

Mobile Application Design of Augmented Reality – Digital Pet

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Abstract—Recently, thanks to the rapid development of smart phones, augmented reality has extended from personal computers to mobile phones. The highly interactive nature of augmented reality with its user has given rise to various augmented reality applications for mobile phones, ranging from mere interaction to marketing, games, navigation, and so on. As such, augmented reality has for years been one of the focuses in mobile phone application development. While users always expect something more of augmented reality, the latter has its inherent limitations. For example, augmented reality typically requires the use of markers, which, however, are not always available, or cannot be carried around with ease, or are not user-friendly in design. In this study, a human-computer interactive interface between a user and a virtual pet was designed with the aim of incorporating augmented reality, and the function of markers was studied by a scenario-oriented approach. A virtual pet application was then developed for a smart phone as the platform, so that intimacy and interaction between the user and the virtual pet can be enhanced with augmented reality. The marker in this study is an easy-to-use and highly portable ID card holder, thus allowing the user to interact with the virtual pet anytime, anywhere. In addition, a questionnaire survey was conducted, the result of which serves as a reference for future development of augmented reality and virtual pets.

Keywords: Augmented Reality, Digital Pet, Mobile Application, Human-Computer Interaction Design

1. INTRODUCTION

1.1 Background and Motivation

With the demand for software resources in recent years, more and more large, relatively rising smart phone hardware, augmented reality technology in the past can only be used on the computer, because the pixels of the camera to enhance graphics

processing progress, and now also to be applied in the mobile phone software, and because the phone is easy to carry, augmented reality is able to generate more interactive applications, such as: interactive advertising, navigation, and games.

Nowadays, augmented reality still needs to use the marker to reach a recognition target. Marker for recognition still requires further improvement, for which many studies are targeted to improve recognition technology, for example, the marker to replace a specific image augmented reality, or to replace the electronic information other than the image tag identification, such as: geographic information to achieve the effect of augmented reality and GPS.

Current markers are not very user-friendly. Most of the markers are photocopying by the user to use and very easily lost after use, therefore improving the design of the marker is the goal of this study. We aim to design the practical and portable markers which are easily remembered and carried in daily life. Finally, the overall appearance of the marker is closely associated with augmented reality content. Based on the above, the concept is to make augmented reality mobile platform, the use of digital content within the practical function of the marker-link phone to the match between the hardware and software to achieve the effect of human-computer interaction.

2. RELATED WORK

2.1 Development and Application of Augmented Reality

I. Definition of the Augmented Reality

Augmented reality is a form of virtual reality which allows users to fully integrate into the computer-generated virtual environment where the user cannot see the reality of its surrounding environment. Augmented Reality allows the user to see the reality of the environment, as well as the synthesis of virtual objects in the real environment superimposed or contrasted with virtual reality. Therefore, the purpose of Augmented Reality environment does not completely replace reality environment. Augmented reality has the following three characteristics: combination of real and virtual environments, real-time interactive study, in three dimensions [1].

II. Principle of the Augmented Reality

In early years it can be done by two head-mounted displays (HMD): optical HMD and image-based HMD that users can integrate into augmented reality combined with either real or virtual environments. Optical HMD is shown in Figure 2-1. Camera identification tag is used on the helmet. The virtual object is directly projected to the transparent lens to achieve the effect of augmented reality. Image type HMD in Figure 2-2 uses a helmet camera identification marker. Real and virtual images are combined to display to the user to watch the small screen inside the helmet [1]. Due to the

immaturity, high cost, and inconvenience to carry, such equipment and technology cannot be accepted for general users. But then the popularity of PC and network cameras makes augmented reality a new way to identify the real environment. As hardware price gets cheaper, video output to PC monitors gets more popular in augmented reality [2].

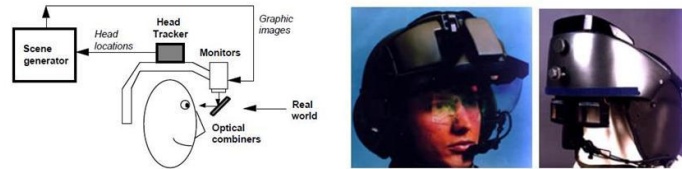


Figure 2-1 The principle of the optical HMD and its appearance [1].

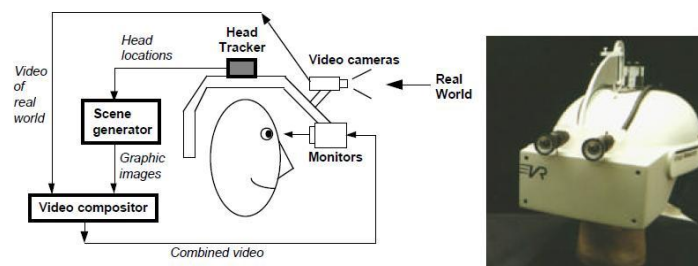


Figure 2-2 The principle of the image HMD and its appearance [1].

2.2 Analyses and Discussions

I. AR software

Table 2-1 Comparisons of various AR software.

	Advantage	Disadvantage
Hoops AR	A basketball court for the marker, to enhance game play.	Need to prepare a marker to the game.
Layar	Intuitive navigation screen.	Need to turn on the camera and Internet connection to use navigation, consume much electricity.
Word Lens	Simple and practical translation software can be used without Internet.	Four translation languages (English, Italian, French, and Spanish) are too few.
iButterfly	Butterfly shape combined with advertising, marketing effect by capturing various butterflies.	Single marketing functions, low user viscosity.

AR Drone	The effect of the AR and play against other players.	Need to buy expensive AR Drone aircraft.
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III. Development of mobile device software

Table 2-2 Development of mobile device software.

	Advantage	Disadvantage
iOS	Development of resource-rich unified development platform, a complete audit of APP trafficking mechanism.	Requires Macintosh computer and becomes a paid member of the development.
Android	Requiring a lower level of development equipment.	Too many different device specifications led to maintenance difficulties.

3. EXPERIMENTS

3.1 Creative Concept of Amplified Reality Pet

Today's culture of pet keeping becomes more and more popular. However, pets need much money to take care, so few can afford. Thus interactive game becomes more and more prevalent in today's science and technology development. Both entity's pet toys and virtual digital pet become more and more authentic and interactive.

3.2 The Development Flow of Augmented Reality Pet

I. Game theme

In this study, the use of augmented reality features interactive games to construct a virtual pet. Musk pig theme features the design of the interactivity of the users and virtual pig. The design concept of the game is categorized into the following two items:

1. Marker designed to document card folder allows users to interact with a virtual pet readily available anywhere.
2. Use of augmented reality virtual objects with the real environment makes users feel for various interactions with virtual pets in real-world environments.

II. Hardware and software architecture

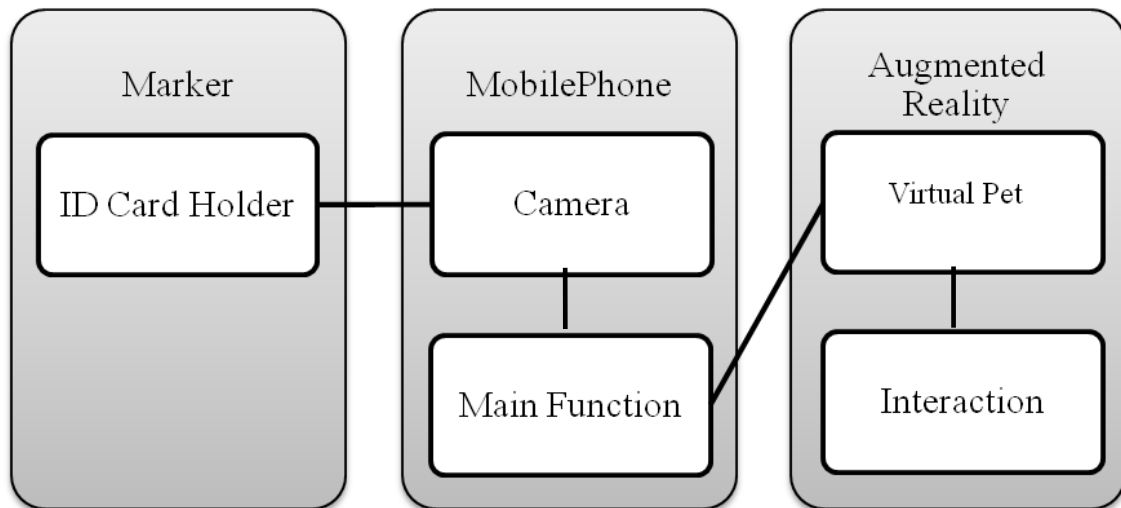


Figure 3-1 Hardware and software architecture.

III. Game music

Use the previous recorded musk pig feeding videos to extract audio to get game music sound. Sound files produce pig crying and eating.

IV. The software development of augmented reality

This section will briefly describe the process to use Unity and Vuforia kit to develop Android Augmented Reality. Software development will be done before the pig model and a pig grunting import Unity for the integration. The following are brief development steps:

1. Launch the Unity and load Vuforia kit.
2. The use of the material dragged into the Unity project library.
3. Identification underlay Loading Unity.
4. Identification base map set completed that will appear in the scene.
5. Pull the pig model from the project within the scene.
6. Set up a virtual button on the scene as well as pig model.
7. Program and debug.
8. Output installation file to your Android phone for installation and testing.

V. Game mechanism and interface

Unlike the ordinary augmented reality, they use a two-dimensional matrix marker to identify objects. The game interface using the ID card folder to do for the identification of the target, shown in Figure 3-2. Documents clip practicality and easy to carry, but also to enhance the degree of adhesion of the virtual pets for users, so that users can always go out with a pet feeling.



Figure 3-2 Clip of the documents.

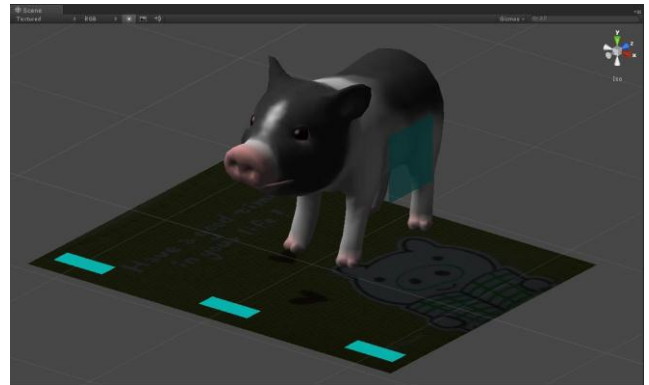


Figure 3-3 Various parts of the virtual button set.

The game mechanism created from Augmented Reality integrates real and virtual features. The use of a set of virtual buttons in the program allows the pig to generate feedback on the user's behavior. When the game executes on the screen, the user could not see the virtual buttons, thus enhancing the pig really interests users to react to feel the position of the virtual buttons including pig in front, left front, right front, and pig's left and right sides of the stomach, such as shown in Figure 3-3.

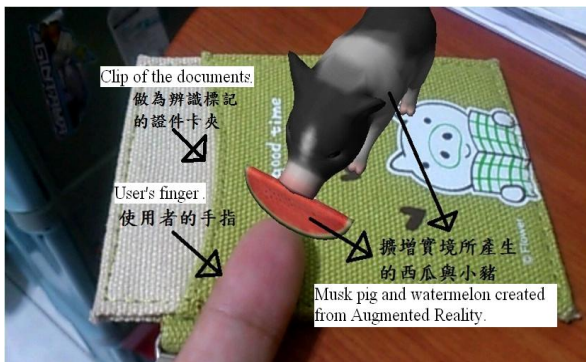


Figure 3-4 Diagram of game operation screen.



Figure 3-5 The pig nose coquetry screen.

When user finger covers each virtual button, the pig will produce the corresponding action. For example, cover the front of the button, the program control pig plays grinding nose coquetry animation from the picture like a pig really with the nose dawdling user's fingers, as shown in Figure 3-5. The description screen of game starting is shown in Figure 3-6.

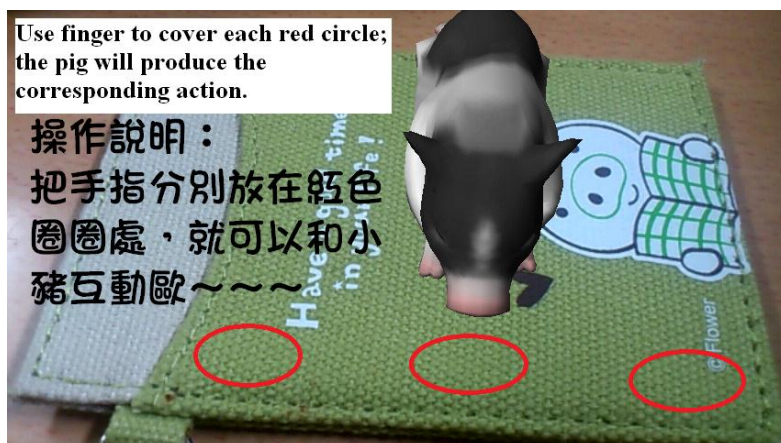


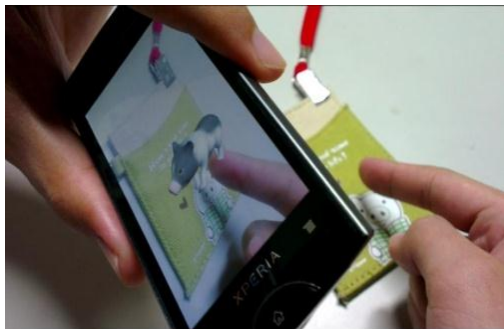


Figure 3-6 The description screen of game starting.

3.3 Systematical Analysis and Comparison



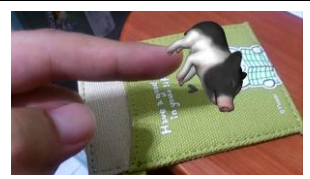
I. Comparison of augmented reality interactions

Table 3-1 Comparison of augmented reality interactions.

	Illustration pictures	Description
Augmented reality on an early computer		Webcam identification of the main tag. Users also need to use other specified tag to interact with digital content.
Popular augmented reality on the phone		A user clicks on the touch screen to interact with digital content on the phone.
The implementation of our augmented reality		Through augmented reality detection effect, user directly uses fingers to interact with digital content in a real environment.

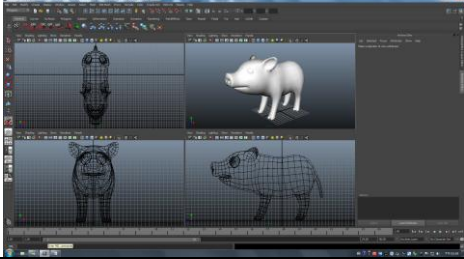

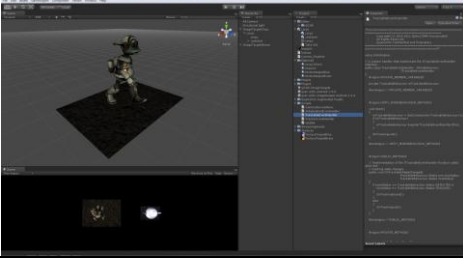
II. Descriptions of Interesting interactive interface

Table 3-2 Descriptions of Interesting interactive interface.

	Illustration pictures	Descriptions
Eat watermelon and drink water		When the user presses the button to eat watermelon or drink, watermelon or a bowl filled with water will appear before the user's fingers, like hand-fed pig to eat watermelon and drink plenty of water.
Nose coquetry like a baby		The musk pigs have interactive habits of pushing things with a nose. When users put their fingers on the piggy nose push things animation, the screen will look like pig has nose-pushed a user's finger.
Touch pig stomach		Interactively touch the belly, like real musk pig habits. When the user presses the button on the pig stomach, pig animation will broadcast to lie down. Pig seems to lie down after user finger touches the belly of the pig.

III. Hardware and software analysis used in this study

Table 3-3 Hardware and software analysis used in this study.

	Name	Illustration pictures	Descriptions
Software	Autodesk Maya		Make a pig model and animation.
	Vuforia		Development of Augmented Reality Kit.
	Unity		Integrated Vuforia kit and output into the APP to Android phone.

Hardware	ID Card		ID card folder.
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4. CONCLUSIONS AND DISCUSSION

Augmented Reality as a starting point, we use musk pig to construct virtual pet settings and create the appearance as well as various animation of virtual pet pig. Then use the ID card folder to identify the marker. Finally, use augmented reality technology to allow users to interact directly with the virtual pet. As a platform to integrate mobile phone, we complete the development of augmented reality pet application.

I. Human-Machine Interaction Design

Digital pet of Tamagotchi type uses the screen or buttons to interact with the pet even without real experience. Due to its large size, we cannot carry digital pet robot types with direct interaction like the Tamagotchi types of products. In this study, due to the use of augmented reality integration of virtual pet new model and the development of a new interaction between the user and the digital pet, users can directly use finger to interact with the virtual pet. Thus significantly enhance the man-machine interface interactivity. This intuitive interactive mode gets a good response from user survey as well as the reaction of the subject's field operations.

II. The Virtual Pet Interactive Effect

With integration through augmented reality, the user can use fingers directly to interact with the pig and see through the phone's screen. For example, to feed piglets to eat watermelon interactively. Directly touch the pig's stomach by finger, the pig lies down and rests. The effect of these interactive features achieves satisfactory evaluation.

III. Identify Markers

From the literature, the identification marker is difficult because of inconvenience for user to carry or save and may make decrease software viscosity. Therefore, this study uses practical and simple appearance of a card folder as identification tags. Most of the subjects from the questionnaire results like such convenient design.

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