Facilitate Access ability and Provide Security for Handicap Person Computers

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Abstract

Simple Human computer interaction (HCI) is typically easily used by normal people to interact with computer like mouse, keyboard, and .etc. However for user suffering from difficulties in hand moving or amputees this HCI barely impossible to use to interact with computer, for this reasons this paper aims to suggestion HCI interface for disability user as well as the normal user to control computer with security system without need to use their fingers. HCI interface in this paper track computer user arms movements using Kinect sensor and processing this movements to move the computer cursor on the computer. This interface has security methodology to control computer files access by tracking the user activity in the computer.

Keywords: *Amputees People, Kinect, Assistive Technology, Computer Security, Vision-Based Human-Computer Interface.*

1. Introduction

There are over than billion persons, around 15 per cent from the word population, that suffer from disability, this number increase through population growth [1] these part of people require special support to provide independently and conveniently life with normal people. The handicapped who have a trouble in hand activates or hand amputation that causes by accidents or diseases suffer from great difficulties in using computer to perform many operation like internet surfing, communication, information management, shopping, etc... The computer can easily use by the normal people through traditional computer interaction technology that include mouse, keyboard, touchscreen and etc. these technology not suitable for handicapped due to the limit in physical abilities. Thus, special methods of computer interaction technology needed to assist them in operating computer. Many researchers work on method to detect human or part from human and track it. This method can adopted to fit the handicapped needed where, in some methods they measure and detected different human activity using sensors. This can be found in recent research presents [2-4].other methods they monitor the user action using vision device. Images or videos obtained via camera processed to interpret the action, this method not required any sensor or circuit or connection connected on the users just the user need to be in front of the camera that make it more comfortable and unexpansive for the user. This can be found in recent research presents [5-7].for this reasons ,this paper illustrates the uses of Kinect sensor to track the move of human arm, even the partial amputees ,to provide a facility to control mouse and provide security system for the handicapped person. This paper is organized as follows: Kinect Sensor is presented in section 2, System algorithms and experimentally in section 3, result is presented in section 4, finally, conclusion is presented in section 5.

2. Kinect Sensor

Kinect sensor is a motion sensor device for tracking human gesture. It manufactured by Microsoft cooperation to their Gaming console XBOX 360, that allow the user to play game without the need for the traditional controlling tool like joystick ,keyboard and etc. Where the user interact with game through his human gesture and voice command. After time Microsoft manufacture Kinect device for Windows and relies SDK.in the meantime Microsoft realize Kinect 2 for XBOX one the new gaming console this version have some improvement in the Kinect. Kinect sensor implement using prime sense diagram where the prime sense give devices the ability to capture the scene in three dimensions by use 2D images to generate 3D images (depth image) where it is a flat black box contain IR sensor (camera), IR light projector, RGB

camera and sets of microphone, its sets on small platform that contain small motor as shown in the figure1.

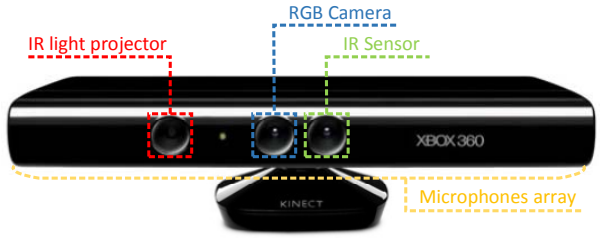

Fig. 1 Kinect Sensor Component.

IR sensor (camera) and IR light projector inform the depth sensor in the Kinect, depth sensor form the depth image (3D image) for the scene in front of the Kinect view. This image construct by projecting dense and non-uniform array of infrared light dot to triangulate the scene in front of the Kinect through IR light projector and capture the reflected infrared light with the IR camera as shown in the figure 2 .the pixels value (depth) are set according to distort in the dot map [8].the resulting image provide the actual depth between the Kinect and everything in the scene with 16 bit pixel resolution and 320x240 image size (this image can scale up to 640x480 in software[8]).depth sensor can capture thirty frames per second.

Fig. 2 depth image construct.

RGB camera :this camera detect the color components in the scene RED,GREEN and BLUE which provide color image with 1280x960 size and has a capability to capture thirty frame per second, its use in facial recognition and other detection of color feature.

Microphone array: set of 4 microphone used to catch the human speeches sound. Set of microphones work together to isolate the human sound from the noise in the room.

3. System algorithms

The implementation of the system is divided in to two parts Hardware part and Software part, the hardware part compose from two platform, first platform is the Kinect sensor that inform the input method in the system, Kinect senor provide depth image that contain depth information for all the shapes in the scene. Second platform is the PC where inform the processing unit in the system that process 3D information and control the mouse movement with security as shown in the figure 3.

Software part compose from two platform work parallel together, the first platform process the information that come from the Kinect and generate cursor commands. The process start by send command to Kinect to start capture 3D image and enable Skelton. Next step detect the positions of human hands and centre of the shoulder in the scene. Centre of the shoulder position define the position of the human body, position zero in the algorithms. Position of the Right hand (X, Y position) mapped to the dimension of computer screen, this positions are the position of computer mouse. The current positions of the hands are memorized and compare with the next positions (new position).

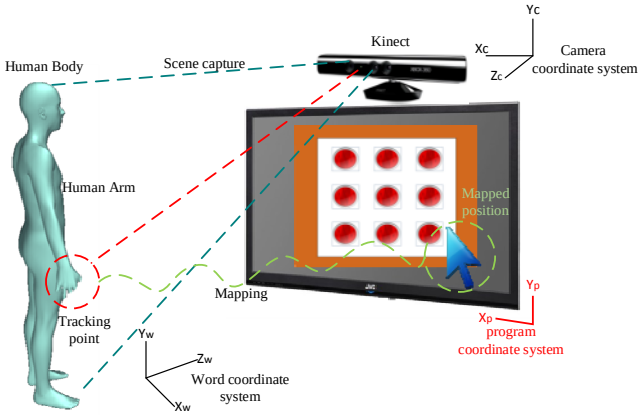

Fig. 3 System Overview.

the compare operation create commands define which operation the user want to do (Right click, Left click and double click).the position of the Right hand (Z position) is set as a reference for the comparison that detect the type of click. When the Left hand position (Z position) exceed the Right hand position (Z position) and then back in short time then this mean the user inform single left click. When the left hand stay after exceed right hand for amount of time this mean double left click. When the left hand exceed the right hand with predefine distance in the Y axis this mean left click.at last all the position information of the cursor and type click (if the user press click)will send to mouse DLL to move the cursor in the screen as shown in the figure 4.

Second platform inform the security part in the system. the security in the system depend on the access depth for the folders in the window where our program will start directly after the window completely loaded. all the system access method will disable only the cursor will move (depend on the first platform) on the PC display to enter the password, the password enter by moving the

cursor on the circles array that appear on the screen. the cursor should stay for specific amount of time on circle where the circle well change in the colours until get fully red to inform the user this position take, then the user continue to complete password pattern as shown in the figure 5.the input pattern screen will appear when the user access number of folders (only folders that leads to the other) depend on the security level. The program will scan the operation of the mouse click to identify is a file open or folder, does the user access folder or file in the depth and does the user close file or folder all of this will affect when the security screen while appear as shown in the figure 6. Each security folder level has a security pattern different to the pattern of another level. Number of the Security levels define by the user.

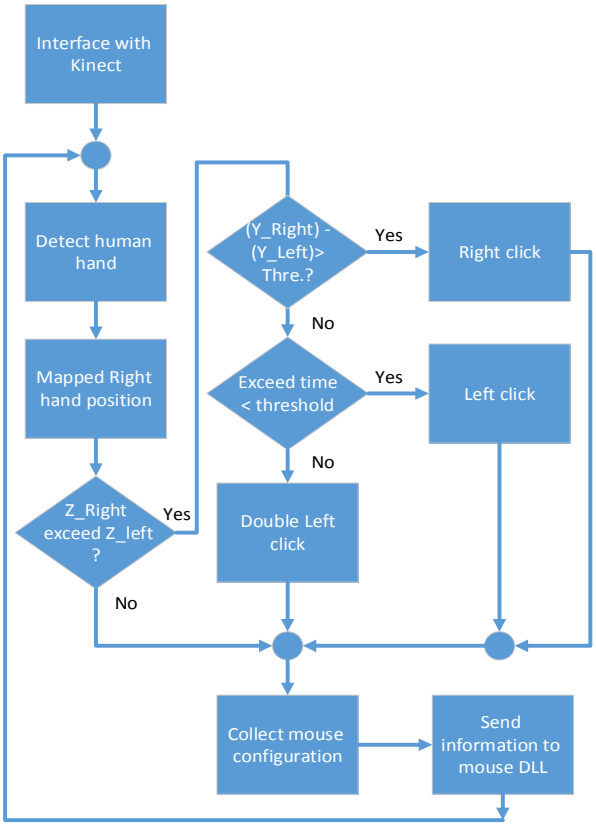

Fig. 4 Mouse Operation Algorithm.

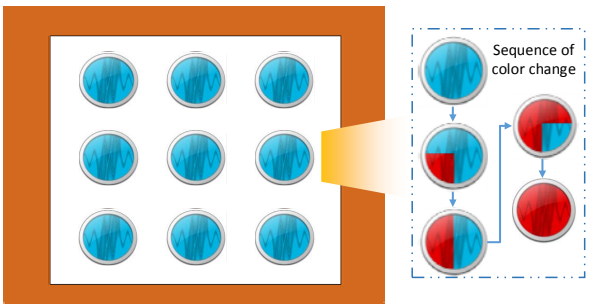

Fig. 5 Security Program Window.

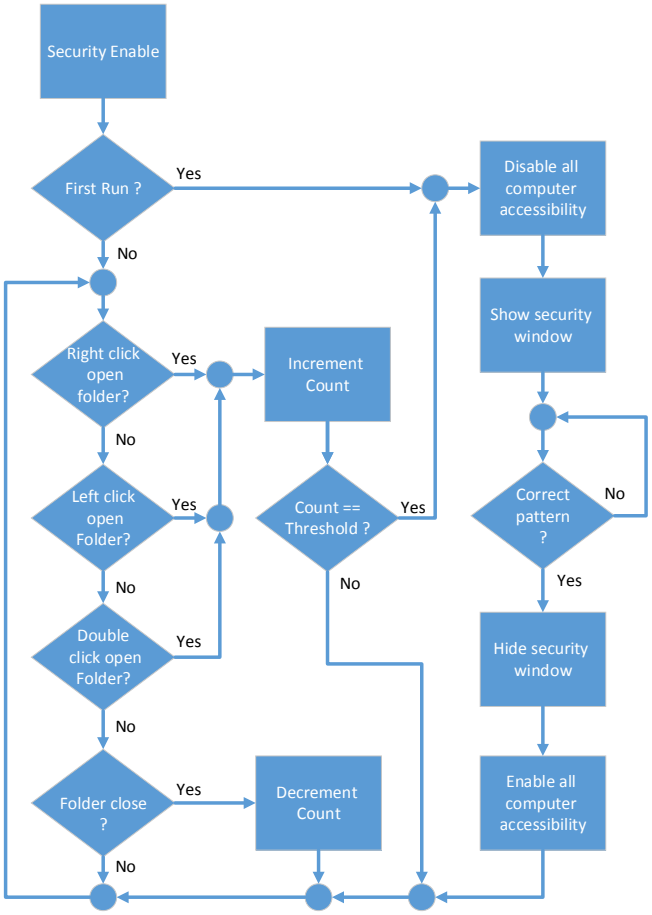

Fig. 6 Security Algorithm.

4. Result

The suggested computer interface result in this paper divided in to two major. First major measure the security effectiveness .second major validate the interface for well cursor control.

Security effectiveness for the suggested interface tested to validate effectiveness. For ever security system, the most important task, keep information secure. From this principle the system design with many level of security to gain access to the data. Every security level has different password patterns. System security validate by three process. First process the authentication pattern. The attackers for system security try to determine the authentication password by collect information about the user and use some available data base in the internet to find the password. This case solved by using the pattern of human arm move instead of using number and character in the classical password. Second process cracked program. The attackers try to access the system by using method that try to guess the password. Some of these methods try more than billion password per second to guess the

password. This case solved using the suggested system interface that accept the authentication pattern exclusively by human only. Where the system respond only for the human that in front of the Kinect, so any guess technic will not pass this situation. Last process the probability to guess the authentication pattern. Strength of the authentication pattern measure by calculating the entropy for every expected case for the pattern. The entropy determine by the equation (1) [9].

$$H(X) = -\sum_i P(x_i) \log_b P(x_i) \quad (1)$$

Where H(X) the entropy, (xi) the probability and b the base of the logarithm.

In table 1 the entropy result for every expected authentication pattern case.

Number of the movement in the pattern	*Probability for the pattern in number of try*	*Entropy for the pattern In bits*
6	531441	19.0195
7	4782969	22.1894
8	43046721	25.3594
9	387420489	28.5293
10	3486784401	31.6992
11	31381059609	34.8691
12	282429536481	38.0391

Table 1: Result for Entropy and probability.

From table 1, the entropy for the pattern increase with increase the number of the move in the pattern that give more immunity for the authentication pattern from guess, also the probability greatly increase be increase the number of move as shown in Figure 7.

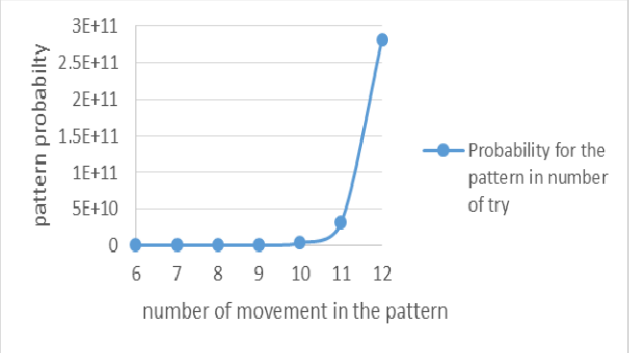

Fig. 7 Probability graph.

The system allow 3 try for the user to enter the correct pattern if he can't the system will stop for an amount of time and give a sign in the window, that show, there is someone try to access the system. Also every level has a different pattern so the attacker will facieses many security level. The three process show that the system validate the security effectiveness.

The Suggested computer interface for curser controlling was tested to validate the interface for well cursor control in two main field. The first field to measure the performance in computer surfing and the second to measure the capability to work as an input device to enter data.

The first field of the test involved many operation to measure the interface performance to perform operation like folders and files management, open or close folders and files, windows navigation and etc... For test this field user perform a determine sequence of operation that include many of the operation that mention before, the sequence shown in figure 8 and Table 2 show the result for the test.

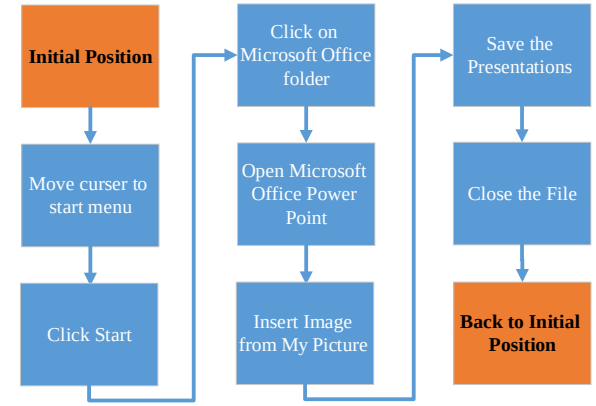

Fig. 8 Operation sequence.

Interface	*Interface type*	*Average Surfing Time*	*Standard Deviation*
Traditional interface	Mouse	16.608	0.904829266
	Touch pad	20.952	1.239191672
	Track ball	26.061	1.255583131
Suggested Interface	Hand point track	79.4	18.44559568

Table 2: Operation sequence test result.

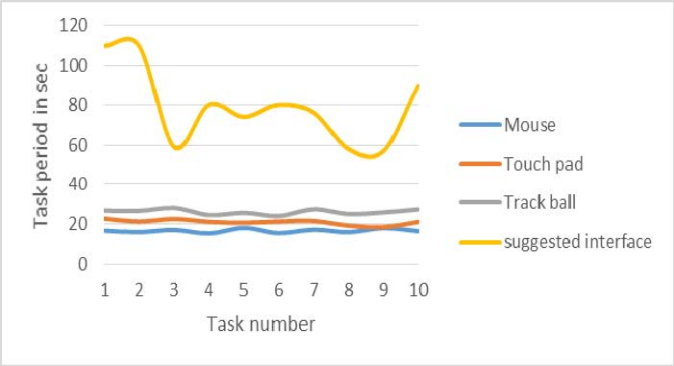

Fig. 9 Operation sequence test graph.

The second field of the test to measure the interface capability to perform operation on data like write sentences, modify text and etc... For test this field, the user use the suggested interface to write “hello world” on empty note pad file using “On-Screen Keyboard” program. Table 3 show the result of the test where the average

Interface	***Interface type***	***Average writing Time***	***Standard Deviation***
Traditional interface	Mouse	6.956	0.328152
	Keyboard	3.249	0.266775
	Touch pad	8.544	0.551638
	Track ball	13.792	1.263913
Suggested Interface	Track point	45.7	2.491987

Table 3: writing capability test result.

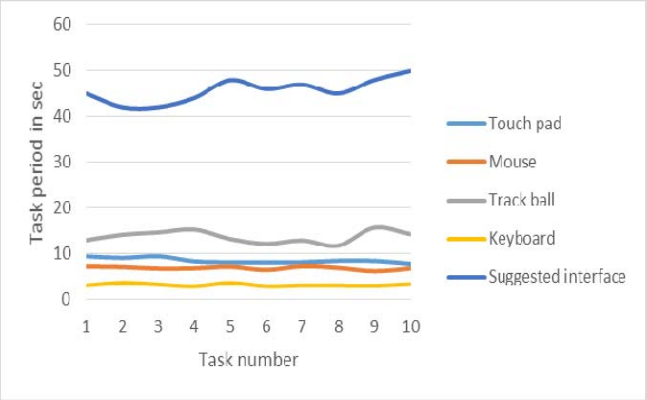

Fig. 10 writing capability test graph.

From the results figure 9, 10 and table 2, 3, the variation in the task period for the suggested interface compared with the other classical interface back to main reason. That the user is new for the interface not fully familiar with it where any interface required a practice time for the user to deal with it. All the result for the suggested interface will improve will the use of the interface where the user get more practice on it. Just like the mouse, touch pad and track ball when the user try to use it for the first time. The variation lead to high standard deviation compared to other interface. The handicapped person may require more time when he use the classical interface if he can use it depend on his disability. Many handicapped person can’t use the classical interface so the suggested interface is very useful for them.so the suggested interface for curser controlling was validate in the two field.

5. Conclusions

This paper has presented a method for computer security and control interface that provide an axiomatic interface for the handicapped who has a trouble in hand activates or hand amputation to make computer surfing with security more comfortable to use to improve their life. Here we inform that the Kinect can be helpful for make computer interface and computer security for handicapped and normal people. In this method the disable person can control the computer cursor at the same time can be used as keyboard by using “On-Screen Keyboard” program.

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