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Research paper



Augmented Reality and Virtual Battle System for Trading Card Game

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Abstract

In this research, we discuss the fairness in gameplay and technology enhancement for playing trading card game. This research mainly focused in applying augmented reality and virtual battle system while developing a new trading card game. Unity is used for developing the game that is based on extreme programming methodology, and the requirements are gathered by interviews, surveys, and research that have been conducted. By applying the augmented reality and virtual battle system, the game will be more interesting and fairer to be played.

Keywords: *Augmented Reality; Virtual Battle System; Trading Card Game*

1. Introduction

Computer games have become a success and considered as cultural and commercial phenomena. This fast and growing market is reported to be reaching 128 billion dollars by 2017 (Sekhavat, 2016).
In physical real-world games, players can communicate with each other in natural ways. Providing animated contents that can be extraordinary and seems impossible in the real world can be an advantage of a computer game (Mulloni, Wagner, & Schmalstieg, 2008).
Trading Card Game (TCG), or sometimes called as Collectible Card Game, is a kind of card game which requires the game to resemble trading cards in shape and functions, for trading or collectible and has the rules as in a strategic gameplay (Williams, Hendricks, & Winkler, 2006; Frank, 2012). TCG has now become one of the popular games in the world. Yu-gi-oh!, one of TCG which managed to score a record of Guinness World Record in 2011 as the best-selling card game in the world, with more than 25 billion units sold. TCG is usually played conventionally and traditionally without any electronic technologies, which brings difficulties in applying fair judgments for each time the game is played due to subjectivity of each player. TCG is also used as a learning tool to stimulate creativity, cognition, and logical reasoning (Turkay, Adinolf, & Tirthali, 2012).
Traditionally, computer games are locked or bounded by a computer or a smartphone display where small windows provide a view into the virtual game world and the player is disconnected from the surrounding physical environment. The game experience can actually be extended by bringing the virtual world out into real-world such that players can incorporate the real-world in the game (Mulloni, Wagner, & Schmalstieg, 2008).
Augmented Reality (AR) is the art that force graphic from computer to be displayed in real world (Madden, 2011). AR is currently a trend as it has many admirers as reported by Mangiaforte in 2014. Lisa Hu, the Vice President of Blipper – an AR application, predict AR as one of the most rapidly-growing market globally for five years ahead. Blipper itself has currently over than 50 million global users, and if it is compared to social tools or services like Vine (40 million users) and Pinterest (70 million users), then augmented reality is set to become a permanent fixture in digital marketing landscape.
Based on the data above along with the interview, surveys and other research conducted, TCG game combined with AR will become a highly promising game. The AR can be used for developing a new feature that attract more players, such as bringing the playing experience into live by displaying the monsters using three dimensional images. Virtual Battle System will be an extra bonus point, as the system will replace player's subjectivity in calculating the game score and it will reduce conflicts and such. By combining TCG with AR and Virtual Battle System, the game developed will be more interesting and can maximize the card gaming experience, just like in anime.

2. Related Work

AR is becoming popular in digital entertainment area as it gives users immersed feeling into the combined virtual and real scenes, which is a very attractive technique for game development, and thus led to many researches in the area (Lyu, King, Wong, Yau, & Chan, 2005). A virtual table was developed for playing trading card using Augmented Reality, to provide interactive environment and input method (Lam, Chow, Yau & Michael, 2006). In this research, the monitor was used as virtual table to play the card game. In (Chowanda, 2011) the 3D visualization object was shown according to the chosen card in the smart phone screen while the game played. While in (Katay-

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ose, Imanishi, 2005), an arm controller was used as the game arena in a trading card game based on AR, in a way the player can experience monster summoning and battles.
However, in most of these applications emphasizes only in how to show the 3D object according the card chosen, while the battle-like environment were ignored. And also only the players got the experience of the game, as for the experience for the spectators was not accommodated.
In this paper, it will developed the prototype of a combined Trading Card Game with AR and Virtual Battle System , with specific rules that can be experienced not only by the players but also by other people who acted as spectator, therefore the experience of the game can be experienced by more people.

3. Methodology

The game will be developed according to extreme programming methodology in four steps, planning, design, code, and testing. Planning covers the requirements gathering in order to develop the game. The research is conducted by collecting data from the online surveys conducted to 55 TCG players and by interviewing TCG experts. Data from surveys reflects the desires and expectations from prospective players; meanwhile data from expert is supporting the details. Analyzing the features offered in similar game applications will extract the strength and weakness of each game, and by doing such the new game developed will offer more points and be more interesting to play.
Based on the requirement gathering, we get the following problems from players playing TCG:
• Simple TCG that can be easily understood is much more interesting.
• Respondents have difficulties when playing due to unclear description and rules described in the card which led to an unfair game.
• Respondents are getting weary with existing games. An improved version with new technology is expected, such as the real experience of the battle, the spectator to support the player, to increase amusement and decrease dullness of the conventional TCG.
The similar applications analyzed as the basis of creating the new TCG are Yu-gi-oh!, Duel Masters, and Cardfight Vanguard. The table below shows the comparison:

Table 1: Similar TCG Applications

	Yu-gi-oh!	**Duel Masters**	**Cardfight! Vanguard**	**Soul and Spirit (our suggestion)**
Theme	Magic and Monster	Magic and Monster	Magic and Monster	Magic and Monster
Card Types	Monster and *Support*	Monster and *Support*	Monster	Monster and *Support*
Balancing Strong Card	Weak Card Sacrifices	*Manna*	Weak Card Sacrifices	*Manna*
Luck Factor	None	Yes	Yes	Yes
Winning Condition	Certain points meet 0	Certain points meet 0	The monster died	The monster died
Limit of certain cards	Yes	Yes	Yes	Yes
Augmented Reality	No	No	No	Yes

The data collected are used for the next step, design. In design step, gameplay will be designed along with all other game components such as assets, user interface, game balancing, and such, in a document called as Game Design Document (GDD). And UML is used to describe the system design.
Below is the use cases design for the game developed :

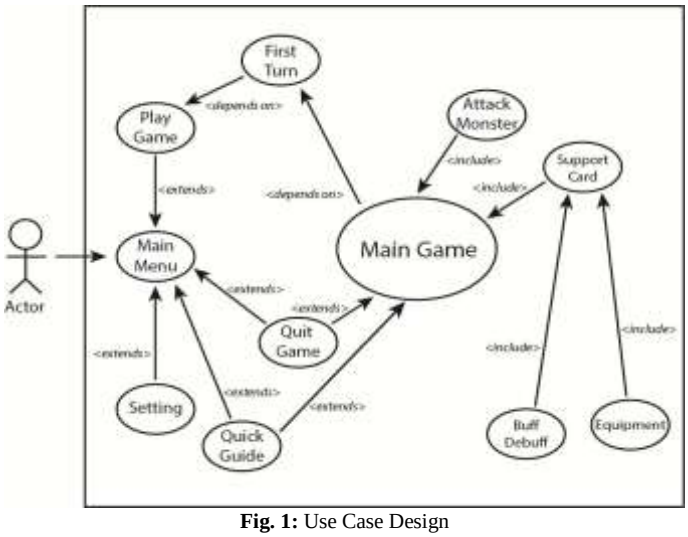


Fig. 1: Use Case Design

The game will run in Windows Operating System, preferably at least Windows 7 with screen resolution of 1280 x 720. The settings of the desk for playing are as follows:
• A desk with minimum length of 75 cm, width of 48 cm
• Height of tools to support the webcam: 135 cm (and if done so, the desk in the previous point must at least has the min height of 70 cm)
• Horizontal distance of the webcam support tools to the desk: 15 cm
• Vertical distance of webcam from top of the desk: 53 cm

The recommended hardware Specification for playing the game, are as follow :
• Processor Intel Core i3

• Graphics Processor Unit Intel HD4000
• RAM 1GB
• HDD 500MB

The recommended setting as described above can be seen as in Fig. 2.

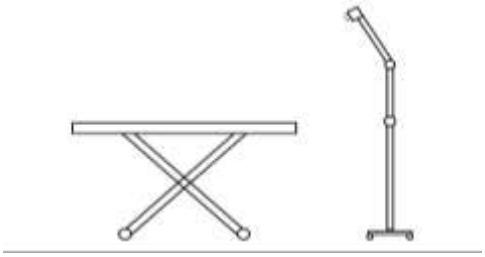


Fig. 2: Table Design

To complete the game and make it more interesting to play, a game field is created, as in the figure below.



Fig. 3: Game Field

The code step, is the next step after the design is completed, in which, the codes will be written to develop the game according to the design. In this research, the codes are developed using Unity.
The last step is testing, where the game will be tested to make sure it is running correctly, and meet all the requirements; and if it is not, then the previous steps will be redone.

4. Result and Discussion

According to the problems above, we suggest that the new TCG, named "Soul and Spirit", will be a desktop game and combined with AR to increase attractiveness. The game will have various types of support cards with combos and many kinds of strategies. Each card will have simple description of its attributes and effects.
Virtual battle system will be used to replace player's opinion in judging the game to determine turns, calculate the score for each player based on the status of the cards being played, and conclude the winner. The virtual battle system will set the course of the game, but the player holds the main control of the game to decide cards to be used and give orders.
The game will also adopt Virtual Turn Binder system, in which, the player must wait his/her opponent turn to end before starting his/her turn. The Virtual Turn Binder system will give information to let the player knows whose turn it is now. If the player does not follow the rules, the card that is used will not have its effect and the virtual battle system will not recognize the move, so the card will have no effects at all.
The game balancing for Soul and Spirit is as follows:
• Monster Card Balancing
From the total capacity of 20 souls, monster card will require maximum of 16 souls to be called.

Table 2: Monster Balancing According to Soul and Attributes

Type	**Max Point**	***Soul* for each addition**	***Max Soul***
HP	4800	1 per 600	8
Armor	200	1 per 50	4
Attack	400	1 per 100	4

The need for souls is calculated using the smallest multiple numbers approach. For example, a monster with HP of 1200 will require 2 souls, and another monster with HP of 1500 will also require 2 souls only. Meanwhile, a monster with HP of 1800 will require 3 souls.
Based on the effect of Critical Point, number of souls needed is described below.

Table 3: Monster Balancing According to Soul and Attributes

Effect	***Soul* for each addition**	***Max Soul***
Critical Point	1 for <=4	3
	2 for 5-8	
	3 for 9-10	

• Support Card Balancing

Table 4: Support Card Balancing

Type	*Soul* for each addition (enhancement)
Buff	1 per 250 HP
	1 per 50 other attributes
	1 per 2 Critical Point
Debuff	1 per 200 HP
	1 per 50 other attributes
	1 per 2 Critical Point
Weapon	1 per 50 Attack Point
Armor	1 per 100 Armor Point

• Damage Calculation

Damage = Base Attack Point + (Weapon Card Attack Point + Random Critical Value) – Opponent's Armor.

When the opponent's armor is larger than the attack of player, damage will be neutral or zero.

• Critical Points Calculation

Table 5: Critical Points Calculation

Critical Value of the card	Random Critical Value
0	0 – 20
1-5	20 – 50
>5	50 – 100

At the beginning of each game, players must place the monster card into fields and decide turns. After the monster card is scanned, the monster will appear in the screen display, as in Fig 4.



Fig. 4: (a) Deck and Game Layout (left); (b) Monsters in field, spectator's view (right)

Each player will have one monster card and 20 other cards on the deck, and also 20 souls to call the cards. Each monster and support card requires different numbers of souls to be used. The monster's life is indicated by life points, described using a life bar, which we call as HP (hit points). Before the first turn, player must choose 3 cards from the deck, the support cards, as user cannot attack at the first turn. This is to make sure that both of the players have the same chance to win the game.

At each turn, the player may use support card to support the monster, but the card must first be validated in the tapping zone. The tapping zone is the area where the webcam will read and recognize the card. There are two types of support card, buff and equipment. Buff is the type of card that can affect attributes of the monster and can only be used for one turn. Buff has two types, buffer for own's card enhancement and debuffer for decreasing enemy's card points. The equipment type consists of armor and weapon. Armor will increase defense point of the monster, meanwhile weapon will increase attack point of the monster.

When player has the turn to attack, the player will enter the battle phase, the phase where one of the monster attacks the other. Each player will attack the other player's monster to reduce the life points (HP). In the figure below (Fig 5 (a)), a monster called Trollgar (right) attacks Makhai (left), and it caused Makhai's HP to reduce. Damage for each attack will be calculated by the Attack Phase Calculator. When the HP becomes zero, the monster will be dead, the player will lose, and the game will be over (Fig. 5 (b)).



Fig. 5: (a) Battle Phase (left); (b) Game Over Screen (right)

The prototype was given to 49 users to try to play the game, the users age range are 17 – 24 years. The experiment is focused on the use of Augmented Reality and Virtual Battle System for the Trading Card Game. And the result shows that most players think that the Augmented Reality and the Virtual Battle System enhanced the experience of playing the Trading Card Game and make the game more interesting to be played, as shown below :

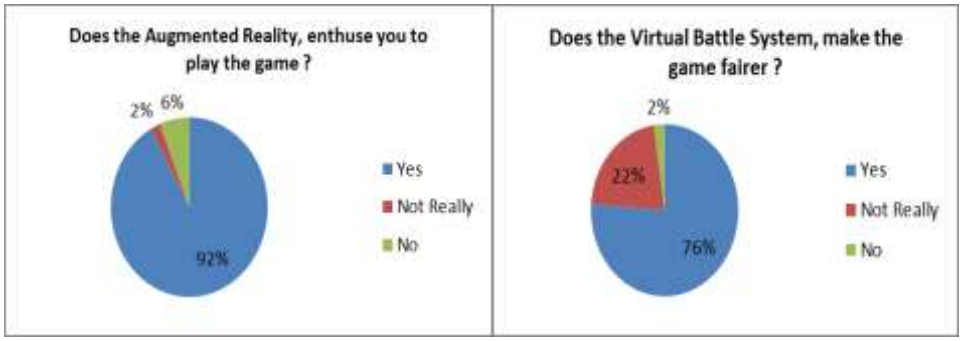


Fig. 6: (a) Augmented Reality effect (left) ; (b) Virtual Battle System effect (right)

5. Conclusion and Recommendation

Based on the surveys conducted to 49 volunteers who have tried and played the game, the new TCG has simple gameplay, easily understood rule and interesting to be played. It is much more entertaining because of the AR applied in TCG, and the Virtual Battle System made the game fairer to be played. Some recommendations for the game are to develop TCG using Head Mounted Display to make playing more real; Voice commands feature to give attack orders will be a bonus point rather than swiping the card; and Visual effects can be other extra points to make the game more interesting.

References

[1] Braun, E. (2013). United States of America Patent No. 8401343 B2.
[2] Frank, J. (2012). Role-Playing Game and Collectible Card Game Artists: A Biographical Dictionary. United States of America: McFarland & Company.
[3] Guiness World Record. (2011, March 31). Retrieved from http://www.guinnessworldrecords.com/world-records/best-selling-trading-card-game
[4] Katayose, H., & Imanishi, K. (2005). ARMS : A Trading Card Game using AR Technology. ACM SIGCHI International Conference on Advances in Computer Apps Technology ACE, (pp. 354-355).
[5] Lam, A., Chow, K., Yao, E., & Michael, L. (2006). ART: augmented reality table for interactive trading card game. ACM International Conference on Virtual Reality Continuum and Its Applications VRCIA, (pp. 357-360).
[6] Chowanda, A. (2011). Perancangan Game Kartu Interaktif Berbasis Android Menggunakan Augmented Reality. ComTech, vol 2, no 2, (pp. 726-735).
[7] Lyu, M., King, I., Wong, T., Yau, E., & Chan, P. (2005). Arcade: Augmented reality computing arena for digitalentertainment. 2005 IEEE Aerospace Conference. Montana, USA.
[8] Madden, L. (2011). Professional Augmented Reality Browsers for Smartphones: Programming for junaio, Layar and Wikitude. Wiley.
[9] Mangiaforte, L. (2014, December 3). Business 2 Community. Retrieved from http://www.business2community.com/brandviews/newscred/augmented-reality-marketing-will-huge-2015-01086301
[10] Mulloni, A., Wagner, D., & Schmalstieg, D. (2008). Mobility and social interaction as core gameplay elements in multi-player augmented reality. Proceedings of the 3rd International Conference on Digital Interactive Media in Entertainment and Arts (DIMEA '08), ACM, (pp. 472-478).
[11] Sekhavat, Y. (2016). KioskAR: An Augmented Reality Game as a New Business Model to Present Artworks. International Journal of Computer Games Technology, vol. 2016.
[12] Turkay, S., Adinolf, S., & Tirthali, D. (2012). Collectible Card Games as Learning Tools. 4th World Conference on Education Sciences (WCES-2012), Procedia Social and Behavioral Sciences Vol 46, (pp. 3701-3705).
[13] Williams, J., Hendricks, S., & Winkler, W. (2006). Gaming as Culture: Essays on Reality, Identity and Experience in Fantasy Games, 1st edition United States of America. McFarland & Company.