and event Module, Interface Mouse Control Module, Triggering Keyboard Control Module, Interface voice recognized Switching Module. Each one of them helps in interfacing the Kinect with the system and are useful effective UI using Kinect hardware. The whole package of Kinect is used to recognize the gesture events.

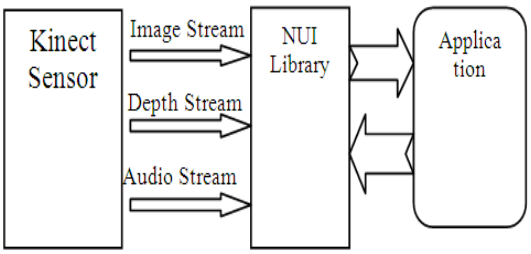

Fig.1 Proposed Block Diagram for Kinect connection.

3. Kinect technology

A. Kinect

It is the 3D image sensing device shown in the figure 1, is used to sense the gesture movements given by the user. It was developed by Microsoft for XBOX 360 gaming console. The Kinect sensor is a horizontal bar connected to a small base with a motorized pivot and is designed to be positioned lengthwise above or below the video display. The device

features an RGB camera, depth sensor and multi-array microphone running proprietary software, which provide full-body 3Dmotion capture, facial recognition and Voicerecognition capabilities. RGB camera captures images in 2D and along with depth sensor which uses IR rays to sense the image thus 3D image is obtained. The multi array microphone captures HD quality audio for voice commands. The Kinect obtains the skeletal view of the user and thus their gestures can be analyzed[2][1].

Fig. 2 Kinect device.

Kinect SDK

The Kinect sensor is connected to computer by using the USB port. It converts the raw data into binary form. It is obtained as output by using Kinect SDK. This output is used for performing various operations by linking the SDK with many high level programming tools. The SDK contains many inbuilt functions to perform operations on the output data obtained from the Kinect. The skeletal view of the image is used to obtain the gestures. The various library functions and namespaces in Kinect as shown in the figure3, are used to obtain the video stream, the skeletal views and audio. Microsoft. Research. Kinect. Nui is the namespace used for video stream and skeletal view access. The other one is

Microsoft. Research. Kinect. Audio used for audio[4,6].

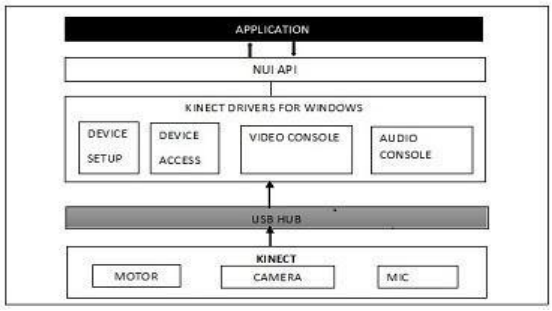

Fig. 3 Various Namespace for Kinect.

The Kinect is connected via the USB port to the system. It is a sensing device that is placed above or below. It has pivot along with motors so that it adjust according to user movements. The Kinect is initialized first using the SDK and the Kinect sensors are tested first. Then the video features, depth image features, etc are extracted from the Kinect output. Based on their output, the gestures decided and is used determining the actions for various gestures. The Kinect has 4 array microphone that is used to obtain HD sound. It is used to determine the voice command function and thus enabling users to control over an application by voice commands which is the most efficient and easy means of controlling.

B. KINECT Interface

It is used to display the output of Kinect sensors. The interface can be designed using XML and C#. The user interface provides the depth data, RGB camera output, Voice output. In the figure 4, it shows how the NUI and Kinect are interfaced. Here the computer applications are controlled by interfacing with system operating system through various NUI application program interfaces. Similarly USB HUB is used to connect KINECT with windows OS.

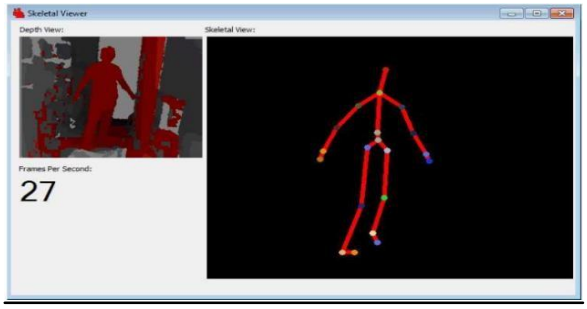

Fig. 4 Interface diagram for Kinect and NUI.

C. Gesture Recognition Andevent Handling

NUI library is the source for all gesture movements obtained from Kinect SDK. Through this library one can define

many actions for different gestures. Kinect can look up to 4 persons individually and can sense them individually. As shown above Kinect uses skeletal tracking system and can sense the individual via their skeletal structure. Moreover it can sense the color and tone of an individual. It enhances its security. There are 20 key points in human body that is sensed by Kinect to detect the different gestures of an individual. As shown in figure 5, the skeletal structure combined with the NUI library provides easy interfacing of Kinect with system and make it as a NUI.[6]

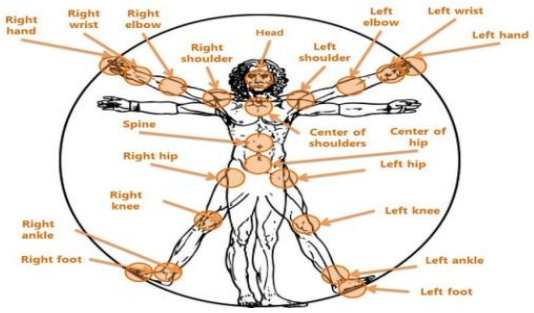

Fig.5 Skeletal tracking system.

Interface Mouse Control

As shown in figure 6, the Kinect detects the X and Y coordinates of the user's gestures by using the depth sensor. This is used to perform an event. Based on the X and Y coordinates, ASCII values are generated as done by the hardware and is used to perform various events. Thus mouse movements can be done by different gestures and it serves as a replacement to conventionalmouse.

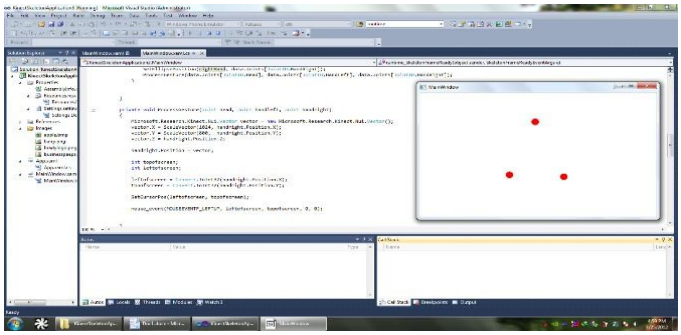

Fig.6 Mouse Control.

Triggering Keyboard Control

Here the Kinect detects the different gestures and match it with the one performed by keyboard. For each gestures performed based on Kinect library an event is determined and ASCII values are generated which is used to give an interrupt to system as done by the keyboard. The Kinect serves as a replacement to conventional keyboard. Some sample output is asshown.

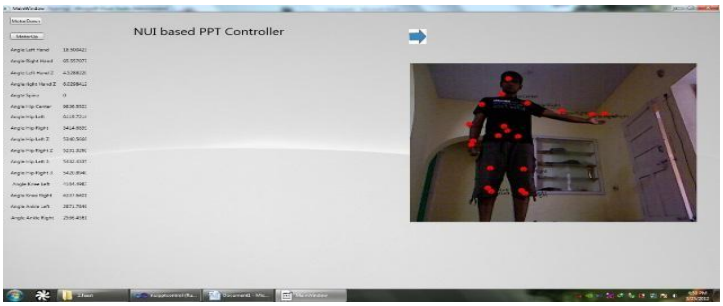

Fig 7.1 Right Hand Movement.

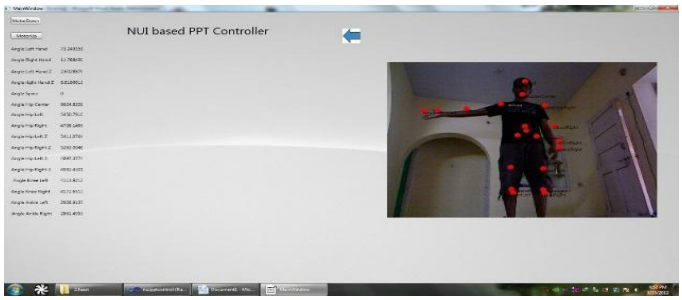

Fig 7.2 Left Hand Movement.

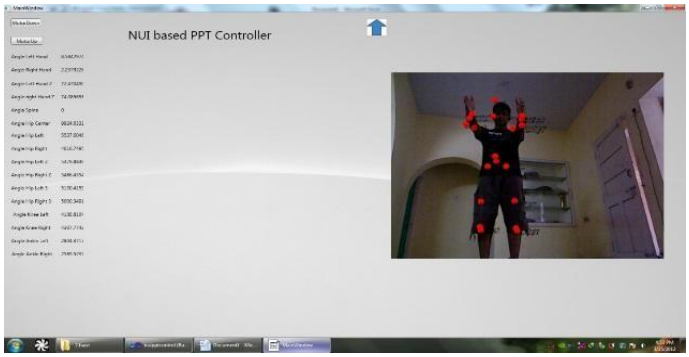

Fig 7.3 Upward Movement.

Voice Command Interface

Kinect has 4 array microphone to record HD sound [3]. This sound can be analyzed clearly since it noise filtered and echo cancellation is performed in Kinect. Thus, voice control can be done through Kinect. This voice command feature is used to trigger different that can be performed and act as a best input device for many users. It is more feasible and friendly to users.

4. Conclusion

The concept of NUI using Kinect is very new to every users and they don't want to stick anymore to keyboards and mouse. WINDOWS will obey our order with the help of KINECT because of this gesture recognized and voice command systems which can be used from little kid to an old people and they feel more interested to work in these

systems. As the hardware and software technologies mature, there is plenty of potential for gestural performance to become more expressive.

5. Future work

Near future scopes of this paper are as follows.

Kinect WINDOWS OS:

In this paper we have just discussed about controlling the power point application by keyboard interface console that handles some of the main events of the keyboard interrupts. This extended in future which is used to control the entire Windows OS via Kinect as the main input device. More gestures can be used to control many operations in the system.

Robotics with KINECT:

Kinect can be widely used in robotics. It reduces the disadvantages of Artificial Intelligence and can be used to secure the system. The skeletal tracking system used can be changed to track the robotic tracing system where simple robots can be used to perform more complicated action via Kinect securely.

Gesture Events in Automobiles

Automobiles are the place where much more automation is required. Kinect can be effectively implemented on automobiles to control them and for virtual interactions that makes us to control automobiles easily. Kinect can be used to automate the EMU trains using robots or human pilot box that enhances the control and security of thesystem.

Individual Finger movement detection*:*

Kinect can't recognize individual finger gestures. A wrist mounted IR camera combined with laser can be used detect individual finger movements. This can be used to introduce more gestures can make Kinect more feasible device and is used to enhance the above three features. But it introduces an additional device to be worn. It is an IR wireless camera to sense individual fingers and to introduce moregestures.

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