Implementation of Authoring Tool-based Ubiquitous Virtual Reality for Home Control with the Smart Devices

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Abstract. In this paper, we designed the authoring tool-based ubiquitous virtual reality for home control with the smart devices. The main point of proposed the ubiquitous virtual reality is the user-centric environment that users can place the objects such as furniture, home appliances similar to embellish their home structure. Designed the virtual space is loaded on the smart device, and some experiment are conducted so as to verify the execution condition. The implemented authoring tool-based ubiquitous virtual reality can apply to various fields such as smart home, smart business and smart fusion technology.

Keywords: smart home control, ubiquitous virtual reality, UVR, user-centric

1 Introduction

Recently, the role of the PC that led the people into the world of information has been reduced with the advent of smart devices, and the rapid dissemination of smart devices is changing the human life [1], [2]. Smart devices are being utilized in the business with internet, basic office work as well as phone features, message-passing purposes. Also, smart appliances are being primarily applied to smart TV in the home, and are being expanded the various smart devices such as refrigerator, washing machines and cleaner, etc. Ubiquitous virtual reality (UVR), the core of the paper, is the field that is very high value creation. Despite UVR is an old issue, its applications can be greatly expanded with smart media [3]. UVR is the technology that integrates a variety of factors including computer graphic, sensor and display technology, etc.

In this paper, we designed the authoring tool-based UVR for the smart home control. This paper was organized as follows: section 2 was devoted to proposed home control system, and was demonstrated the implemented UVR and its features. Section 3 and 4 conduct a performance test with conclusions.

2 Authoring tool-based ubiquitous virtual reality

The proposed authoring tool-based UVR is for the purpose of intelligent home

network system [3], [4]. In the existing PC environment or the mobile phone, the home network system is sent the simple signal for home control such as boiler on/off. In this paper, we designed the authoring tool-based UVR that can set the house environment by user themselves. Namely, users can set the location of home appliances such as TV, refrigerator, electric fan, furniture and light button with the structure as their home. For the home control services, we implemented the authoring tool-based UVR on the smart device as shown in Figure 1.
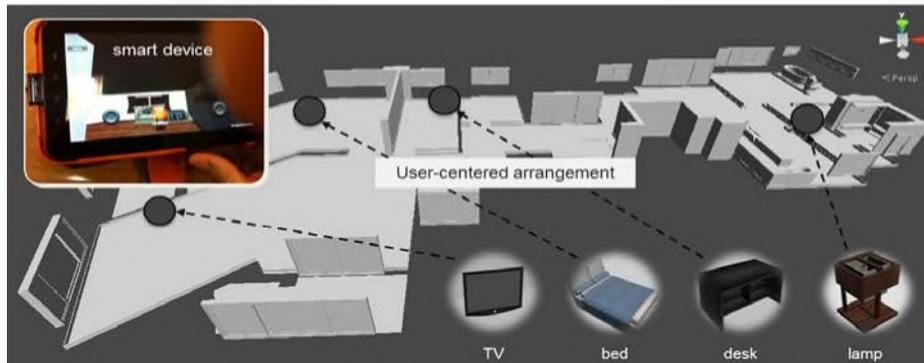

Fig. 1. The concept of authoring tool-based UVR

The background of Figure 1 was created the structure in 3D MAX [5], and is covered the materials in Unity3D [6]. The proposed UVR environment is consists of three functions as follows: the viewpoint, the user interface and auto-save feature. The viewpoint was designed as a first-person point for realism. Figure 2 is the camera settings for a first-person viewpoint and the implemented scene. In case of a first-person controller, it was controlled the movement and direction through the camera placed in front of the character.

Fig. 2. The first-person point

The character moves by virtual joystick as shown in Figure 3. The first column of Figure 3 shows the scope of the touch area and button coordinates. By the size of buttons and the margins, each of the left and right buttons is given by:

$$Lbutton(-Screen\ .width\ /\ 2+marg\ in,-Screen\ .height\ /2\ +\ margin\ )$$

$$Rbutton(Screen\ .width\ /\ 2-marg\ in,\ -Screen\ .height/2\ +\ margin\ ).$$
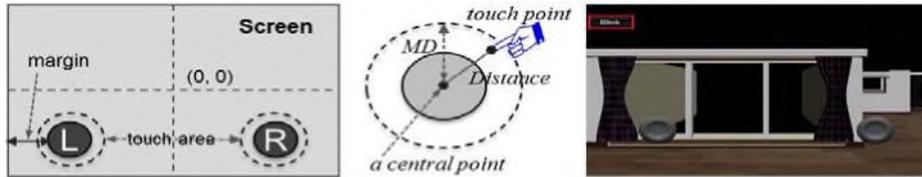
(**1**)

Fig. 3. The virtual joystick for moving the character

The touch area is set while maintaining the distance between a central point (a, b) and touch point (c, d) on a straight line. If the touch point is out of the area, the coordinates of the virtual stick is set to the x-axis and y-axis coordinate values of the maximum distance (MD). In order to obtain each component (θ , $Limit(x, y)$), the angle between (a, b) and (c, d) is obtained by formula (2) and (3).

$$Distance=\ \sqrt{(a-c)^2+(b-d)^2} \tag{2}$$

$$\theta=180\times\arctan((b-d)/(a-c))\times\pi \tag{3}$$

$$Limit\_x = MD\times\ \sin\theta,\ Limit\_y =MD\times\ \cos\theta \tag{4}$$

Figure 4 shows the GUI menu and the completed scene of object placement. In GUI menu, users can select the object such as furniture, home appliances. After the object is selected, a chosen object is activated in the middle of the virtual space as shown in the second column of Figure 4. And then, users can move the activated object by dragging in the proper area.
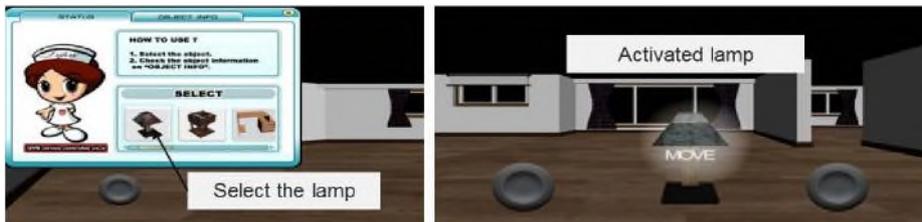

Fig. 4. The scene of GUI menu and object activation

3 Experimental results

In order to test the implemented authoring tool-based UVR, the virtual space was loaded on the android-based smart devices. Users can decorate their home environment, and home appliances can be placed in a similar position with the realism. Figure 5 (a)-(e) is the experimental results that are showing the process of placing the object in the suitable position. In the process of placing the object, users can check the suitable area (Figure 5(c)) and non-acceptable area (Figure 5(d)).
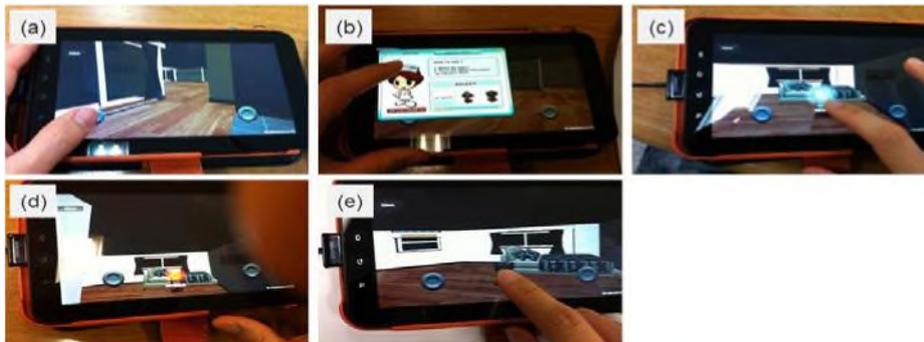

Fig. 5. The experimental results of authoring tool-based UVR

4 Conclusions

In this paper, we designed the authoring tool-based UVR for smart home control. The virtual space and objects has been implemented using 3D MAX and Unity3D, and users can select the object from home appliances in GUI menu. A chosen object is activated in the middle of the virtual space. And then, users can check the areas that can be placed. Some experiments are conducted so as to verify the execution condition, and as a result, authoring tool-based UVR is well operated same as the design specification. The implemented authoring tool-based UVR can apply to various fields such as smart home, smart business and smart fusion technology.

Acknowledge

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