NUI Design and Realization for Game Content Control

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Abstract. With the development of information technology, a variety of content platforms including computer have been popularized and a number of studies on more convenient and natural interface are in progress. This study suggests how to design and display motion-based interface using Kinect sensor to control game content for the purpose that the existing controlling method in GUI environment is shaped to be fitted in NUI setting.

Keywords: Interactive Game, Kinect, NUI, NUX, User Interface

1 Introduction

Recently, the amazing development of information technology has led to introduction of various platforms including smart phone, smart TV, tablet PC, and wearable devices as well as personal computer. For users to interact with these content, there have increased researched and studies on more simply and intuitive way to control including motion controller or controlling with detecting contact point of touch panel as well as the most common input device such as mouse and keyboard[1].

In particular, more attention is paid to direct interaction between content and users, called NUI(Natural User Interface) or NUX(Natural User Experience). In terms of interface between computer and human, many of researches has been in progress, especially regarding how to control and communicate more naturally and intuitively by detecting user's voice or motion, which is the developed outcome from GUI with mouse or keyboard once, and now it is settling down as a part of promising area, HCI(Human-Computer Interaction)[2, 3, 4].

In detecting motion technology, there are two different methods; one is contact method which detects data by attaching sensors or certain devices to human body, while the other is non-contact method extracting motion data by tracking user's recorded motion video with camera. Contact method is better for obtaining accurate data because it attaches sensor directive to human body but it causes inconvenience for users to wear the devices. Non-contact method utilizes motion data extracted from Video filming user's movement.

Most of contents have been developed to be compatible with traditional GUI set-
ting so it is not suitable for NUI setting. This study produces an interactive game con-
tent to establish NUI based setting in game content control and designs a motion de-
tection model to use as interactive interface based on NUI. Interactive game content
refers to FPS(first Person Shooting) game played in the first-person and it offers vivid
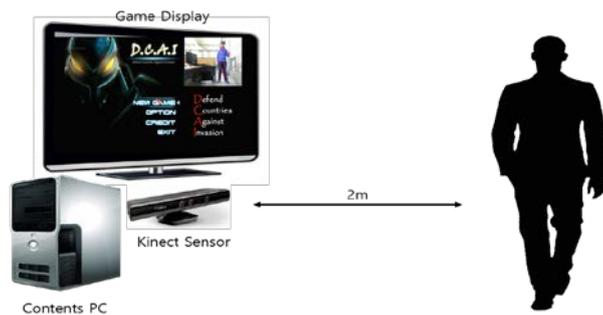imagination for players to feel reality while playing [Figure 1].

Fig. 1. NUI System overview

2 Outline of FPS game content

In game content, there are numerous genres including arcade, racing, RPG and FPS
and each genre has its own controlling technique. Of them, FPS game is considered as
the most suitable type for NUI setting because it has relatively simple and intuitive
controller.

Fig. 2. Interpreter execution model

The suggested FPS game content is developed in Windows7 64bit setting and [Fig-
ure 2]   shows its composition. The game content has two parts; the first part consists
of UI such as main and pause display and the second one is about actual playing. The
part of moving mouse cursor or selecting menu is played mostly by hand movement
and that of character control is done by actual movement of user.

3 Analysis and design the playing pattern

This study is aimed at how we should design the playing patterns for players to feel strong involvement without little resistance and conducts a number of tests and experiments [5, 6]. At this point, the most popular interface is keyboard and mouse in GUI setting. So by analyzing 8 games including Sudden Attack, Special Force2, Gears of War, Section8, A.V.A, Counterstrike, and Dizzel, it figures out playing patterns when the existing users play FPS game.

Table 1. Analysis on Playing Pattern of FPS Game.

Major Playing Pattern	Minor Playing Pattern
Forward Movement	Moving Left or Right
Backward Movement	Jumping
Use of Weapon	Sitting
Up and Down Movement of Camera View	Altering Weapon
Right and Left Movement of Camera View	

In [Table 1], major playing pattern shows the most frequently displayed behaviors when playing the game. In other words, it is called major playing pattern that user shows certain behavior pattern the most frequently in playing and minor playing pattern suggests that of less frequency even if it shows certain behavioral patterns with keyboard and mouse.

Table 2. The Relevant Response of Major Playing Pattern

State	Function(Control)	Response
Waiting	W	Forward Movement
Waiting	S	Backward Movement
Waiting	Click on the Left Mouse Button	Use of Weapon
Waiting	Mouse Shift	Shifting the Aiming Point
Forward Movement	S	Backward Movement
Forward Movement	Click on the Left Mouse Button	Use of Weapon While Moving Forward
Forward Movement	Mouse Shift	Shifting the Aiming Point While Moving Forward
Backward Movement	Click on the Left Mouse Button	Use of Weapon While Moving Backward
Backward Movement	Mouse Shift	Shifting the Aiming Point While Moving Backward
Shooting	W	Shooting While Moving Forward
Shooting	S	Shooting While Moving Backward
Shooting	Mouse Shift	Shooting with Aiming Point Shift
Forward Movement + Shooting	Mouse Shift	Shooting with Aiming Point Shift While Moving Forward
Backward Movement + Shooting	Mouse Shift	Shooting with Aiming Point Shift While Moving Backward

In FPS game, major playing pattern includes forward and backward movement of character, up and down movement of camera view in 180 degree, right and left movement of camera view in 360 degree and the use of weapon. Minor playing pattern refers to right and left movement of character, sitting, jumping, altering weapons, dash and so on.

Especially, in character's movement, right and left movement is not independent motion but following the forward or backward movement. Camera view moves while character takes forward or backward motion, whereas the use of weapon is shown frequently while simple or complex movement and waiting. The motion of sitting and jumping occurs intermittently when facing hiding barriers in complicated stage, while altering weapon takes place in waiting the most.

Both major and minor playing pattern is carried out independently but in most cases they have connection with previous behavior or shows more complex playing pattering related with current state.

Based on this information, this study applies 3 simply actions(waiting, forward movement, backward movement) and 3 relevant actions(movement, shooting, the movement of camera view) to game interface then makes most playing patterns available in FPS into convergence. Referring [Table 2], [Table 3] shows the definition of playing patterns used in FPS game content of NUI setting.

Table 3. Playing Pattern List for NUI

State	Playing Pattern
Forward Movement	Walking at Stand Still
Rapid Moving Left	1. Depending on where the upper body is tilted,
Rapid Moving Right	the character would dash certain distance toward each
Rapid Moving Forward	direction
Rapid Moving Backward	
Shooting	Reach both hands out.
Camera Moving Left	1. Pivot on certain point to adjust the view of camera
Camera Moving Right	depending on the location of left hand.
Camera Moving Upward	2. In proportion to distance from the given point, ad-
Camera Moving Downward	just the rate of movement.
Rate of Movement in view	
Altering Weapon	Put both hands in the back.
Calling Menu	Raise the right hand above the head.
Selecting Menu	Stay still on the button for a period of time.

4   Detecting motions with Kinect

This study adopts Kinect sensor from Microsoft in order to make database with movements of human body. The process of detecting human motion with Kinect consists of RGB camera and the other camera which senses the depth value with infrared rays and then processes two input images through digital filtering to break down human motion data into 20 different frames with 3D coordinate data [7, 8, 9, 10].

First of all, it needs to create a sort of hand mouse for some of functions like select-

ing menu. Putting Shoulder Center point into the middle, it creates virtual display in front of user and tracks real-time movements of Hand Right point in order to make the mouse cursor in actual display move as it travels in virtual display. The event such as a click is considered to be selected if it places itself at a button for a period of time.

And then for playing game content, each degree between 3D coordinate of frame data is calculated to display movements, evasion or shooting [Figure 3]. Each playing pattern is in complex combination with other patterns to play. Movement is defined by calculating frequency of crossing right and left legs after getting interior angle of three coordinates from HIP_CENTER, KNEE and ANKLE. Evasion is defined by comparing locations of SHOULDER_CENTER, HIP_CENTER, HIP_RIGHT and HIP_LEFT and Shooting is displayed by a two-part motion which consists of reaching out two hands and aiming with tracking left hand.
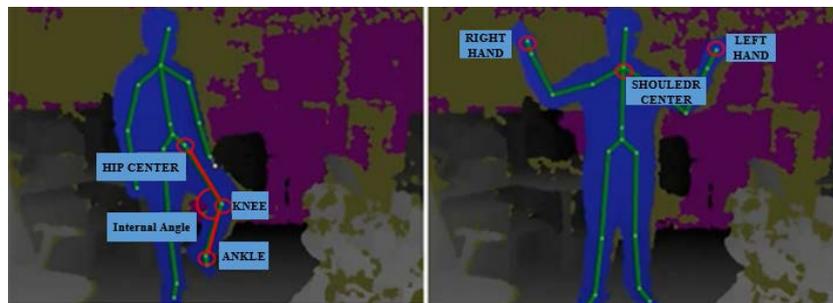

Fig. 3. Motion recognition using the real-time tracking

5 Conclusion and future works

This study researches the process of designing and producing interface using human body motion to interact user and game content in NUI setting with Kinect sensor. [Figure 4] shows how user plays the developed FPS game content with defined playing pattern interface. The interface based on Kinect, which is played by actual physical movement of user, offers more natural control and realistic involvement. However, in case of other genre which has far more complex control process, a variety of movements causes disturbance in game playing. In particular, even with new controller having no connection with the existing one, it is not requirement for user's involvement in game content.

For establishing NUI setting, above all, it is necessary to repeatedly analyze and apply major and minor playing patterns in the exiting controlling process. With analyzing major and minor playing patterns in the exiting controlling process, it is crucial to design as simple as possible. If designing control process in every single movement, it disturbs game playing while if too simple, it would fail to make user involved. Finding out the proper balance could be built in long-term and repeated testing procedures. Thus this study might be referred to as suggestion of design and development NUI setting for interface development using human body.

Further study would be about designing NUI setting for more various game genres so as to make user enjoy interesting and easy game content with far much convenient and intuitive interface.

Fig. 4. NUI System fo FPS game control

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