Humanized Game Design Based on Augmented Reality

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Abstract. Currently, the primary research of AR (Augmented Reality) is focus on how to improve the accuracy of identification and reduce the dependency to markers. Successful cases are scarce on how to play the special advantage of augmented reality, combine it with mobile devices and generate practical value. We start form the actuality of AR technology characteristics, achieved the first blind game system which based on mobile platform Android. This system is not only regard game`s emotion design as starting point and pay closely attention to the vulnerable groups, especially the blind community, but also provide them opportunities that compete with average person. Besides, it offers a diversification choice of game against for blind users by set different difficulty level and game player modes. The user experience indicates that the system combines AR and the innovation of game design together, and help vulnerable group achieve flexible user experience and operation.

Keywords: Augmented reality, Game design, Humanized design, Emotional design.

1 Introduction

Augmented Reality (AR) is an emerging field and a hot spot of research in recent years as an important branch of virtual reality technology. Based on information in real scenarios, AR technology superposed virtual objects or other information that computer generated to the real scenario and fused them. By this way, a bridge would be set up between virtual and reality world, thus, we could realize the "Augment" to reality world and presented a new environment with real sensory effect to users.

AR technology has a widely application and a more obvious superiority than VR technology. Zhongwang Jiang`s article[1] introduced the development history and application field of AR technology in detail. Sui Yi`s paper[2] introduced the AR technology based on a handheld device. From 1990, Tom Caudell and David Mizell, engineer of Boeing Co, proposed the concept of "Augmented reality" firstly when they designed the auxiliary wiring system[3]. HIT laboratory at university of Washington released a develop tool of AR system which is named ARToolKit in 1999. Now, just several decades, AR technology has formed a relatively complete workflow and implementation system, its basic principle is shown as Fig.1.

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Games developed rapidly as an emerging industry and various types of games emerged, but games' control mode and scene effect still changed little. In recent years, with the improvement of smartphone`s processing capacity and PDA, AR technology applied to game gradually, so that the game scene is more realistic and users` interactive experience is more immersive. In 2000, Bruce H. Thomas developed the first outdoor mobile AR game which is named AR Quake. In 2004, Mohring[4] et al developed the first application which could completely do all the AR tasks by smart phone. In recent years, research of AR mobile game attracted more and more scholars` attention, and kinds of handheld games based on AR technology constantly emerge. Mobile Maze game[5] require user through the maze by push a car ball. In 2005, Video Processing at VIT developed a multi-user table tennis game which is named Symball[6]. HIT lab NZ developed an AR Tennis game[7]. In 2006, Siemens developed a free throw game, AR Soccer[8]. Besides, Kurt D.Squire team developed an AR scientific education game, Mad City Mystery[9]. From last year, a series of mobile AR game appeared constantly, such as Drop Defender, Zombie Room AR and so on. The application of AR technology made our visual information more intuitive and richer, the real-time interactive experience more real, it will be a development tendency for mobile application in the future.

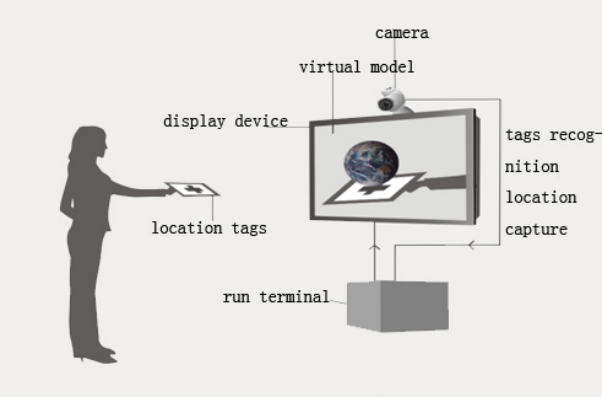

Fig. 1. Augmented reality principle

2 Humanization of Game Design

Except the play ability, game design also needs to pay attention to players` emotional needs. The book "Creating Emotion in Games"[10] told us that emotional design could help game players to realize the additional value of game as an important part of game design, especially for vulnerable groups. Such as: blind person, how to let them to fully experience game`s joy as normal people, the key point is to provide them the opportunities that competitive with normal players. So Shaking World, a puzzle action game which we will introduce in this paper, used the third-person design and AR technology, built a fair competitive platform for blind players. Through the humanized touch board design and with the help of the blind touch habits, blind community could fully experience fun of this game.

3 Game System and Mechanism

3.1 Game System

Shaking World is a fantastic third-person puzzle action game developed by Unity 3d. It has two modes: online mode or console mode, where online mode set up two characters in the same scene, player A and player B. Player A is responsible for shaking the game world and player B should try best to control the character which named little fool against the shaking. They can earn coins and buy props they like by play games. Besides, Shaking World also designed custom mode what players can increase the fun by building themselves level with game props. In a word, this game easy to play, numerous levels plus thrilling scenes make it the best choice for recreation.

Fig. 2. Game system

3.2 Game Props Design and Mechanism Design

Game set in a lot of props in order to increase its playability, such as: bomb, alarm clock, lollipop and so on. The relationship of every element in the game is as shown in Fig. 2. Where, mostly props used to decorate the scene or hinder player B win the game. For example, if character falling into the swimming pool, player B needs a quick click on the character to climb back on the ground, but if player B's clicking too slowly, character will drown and the player A will win the game; The fan has a fixed direction to blow, when the character close to the source of wind, he will be blown away; If player A bought bombs and let player B touched it, player B will be killed, and player A will win the game, but if player B bought the alarm clock and touched it, player A will lose control of the game world 3 seconds, and he will win if he lets the character get the lollipop. In a word, what Player A need to do is that he should try his best to shake player B out of the game world and do the winner, as shown in the left of Fig. 3. On the contrary, player B should make a great effort to overcome player A`s shaking and get the lollipop successfully, as shown in the right of Fig. 3.

Fig. 3. Game mechanism design

3.3 Technology Implementation

Vuforia SDK is based on AR application and display mobile device as a "magic camera" or show the scene as a world that coexistence of virtual and reality. We used this SDK in Shaking World, adopted the AR technology which based on mobile terminal and transplanted the style of AR to cellphone platform. The virtual scene could be stacked to the paper when used the camera of cellphone to shoot it. Besides, in order to assure the consistency between operation and braille, we used the style of virtual button, set a touch area on the paper for blind person. Game runs on Android platform, and its technical principle hierarchy Chart is showed as Fig. 4. Players take photos by camera, find out the target image and determine its coordinate; besides, identify the target images, overlay virtual image on real image and use virtual button interactive with real world. Its bottom technology is as follows: bottom is on Android system, around the operating system to build two big modules, including: camera and rendering module; besides, on the basis of the camera module, we add target tracking module, including: virtual buttons, multi-target tracking, target image recognition, space target recognition and so on, and in the form of SDK provides the chance that developers call low-level interface, can achieve all kinds of special effects effectively.

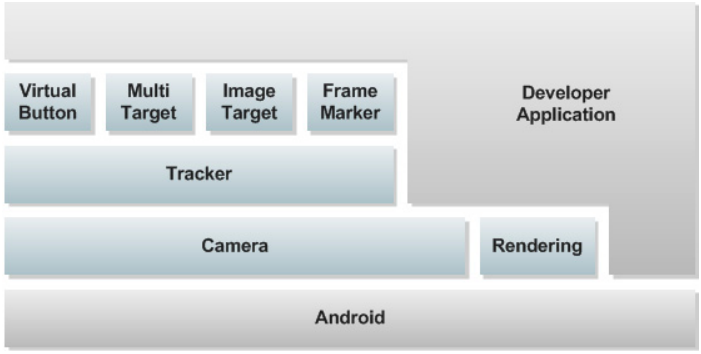

Fig. 4. Bottom framework of AR engine

Virtual Button System. Virtual buttons are developer-defined rectangular regions on image targets that when touched or occluded in the camera view, can trigger an event.

Virtual buttons can be used to implement events such as a button press or to detect if specific areas of the image target are covered by an object. Virtual buttons are evaluated only if the button area is in the camera view and the camera is steady. Evaluation of virtual buttons is disabled during fast camera movements. Define virtual buttons in the Database Configuration XML as children of an image target. To add virtual buttons, insert a section similar to the following:

```
<ImageTarget size="247 173" name="wood">
<VirtualButton name="red" rectangle="-108.68 -53.52 -
75.75 -65.87" enabled="true" />
<VirtualButton name="blue" rectangle="-45.28 -53.52 -
12.35 -65.87" enabled="true" />
</ImageTarget>
```

The Virtual Button state can be requested from active targets in the scene by iterating through the button child objects:

```
// Iterate through this targets virtual buttons:
for (int i = 0; i< target->getNumVirtualButtons(); ++i)
{ constVirtual Button* button = target-
  >getVirtualButton(i);
  if (button->isPressed())
    { textureIndex = i+1;
      break; }
}
```

User-defined the identified image. In this section we show how to use the user-defined target feature to instantiate objects of classes from TrackableSource which can be used to create new Trackables at runtime.

Two new classes, ImageTargetBuilder and ImageTargetBuilderState are introduced: where, class ImageTargetBuilder exposes an API for controlling the building progress, retrieving a TrackableSource for instantiating a new trackable upon successful completion. The flow chart is as shown in Fig. 5.

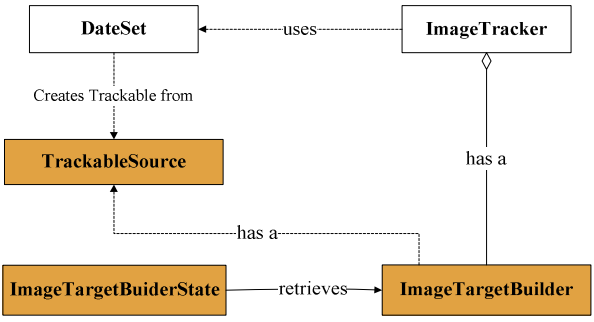

Fig. 5. The process of instantiate object

Expression form of identified images. The expression forms of identified images are as follows:

```
?xml version="1.0" encoding="UTF-8"?>
<QCARConfigxmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance"
xsi:noNamespaceSchemaLocation="qcar_config.xsd">
<Tracking>
<ImageTarget size="247 173" name="stones" />
<ImageTarget size="247 173" name="chips" />
</Tracking>
</QCARConfig>
```

4 Game Results

Relative to other games, Shaking World has few bright spots: (1)Pay attention to user`s emotional experiences, provide humanized attention and care design for vulnerable groups. (2) Using augmented reality mode to increase fun of the game and expand the original dimension of game experience which based on screen to a three-dimensional game space. (3) Using the virtual button mode of AR technology, provided game operation based on braille contact for blind user.(4) Combined the play ways of virtual and reality, and provide an interaction with virtual game by manipulating physical paper. (5) With the aid of AR technology and use the levels mode of blind person book, blind man could touch the dots on graph to operate this game. Besides, different maps represent different level, so with different maps, blind person can take part in every level of game as normal people.

The game Shaking World which based on AR technology could achieve different effects. The left of Fig. 3 stands that player B was shaking out the game world, the right of Fig. 3 stands that the character eats the lollipop. Fig.6 is the whole scene of this game. Fig.7 is the game mode that designed for blind person. They could play the game by touch dots on the graph paper when run the game. Every elements of this game drawn exquisite, character designed personality, and visual effect is preferably.

Fig. 6. Humanized design of game scene

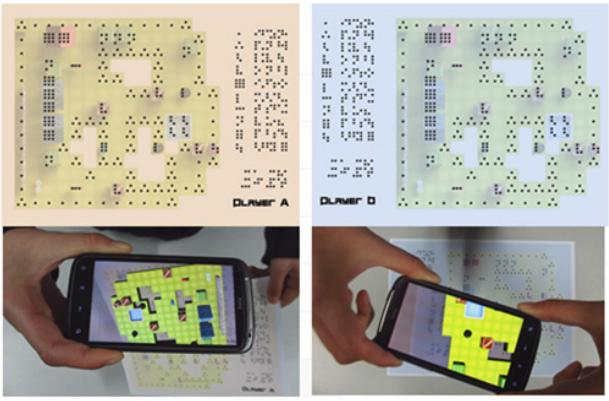

Fig. 7. Blind person mode of the AR game

5 Conclusion

Shaking world game used the AR technology, fully considered humanized design, the research result indicated that it has a certain appeal and also is a better choice for entertainment. Beyond that, it also has much commercial value: (1) Convenient development peripheral products: the "Shaking World" building blocks, gift boxes, store content boxes, alarm clocks and so on. (2) Can implant the SDK advertising on the top of houses in the game scenes and don't destroy the beautiful game. (3) Can implant some products in the art style of the game for joint operations of products. (4) Can promote to many operators, such as: App Store, CUCC, CM, CHA. (5)To cooperate with shopping website: Play the game to earn the points or gold of the shopping website. The more important is that the game also has much public value: (1) Pay attention to vulnerable groups, to provide fair and competitive opportunities for the blind, let them feel the game happiness. (2)With the help of a third party social media channels, for example the game feeds, cause people concern for the vulnerable groups and give them more help.

In the future, AR technology is an emerging and active field of research. It could bring people new visual experience, and has a broad market prospect and application scope. For the game industry, apply the AR technology to game could greatly rich the content of game frames and increase game`s entertainment.

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