

USING AUGMENTED REALITY TO ENHANCE THE CONVENTIONAL GAMEBOOK

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Abstract This paper presents the design of Augmented Reality gamebook to enhance the performance of the conventional gamebook and replace it. Augmented Reality technology that employs animation in real scenes is to bring new digital entertainment experience to the viewers. Traditional gamebooks started to experience bored, become less attractive to gamers and easily obsolete. The conventional way of playing game does not satisfy the players anymore, it is because the interaction between the game and the player is limited to static objects such as text. Augmented Reality with its special characteristics enhancing the display output of real environment and the composition of virtual and reality can bring sense of deeper immersion to the players, thus greatly increasing the interest and attraction of game.

Keywords: Augmented Reality, entertainment, Game, Gamebook

1 INTRODUCTION

A visual Augmented Reality (AR) has become popular in the last decade because it is a natural way of exploring 3D objects and data, as it brings virtual objects into the real world where we live [1]. Prior to AR, the concept of virtual reality technology allows the user to feel as moving inside a virtual world created by the computer much like the natural environment, but the user cannot see the real world around him. AR, on the other side, allows the user to see the real world, augmented it with superimposed virtual objects [2]. AR with its special characteristics enhancing the display output of real environment and the composition of virtual and reality can bring sense of deeper immersion to the players, thus greatly increasing the interest and attraction of game [8]. The number of applications using AR is growing and applications already seen in several fields such as Education, Industry, Games, Travel, Arts, and Medicine.

A gamebook is a work of fiction that allows the reader to participate in the story by making choices that affect the course of the narrative, which

branches down various paths through the use of numbered paragraphs or pages [3]. The main purpose of this work is to apply AR technique to promote the performance of a traditional gamebook. We use AR with multimedia to make the traditional gamebook more interesting and change the way of playing the game. A traditional gamebook, which began its popularization in the seventies of the last century, will be replaced by AR gamebook that can be played in gaming device. There are several famous gamebook titles such as 'In the Footsteps of a Hero', 'House of Horror', 'Midnight Deep', 'The Diamond Key', etc. In this work, an old version of a game book will be selected and the AR technique will be applied to improve the old version, so it will be more attractive to the player.

Gamebook is dissimilar to the normal book or novel, the difference is made in the storyline of the book; there are several plots or ways in which the story can be completed. Stories in gamebook allow user to make choices at several points in the book about how the plot should proceed. Several conditions would appear throughout the story such as fighting, competing, escaping, etc. The reader's

choices make the story character win or lose, live or die. In addition, a gamebook has multiple endings; every player will not go through the same story line as others. Due to the recent improvement of game environment, traditional gamebooks started to experience bored, become less attractive to gamers and easily obsolete [4]. The conventional way of playing game does not satisfy the players anymore. It is because the interaction between the game and the player is limited to static objects such as text. It seems hard for a player to imagine the flow of storyline to continue the game. As AR technology started to rise up, it tends to replace the conventional game environment. Game that uses AR enhances the user's view by adding in multimedia elements such as pictures, graphics, sounds, animations, etc. in creating computer-generated objects and combines it with the real world view. With AR technology, users can view both the simulated object and the real world from the display screen and interact with them. Users can move around the detected AR marker and see the virtual objects or animation from different angles as the AR system performs alignment of the real and virtual cameras automatically.

2 THE CONVENTIONAL GAMEBOOK

'In the Footsteps of a Hero' is an online version gamebook written by Victor Cheng and it was published in the Fighting Fantasy Project website [5]. The overall story of the gamebook is described in the following abstract that written by the gamebook's author: "From a young age, you have dreamt of an adventurous life. You would constantly spy on the training ground from your window, learning then practicing the art of swordplay and combat maneuvers in the confines of your room. Now, growing into adulthood, you find that your arduous work has built up your strength and confidence. Soon you will be ready to join the world's heroes." The adventure covers 50 book pages; it has numerous paths and side adventures to follow. There are large numbers of items available in the book and not all will be useful for the user while playing the game. The game is based on the player's scores of "skill", "stamina", and "luck". Skill value is used to

determine player's strength during battle scenario. Stamina value reflects player's health; the scores will change during the story with different circumstance, the higher the players get, the longer they will be able to survive. The use of luck could determine their fate at certain key points [5].

Figures below show parts of the online version gamebook, named "In the Footsteps of a Hero" [5]. Initial scores of the character are displayed at the upper part of the online page, followed by the book page number (Figure 1). The right side of the page shows the player's attributes, possessions and currency.



Figure 1. First scene in gamebook

When reach at the end of the text, several options in yellow color are given; the selected option will determine where to continue the adventure.

Figure 2 and 3 shows what appear when a player meets an enemy and willing to fight. Skill value and stamina value will change accordingly.

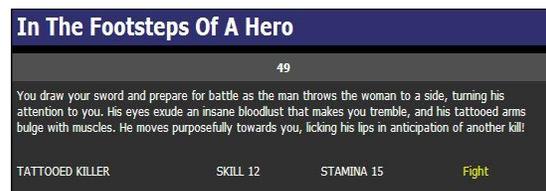


Figure 2. Fighting option in gamebook



Figure 3. Fighting scene in gamebook

Figure 4 shows what appears when a player enters a contest during the game. Reward will be given to the player if he wins the contest.

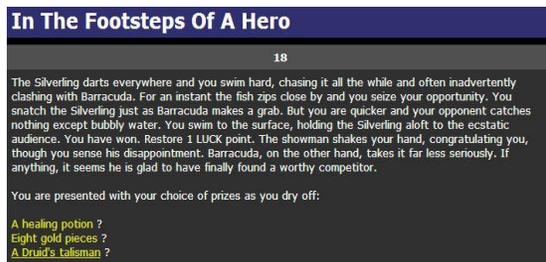


Figure 4. Contest scene in gamebook

The adventure will run smoothly according to the player's choices and go towards the end. Different players will experience different plots of story depending on the player's choices. Sometimes the story may end sadly when the player could not reach the end and die in the

Table 1. Comparisons among versions of gamebook

	Conventional Gamebook (Book)	Conventional Gamebook (Web page)	Augmented Reality Gamebook
Platform/ Tool	Book	Computer	Computer + Book
Function without internet	Yes	No	Yes
Interaction between game and player	Book page	Web page	Book page, touchable marker, virtual 3D object.
Element	Text, picture.	Text, picture, button	Text, picture, sound, animation, marker button, virtual 3D object

middle of the story if his scores had become zero after much fighting. Players need to go through the gamebook several times if they wish to reach a happy ending.

2.1 The Augmented Reality Gamebook

A visual Augmented Reality system combines computer-generated objects and real physical world by giving the illusion of virtual and real object appearing at the same space. As a result, user can interact with the computer-generated objects in the real world. AR can be explained as video-see-through technology [2], the display of both real world and superimposed computer-generated objects can be see through by using AR device. Moreover, the virtual object can be moved around in different angles to enable interaction,

because Augmented Reality technology performs alignment of the real and virtual cameras automatically.

There are two different types of approaches that can be used to integrate with AR [6].

- i. *Marker-based tracking* requires a highly distinct marker patterns that can be detected by AR system. This marker can be categorized into normal marker pattern (Figure 5) and image marker pattern. Once the AR system detects the marker through connected camera, virtual objects will show up and overlaying on the real world environment. For example, this approach is widely used in the field of advertising.
- ii. *Marker-less tracking* does not need markers as it uses different methods in order to obtain location awareness. Marker-less tracking systems can show information about occluded objects in the scene, as they do not rely on a detectable marker. For

example, AR navigation tool used in live Augmented Reality Guiding system for cars. (Figure 6) [7].

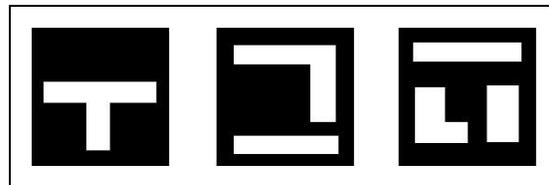


Figure 5. Marker-based tracking



Figure 6. Marker-less tracking

A comparison between the old conventional gamebook and the AR gamebook is shown in Table 1.

3 RELATED WORK

Augmented Reality concept has been researched in recent years and effectively applied in various fields like education, entertainment, medicine, industry advertising, etc.

Fan and Liu [8] pointed out that Boeing's Computer Services Research and Technology group apply AR technology in the connection of power cable and assembly of connector in aircraft manufacturing. Also, Sony's latest PS3 game "Eye of Judgment" is developed by using AR technology "based on manual marked points". The game realistically has rendered 3D characters such as monsters in the real environment around the players, thus being widely praised. In the field of medicine, Lamounier et al [9] presented a system for learning and interpreting Cardiologic Data to analyse and visualize heart beating based on AR. The results obtained by the AR system have shown that the system is able to simplify the understanding of concepts about heart beating and its functioning. Heen Chen et al [10] discussed an application of AR in engineering graphics education to increase student's understanding of the relationship between 3D objects and their 2D projections of engineering structure. Their research was to develop an AR application that enables faster comprehension of complex spatial problems and relationships which will benefit the students greatly during their learning processes. The AR-based method is proved to be effective teaching

aid for engineering graphics courses. In education also, another AR application focused on the experiment simulation prototype [11]. The proposed AR system aimed to improve the conventional way of classroom learning environment which has become less attractive to student. Science subject is used in the prototype system as a case study to observe the result; students had been attracted by the AR technique and it showed a potential in facilitating the learning process. Chouyin Hsu [12] discussed the feasibility of AR in a virtual tourism website in Taiwan. The application's objective is to attract user's interests at the first contact of visiting the website and continue to provide travel information in order to increase the tourism market, which may increase Taiwan's economic development. Marker-based tracking method is used to present the virtual 3D model of famous building and food of Taiwan; it can upgrade the media richness of the website. Henderson and Feiner [13] explored the benefits of AR to professional mechanics performing maintenance and repair tasks in a field setting. A tracked see-through headworn display (HWD) is used to perform an AR prototype which is developed to improve the maintenance and repair process by enhancing the localization in standard maintenance scenarios. It is found that the AR condition allowed mechanics to locate tasks more quickly, it is intuitive and satisfying for the tested sequence of tasks.

4 METHODOLOGY

For developing the Augmented Reality Gamebook, the Rapid Application Development method (RAD) is chosen because RAD has several characteristics that make it suitable for the development of the AR gamebook. RAD is suitable for systems that need to be completed in a short period; least planning with easier respond to requirement changes by producing rapid prototyping.

The life cycle phases of RAD are shown in Figure 7, which are:

1. Requirement Planning Phase
2. User Design Phase
3. Development Phase
4. Testing Phase

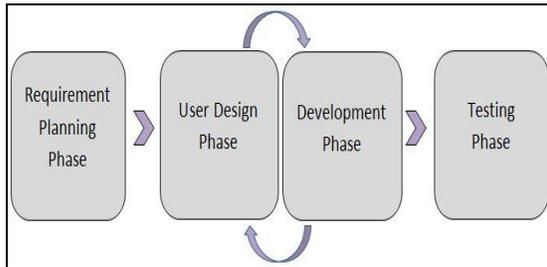


Figure 7. Rapid application development lifecycle

4.1 Requirement Planning

During this phase, the objectives and scope of the project are determined. AR concept has started to impress game players, as it brings more entertainments by adding the reality view. So, the objective of this study is to apply the AR techniques to improve the conventional gamebook environment. This study will focus on developing AR gamebook for portable device and only allows single player. By using AR, there will be more interaction between the gamebook and the player.

Information related to conventional gamebooks, portable devices, AR technique, suitable multimedia elements is collected. Type of conventional gamebook should be selected first, thus, variety of gamebooks has been reviewed and the best choice was an adventure gamebook with element of frighten, which would attract more attention. Various portable devices such as smartphone devices and computer devices had been reviewed to ensure the appropriate device is selected for implementing the new system. Also, the way of presenting AR should be identified clearly by choosing suitable method that fits with the gamebook elements. Marker-based tracking method is more suitable for our gamebook development compared to marker-less tracking method. As mentioned in section 2.1, marker-based tracking rely on detectable marker to display virtual objects that overlay on the real world environment. Marker-based tracking makes it easier to produce a real environment of reading a book compared to marker-less tracking method.

4.1.1 Analysis

Features that the system provides are identified, studied, analyzed and organized through the process of analysis. As frighten category of conventional book is chosen, it should provide the frighten and mystery sense, for this purpose, multimedia elements such as color, sound, text, etc. have been chosen to be more close to dark theme. The chosen color scheme is based on cold colors such as black, dark blue, dark purple, etc. which provide the feel of mystery.

Marker-based tracking method is chosen to present the AR concept. Both normal marker pattern and image marker pattern will be used in developing the system [14]. Marker that will be designed will attain different functions such as being able to rotate and easily touched. Example of normal marker pattern is shown in Figure 8. 2D marker on the left side will be detected by the system's camera, and then the 3D virtual object on the right side will appear on the system's screen.



Figure 8. Example of marker

Device that will be used to play the AR gamebook has been chosen as well. Computer is chosen instead of smartphone because the computer's screen is larger than smartphone's screen and it can easily fit a book size. Integrated computer camera will input and detect the AR marker, then the system will position 3D model and display it through the screen of the computer. The setup plan of these devices is shown in Figure 9.

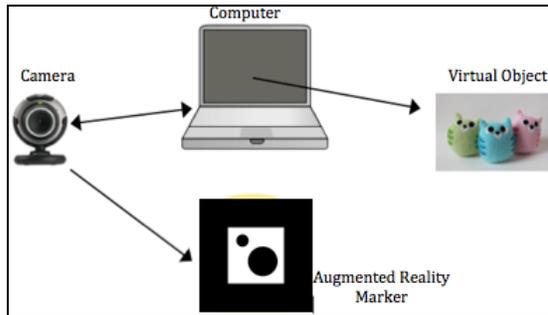


Figure 9. Device setup plan

After investigating the required functions of the suggested system, it can be summarized as follows:

1. This system should be able to detect the designed marker and show up virtual objects that overlay on the real world environment.
2. The designed marker is easily touched to control the gaming process.

4.2 User Design

The design work of the proposed system will be described in next sections..

4.2.1 Game flow

Interaction between the player and the game is done using the computer device and marker. Once user gets into the game application, the storyline runs automatically by introducing the background of the gamebook. There are several options that evoke players' attention during the game and the player has to choose among those critical options in order to continue the game. The story ended differently depending on the players' decision. Figure 10 shows the overall game flow.

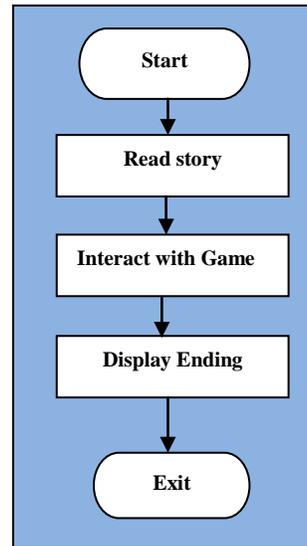


Figure 10. Overall game flow

4.2.2 Gamebook page design

The design of the gamebook's page is shown in Figure 11. The content interface of the gamebook will be separated into two parts, the animation part and the text part. The left part of the gamebook page will encompass the animation that is already created according to the text. When the camera detects the animation's AR marker, the animation will be displayed. The right part will encompass the text followed by given options. The option's marker when touched will display next page direction of the gamebook that will appear in the status bar.

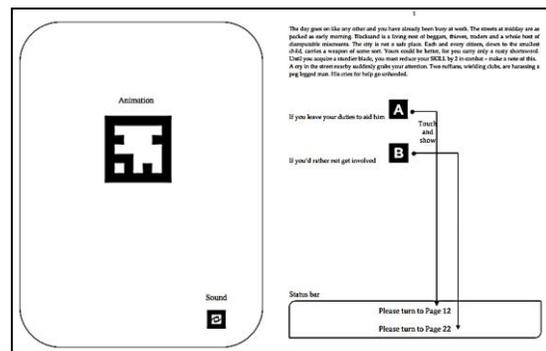


Figure 11. Gamebook page design

4.3 Development

In this phase, the system will be coded and build according to the design specifications. However, in RAD lifecycle, code changes are acceptable according to the changes in design. As a result, the construction will vary according to any modification in the requirements. D'Fusion Studio will be used to produce the AR gamebook application. It is an authoring tool that allows object-oriented programming using standard language such as LUA. LUA scripting language is used to program the gamebook's scenario, integrate related multimedia and create interactions between the gamebook and the player. Besides that, the design and animation of 3D model in the gamebook will be created using Autodesk Maya, a 3D animation software. In this work, the overall storyline of the conventional gamebook would not have much change. However, the 3D design of characters, buildings, places, in the story will be different as it should match the settings of the gamebook's story.

4.4 Testing

Testing will be conducted to detect and identify bugs and errors committed during the previous phases. The planned test is explained in the next section.

4.4.1 Usability testing

Usability testing generally involves measuring how well the system operates in terms of efficiency, accuracy, recall and emotional response [15].

- i. Efficiency: To measure how much time the player would take to complete the basic flow of game.
- ii. Accuracy: To find out the number of mistakes the gamer may make during the playing time.

- iii. Recall: To test how much the gamer recalls the game after a period not using it, how easily can they re-establish proficiency.
- iv. Emotional response: To test how does the gamer feel while interacting with the game and how pleasant it is to use the gamebook.

To ensure better results, the system will be tested piece by piece and the results of all tests will help to determine the quality of the system.

5 CONCLUSION

The main objective of this work is to improve the conventional gamebook environment by implementing the Augmented Reality technique to make it more attractive and interesting. This study discusses the AR technique and how it could be applied in Gamebook to enhance its performance. The methodology used to develop the AR Gamebook is Rapid Application Development (RAD). In this study, the analysis and design of the new system have been discussed and a testing plan is proposed to test the system operation after the implementation is completed.

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