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User Interaction System Controller for Presentation using Kinect

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Abstract: ***The most important research field of HCI (Human Computer Interaction) is recognition of Gesture as it's a natural way to communicate with user and system. Gesture based on Human computer Interaction having a wide range of application from games to augmented reality and still it is exploring in various field.The major objective of this work is to develop a Presentation System Controller for User while giving presentation anywhere using Microsoft Kinect depth sensor which will be going to integrated with the application develop. I am focusing on hand recognition of user with skeleton tracking for controlling the application and solving the problem which incurs real time vision based gesture tracking, hand detection for communicating with the application.The Work can be divided into two major modules namely, Hand Detection and Gesture Recognition. For hand detection, the application uses the Kinect for Windows Software Development Kit (SDK) [1] and its skeletal tracking features to detect a user's hand which enables the user to control the application.By using Gesture Detection and Hand Tracking I have develop an application which will work like a controller for the User for making their presentation simpler and attractive with their Natural Interface.***

Keywords: Kinect, Hand Detection, Skeleton tracking, Human Computer Interaction

1. Introduction

The development of existing computing and the need to communicate in a more natural, flexible, efficient but powerful way has rendered most current user interaction approaches which utilizes keyboard, mouse are insufficient. Human Computer Interaction technology has seen significant changes over the years which range from Text based UI which relies heavily on the keyboard as an input device to 2-D graphical-based interfaces based on mice. The natural way of interaction between user and system has brought wide focus on the Gesture recognition along with hand detection. For recognition of Hand the application uses Kinect SDK along with skeleton and allows distance estimation of hand in application.

This paper aims is to provide a basic understanding on gesture recognition and how the application which is able to recognize users and understand their intentions using a "natural" user interface consisting of gestures. To implement this, the Microsoft SDK of the Kinect Device is utilized as well as both the depth map and color image obtained by the sensor which enables the user to operate Operating System and explore its functionality.

The Work is organized as follows: Second Section deals with related work which involves Gesture Recognition Technologies. Third Section includes proposed work. In Fourth Section include experimental result and finally the Conclusion and Reference.

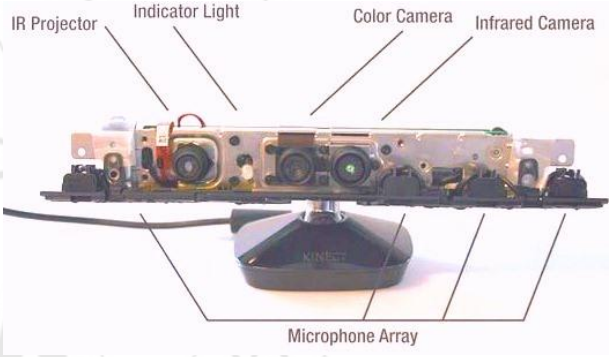


Figure 1: Internal Structure of Kinect Device

2. Related Work

Activity recognition can be classified into two types they are Glove based or wearable based recognition system and Fixed Device or vision based recognition system.

Glove based system consist of components which you need to wear. For gesture to be recognized you have to wear the heavy device to connect with the application and it is inconvenient for user for their work.

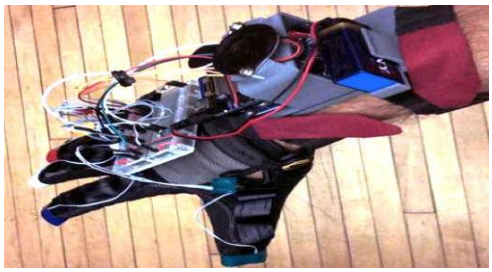


Figure 2: Glove based recognition system

Vision based recognition is widely used in different field along with different device according to users need. It includes various types of devices like camera, Vision System

etc. This system is flexible to user as it includes natural way to interact with the system and comparatively easy than glove based system.

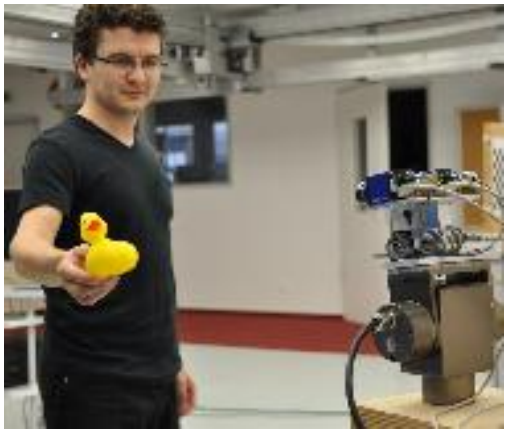


Figure 3: Computer Vision based recognition system

In this above figure the system is recognizing the object with the background and information of object is identified.

Table 1: Comparison of Various Recognition Systems

Methods	*Glove Based*	*Vision Based*
Cost	Higher	Lesser
User Comfort	Lesser	Higher than GB
Calibration	Critical	Not Critical
Hand Anatomy	Restriction is High	Less
Portability	Lesser ability	High Portability

In this research paper, we are introducing the application for user to make their presentation easier and user friendly. We are going to recognized user first and extract the skeleton information and processed the execution.

3. Proposed Work

3.1 Kinect Architecture

The most important thing for any application development is the architecture. Microsoft has provided SDK which will be helpful from developer point of view. The hardware is connected via USB port to system. It includes transfer function to use more than one sensor of Kinect device. NUI (Natural User Interface) is use to track the skeleton, image color depth and audio.

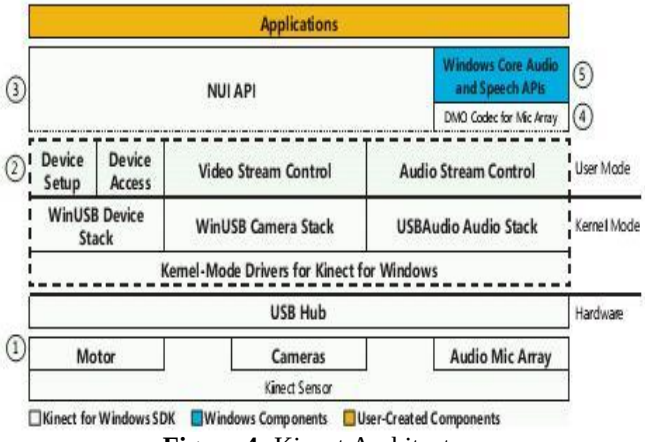


Figure 4: Kinect Architecture

3.2 Work Flow of Application

The hardware need to be connected to the system as the connection is proper it will start tracking the Skeleton by tracking mechanism .It will also provide distance estimation of left and right hand from head. There will be User Screen which will have all information like skeleton tracking of user and hand distance to the user to handle controller. The Presentation screen will be visible to public user to see. The work flow diagram is shown below:

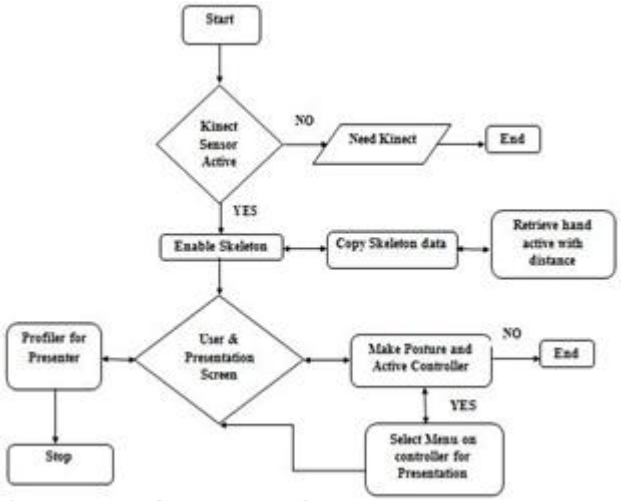


Figure 5: Work Flow of Application.

3.3 System Implementation

3.3.1 Sensor device Specification

For implementation we need sensor for tracking the skeleton along with joints so here is the specification below for system implementation with certain parameters. It will include resolution, pixels size and so on.

Table 2: Sensor Device Specifications

	Camera Name	
	Kinect 1.0 RBG Camera	Kinect 1.0 IR Camera
	Imaging Sensor	
Type	Aptina MT9M112 CMOS	Aptina MT9M001 CMOS
Resolution (Pixels)	1280*1024 or 640*480	640*480
Pixels Size(µm)	2.8	5.2
Focal length (mm)	3.099	6.497
Format width (mm)	3.58	6.66
Format height (mm)	2.87	5.32
Image Width (pixels)	640	640
Image Height (pixels)	480	480

3.3.2 Human Skeleton Tracking.

The Skeleton tracking feature of Microsoft Kinect for Microsoft Software development kit is used to tracking the users. There are two major cameras in Kinect. Infrared Camera and RGB camera is used for tracking Users. At max six users can be detected only two can be active along with indexing value. The Skeleton tracking module involves tracking of 20 joints points of usersrecognizing every joint like Head, Hand right, Hand left and so on. The information of each user Skeleton joints is stored as x, y, and z coordinates and it is measure in meters from device. The data

of skeleton is used for execution. The pictorial representation of User Skeleton is show below along with the direction of Kinect sensor.

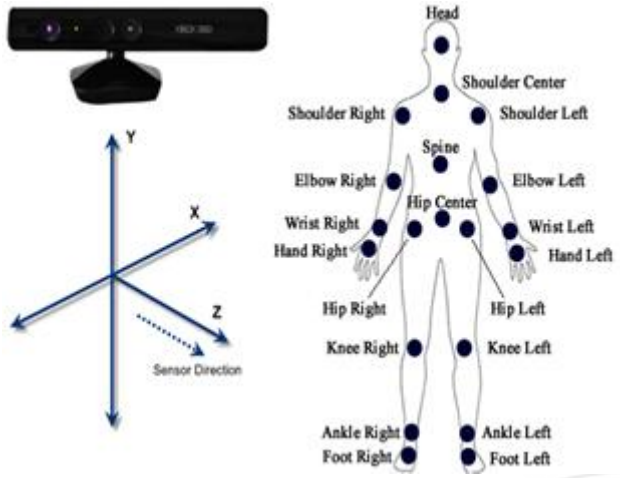


Figure 6: Skeleton Joints

Communication start from hardware to application with various stages getting the stream data from Kinect sensor it transfer the data to PC afterward it uses Kinect SDK with Natural user interface and connection is properly established shown in figure below.

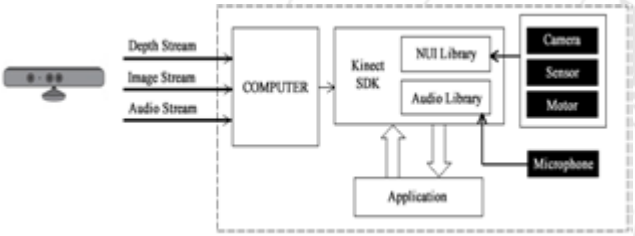
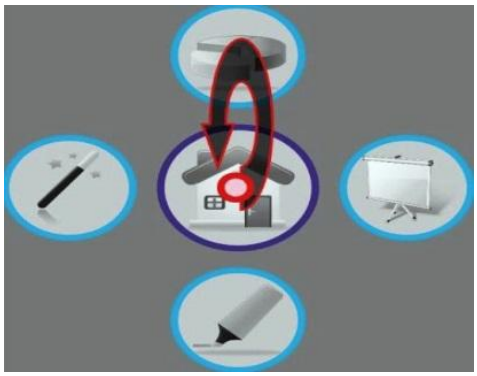


Figure 7: Communication between Kinect and Application

4. Experimental Result & Discussion

The application will consist of two screen one for User and for Presentation. On one Screen it will show Skeleton tracking along with the distance estimation of hand and second screen will be visible to the audience for their view. The controller will be handled by the user for making the presentation simpler.



(a)

(b)

Figure 7: (a) Controller for User **(b)** User and Presentation screen along with skeleton tracking

The above figures shows the proposed work result which include skeleton tracking technique along with distance estimation for betterment of Presenter to give there presentation in more natural way.

5. Conclusion

The application developed by us is very helpful from presenter point of view. This application can use by colleges, industries and so on for Presentations. It is the natural way of interactions with the system while delivering the Presentation. The work achieved here is one step ahead of what we are using recent today. The real time performance, robustness and user independent are improved in this work. We have developed controller for user for handling the application in smoother way. This work will motivate more researcher and explorer themselves in computer vision field. The main advantage of the application is its simple to use and flexible.

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