웹 어플리케이션을 위한 멀티터치 기반 시스템의 효율적 요소 분석

Analyzing the Efficient Elements on Multi-Touch Based Device for Web Application

조재준, 장현수, 조옥희, 이원형
중앙대학교 컴퓨터게임 및 문화기술연구실

Cho Jae-Joon, Jang Hyun-Su, Cho Ok-Hue, Lee Won-Hyung
Computer Game & Culture Technology Lab of Chung-Ang University

요약

지능형 정보 기기의 개발 측면에 가장 중요한 요소는 사용자가 원하는 정보를 복잡하지 않고 쉽고 용이하게 자신이 원하는 정보를 입력 장치를 통해 정보를 전달할 수 있는 기능이라 말할 수 있을 것이다. 인간의 목소리, 표정 혹은 표현, 몸짓, 신체적 접촉 등과 같은 인간들이 일상생활에서 사용할 수 있는 도구적 수단을 사용함으로써 인간은 기계적 장치와 쉽고 간단하게 상호작용을 할 수 있을 것이다.
본 논문을 통해 우리는 상호작용적 서페이스 시스템, 즉 사용자들이 그들 자신의 손짓을 마우스와 키보드 등의 객체의 기능처럼 자유롭게 사용할 수 있는 멀티터치 기반 시스템을 웹 형태의 어플리케이션의 플랫폼에서 인간과 상호작용 할 수 있도록 제안하고자 하며 또한 멀티터치 기반 시스템의 효율적 요소를 분석함으로써 향후 연구방법들을 모색하고자 한다.

Abstract

In terms of development of intelligent information devices, the most important element is the function which is able to deliver the information user wants to input on the device without complexities. By using the mean such as our voice, expression, gesture and physical contact we use in our daily routine, we are able to interact with device easily and simply.
In this paper, we are initiated to present interactive surface system, in which allows users to use their hand gesture as a function of mouse and keyboard free, to be interacted within the platform of web application.

1. Introduction

By introduction of multi-touch tabletop display, we were motivated to analyze how users can be immersed into the platform of web. For further study, we were also initiated to analyze following two possibilities to be achieved the purpose of this research:

- Implementation of hand free gesture recognition in interactive surface system
- Offering efficient elements which are suitable for interactive surface system

In this research, our proposed interactive surface system is based on FTIR (Frustrated Total Internal Reflection) mechanism which enables to recognize the gesture of fingers on tabletop display [5]. Recognition of finger gesture on interactive tabletop display offered and initiated us into researching the control of game interface through hand free gesture based method [1].

Thus in this paper, we were intended to evaluate efficiency of 'Multi-Touch Based Device' as a user-centered platform within interactive surface and prove its efficiency

through multi-touch interactive surface. Through the experiment which is offered previously, we present how we are managed to introduce 'interactive surface' in our research. Mainly this paper is intended to focus on how we improved the distinctive features of interactive surface system for web application.

2. Purpose of 'Interactive Surface'

'Interactive Surface' may be the mean that we are able to use our bare hands as the most intuitive implement to embody the interaction between human and computer and it also can be embodied as the function of display and platform at once. Thus 'interactive surface' became an issue that it will be offered as the next generation intelligence multimedia platform in our contemporary society. By introduction of FTIR based application and 'Surface' which is developed by Microsoft Co., it has been promoting to be distributed as practical use.

Interactive surface however still has a few problems to be settled for its practical use. One of its problems is the difficulty of contents development which enables to maximize the efficacy of platform. Namely, if the contents of platform are structured simply, it can not be discovered the difference of existing touch display. And also if it is constructed as a complex mechanism, the way for embodying and assembling the environment of use is difficult. By considering these problems, this research was initiated to commence the development of contents which is suitable for environment of interactive surface.

2-1. Efficient features of 'interactive surface'

Generally, following features of interactive surface system (tabletop display) can be explained why 'interactive surface' can be distinguished in terms of platform.

- **By using user's bare hands, interface of interactive surface platform can be operated naturally.** This can be meant that in terms of operation of system, immediacy and metaphorical technique of user can be applied to interaction as it is [2]. Thus it can be suggested that it is satisfied the requirement of the model of futuristic information appliance which is able to emphasize user intimation.
- **The platform (interactive surface) is able to enable more than two users to input the touch information at once.** Through the communication, which can be occurred naturally, user is able to proceed in cooperation with another user rather than one user is occupying the computer and a user is becoming to be isolated. In other word, through interactive surface, users are able to do dispersive work for individual or cooperate to achieve the objective of our proposed game at once [3]. Thus interactive surface can be suggested that it can be applied to the next generation information mechanical platform and delivery the sensitivity of human being through its platform.

Considering these features, we were able to draw a diagram of initial concept of 'Human-Human Interaction' like below Figure 1 illustrates. Through sensing device, interactive surface system is able to analyze inputted signals and analyze what information a user inputted on interactive surface. By the result of analysis, it enables a user, computer and display panel to be interacted at once.

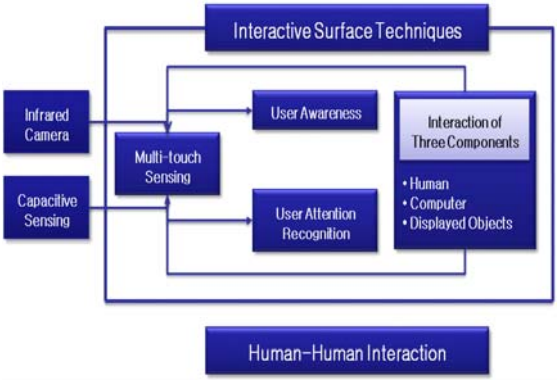

Fig. 1. Diagram of Human-Human Interaction

3. Development of Interactive Surface Environment

1) Principle of 'Interactive Surface'

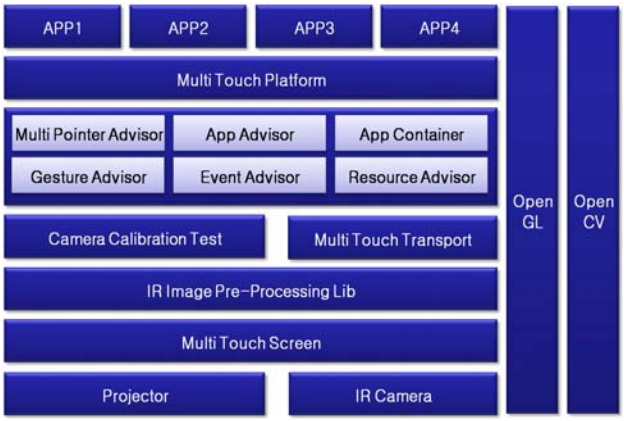

Fig. 2. Diagram of interactive surface system block

As Figure 2 is indicated to illustrate, in terms of general interactive system, it can be divided into five subjects such as 'FTIR applied screen', 'image transaction programming for recognition of touch', 'programming for the control of touch coordinates', 'practical programming which is enabled to act on platform' and 'beam projector' which is assigned to output of screen.

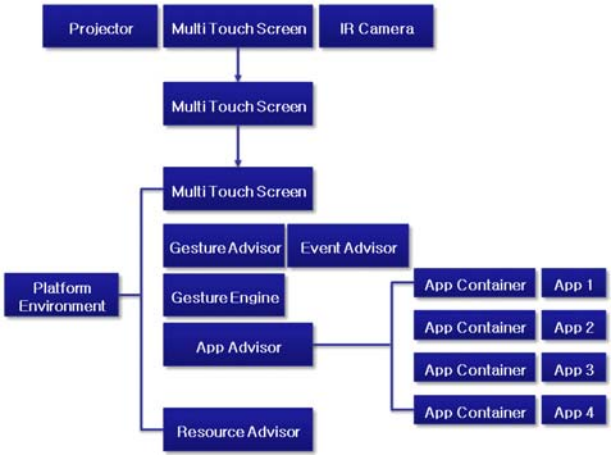

Fig. 3. Flow diagram of interactive surface system

These five sections of interactive surface system can be shown in Figure 3 for describing how interactive system is processed. Through Figure 2 and 3, whole structure of interactive surface can be explained that multi-touch tabletop display is accomplished by the combination of two important regions which are located in hardware and software.

In this research, through below case study, we therefore are focused on embodiment of engine which is suitable for interactive surface and we are also intended to describe the environment of multi touch system which is suitable for features of game platform.

2) Implementation of engine: Designing suitable 'Interactive Surface' engine for web application

For engine part of 'Interactive Surface', we were initiated to optimize the engine for suitability of FTIR based multi-touch screen interface. And for embodiment of multi-touch screen (interactive surface), we used open library source, 'TouchLib' and analyzed how it is supported and provided within the interactive platform. Basically Touchlib is based on c++ and it process quickly. By using TUIO protocol, it enables the platform to use image processing and flash at once.

Engine of 'Interactive Surface' is based on 'TouchLib'. When the engine received the coordinates which is perceived through fingertips gesture recognition program, it enables to perform exact movements of multi-touch screen interface.

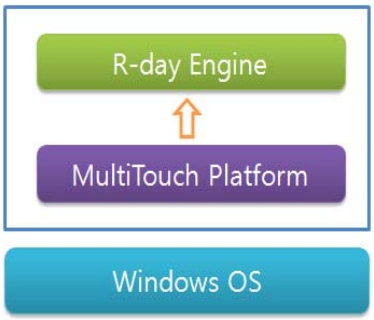

Fig. 4. Initial structure of 'Interactive Surface' engine

Figure 4 is indicated to show the structure of 'Interactive Surface' engine. It is, in face, based on 'TouchLib', which enable the platform to be communicated with Windows operating system, and it is the method that transfers the coordinates of touch recognition to progress the game. Namely it senses the position of user's fingertips what information a user inputted in interactive surface.

3-1. Relation to Previous Experiment Case Study : Practical Use of Multi-Touch Based Application

Fig. 5. Practical exemplification of user interface

As above Figure 5 shows, the map user chose is located on the centre of interface for helping the user to understand the game in terms of graphic. The map, which user chose, represents a region where the company belongs to. Through controlling the map, a user is able to switchover the screen to region of other company or nation and also able to switchover the screen to a general view of the world map. By a function of 'Zoom In' and 'Zoom Out', a user is also able to confirm information a user wanted for its further detail. Certainly for a user, they can be provided and deliveried information easily.

Thus we were intended to aim a concise and structured user-interface, where a user is able to be immersed in the platform, rather than using splendid visualization of graphic in terms of web application.

◎ Map - Zoom In / Zoom Out

Fig. 6. Practical exemplification of Zoom In and Zoom Out

As Figure 6 is indicated to show a screen of basic game play a user is able to see. By using 'Zoom In' button on the menu, a user is able to confirm the region (area) of disease occurrence and also a general statistical data of the region where a disease occurred.

◎ Controlling fingertips

Use of our fingertips is considered for people who are preferred to use a mouse in terms of controlling interface. It is also leaded to run every command and control the graphic user interface.

- To run all the commands, clicking on the surface is a basic function.
- On the map screen, when a user double clicks on the surface, it will be acted as 'Zoom In' function.

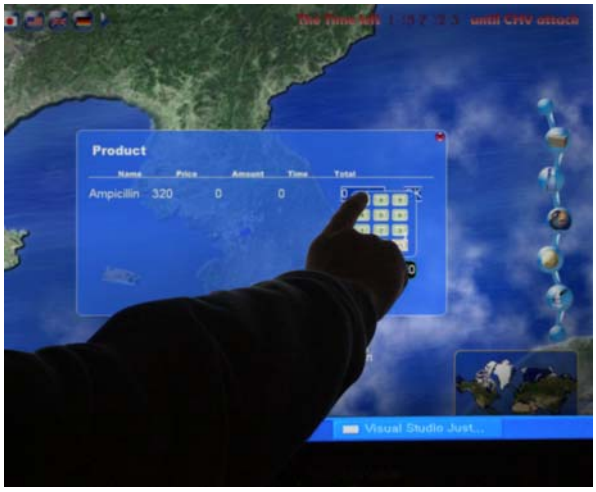

Fig. 7. Still image of movement of fingertip

4. Discussion

4-1. Discussing & Analyzing the Efficient Elements of Interactive Surface

Regardless of the generation, a new platform of multi-use application which is proposed in this paper, can be offered for the present generation, who are being closed with digital contents. It can also be offered for people (users) who are consistently being connected to internet rather than demanding long time to concentrate on playing game. Namely, people (users), who were being closed with computer for their work, are able to manage and raise the company together like people are enjoying their common hobby together. Furthermore through participating multi-play that can be embodied in diplomacy and competition between companies, we were able to establish that users can be accompanied with each other to accomplish the object of game within platform of interactive surface.

4-2 Offering Efficient Element of Operation

Basically a virtual keyboard is a software component which is same as user is able to enter command function through physical keyboards. Through open library program, 'TouchLib', we were able to embody the virtual keyboard for interactive surface. Namely it simplified the actual keyboard to contain fewer number of button and it is also meant to perform the virtual extension program.

In the environment of interactive surface, virtual keyboard, which is based on Windows XP operating system, is able to perform like the function user is able to control a physical keyboard and mouse.

Like the primal purpose of a virtual keyboard, the virtual keyboard was in fact meant to provide an alternative controller for disabled users who are not able to use a physical keyboard. By the introduction of virtual keyboard, we were determined that we are able to implement the function of virtual keyboard to be functionalized like the physical keyboard on interactive surface system. In fact, in terms of playing the game, most users are assumed that use of the mouse is basic control of game and using the keyboard is to constitute as operation of a short-cut notion.

Generally the layout of virtual keyboard may looks like the actual keyboard. Users who are

familiar with the physical keyboard however often evaluate that they are needed to spend a considerable amount of time to be experienced (practiced) a virtual keyboard for a quick input in terms of control. Unlike the physical keyboard, users are not able to feel a three-dimensional effect of the keys (buttons) with their bare hands. Due to the location of keys in a virtual keyboard, users who are not familiar with a virtual keyboard also may feel the pressure to be adopted. However when a user gets used to control within the interface of game, use-frequency of virtual keyboard will be ensured.

5. Conclusion: Summary of what we researched through 'interactive surface'

Through this research, our proposed interactive surface system which is based on FTIR (Frustrated Total Internal Reflection) mechanism enabled us to be able to recognize the gesture of fingers on tabletop display.

Thus in this paper, as the title of this research described, by using the previous experiment; multi-playable management strategy game which is mainly focused for suitability of multi-touch platform and evaluate efficiency of platform as a user-centered multi-control interface. Through realizing the possibility of multi-touch platform in terms of web application, we are interested in following research for further development of multi-touch based web application.

- What type of contents can be suggested to be manageable within the platform of 'interactive surface'
- How we are able to improve interface to be suited for the distinctive features of interactive surface system.

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