Mixed Reality Game YU-GI-OH

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Abstract
Mixed Reality is a technology that combines the real world with the virtual world. Merging these two worlds will form a new environment where each object from each world can interact with each other. This technology will offer a different user experience depending on how it is used, including digital games. This paper will discuss how to construct the card along with its mechanism of movement that used in YU-GI-OH game and its implementation on mixed reality technology using the HoloLens platform. The game be integrated to HoloLens until view stage.

Keywords: Mixed Reality, YU-GI-OH, HoloLens.

1. Introduction

Nowadays, traditional games is losing its charm to video games. Today's generation are more familiar with video games due to its more appealing graphics [1]. Another reasons are traditional games lack the ability to produce complex audio and animation, the ability to play the game online on the Internet, and the availability to play the games.

Although video games is more attractive than traditional games, not all the videos games is popular to users. Several reasons for that are the originality and the complexity of the gameplay, and the complexity of the graphics that offered by the games. The more original and complex the gameplay, and the more complex the graphics offered by the games, the more popular the games. In short, one way to make the games successful is offering new and complex user experience to the user. Some of the easiest ways to prove that are how many people are downloading and how many positive reviews for the game.

There are several number of games that have been existed since a few years ago but the user experience offered from the updated version does not have much different from the old version, one of them is YU-GI-OH game. In order for YU-GIOH game to increase the number of people downloading or positive reviews, a significant enhancement in user experience is required compared to previous versions. By using mixed reality technology in YU-GI-OH game, it will revolutionize the game itself. The project in this paper will focus on graphic improvement in YU-GI-OH game by using HoloLens. The paper itself will discuss how to create the cards that are used in YU-GI-OH game in mixed reality form. In this project, the integration of games into HoloLens only reaches game visualization stage in mixed reality form.

A. Mixed Reality

Mixed reality is the merging of the real and virtual worlds to produce new environments and visualizations, where physical and digital objects coexist and interact in real time [2]. To produce mixed reality world, it takes three basic components, which are humans, computers, and environment (shown in Fig. 1). Mixed reality does not exclusively take place in either the physical or virtual world, but is a combination of the real world and the virtual world where the combination includes augmented reality and virtual reality using immersive technology. In other word, mixed reality let u interact with and manipulate both physical and virtual items and environments, using next-generation sensing and imaging technologies [3]. Fig. 2 shows the spectrum in which mixed reality works. Mixed Reality is the next evolution in human, computer and environmental interactions and opens up the possibilities that were previously limited to our imagination. This is possible because the advances in computer vision, graphics processing power, display technology, and input systems open boundaries that could not be achieved before [4].
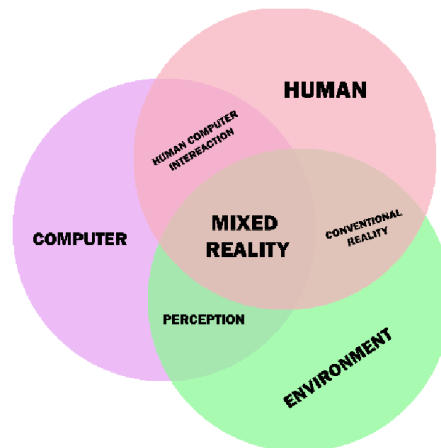
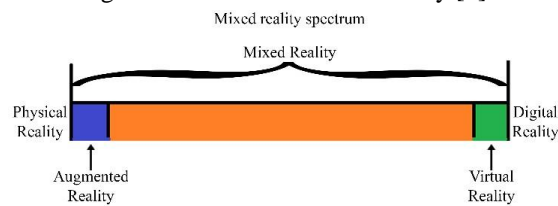Fig. 1. The Form of Mixed Reality [4].

Fig. 2. The mixed reality spectrum [4].

B. YU-GI-OH Trading Card Game

YU-GI-OH is a Japanese manga series about gaming written and illustrated by Kazuki Takahashi [5]. The series tell about the main characters (MC) that face some enemies and problems and solve it by playing games. The problems and enemies are different for each series (currently there are 6 series), but the MC always solve it by playing games. At early of first series, various types of games are played. However, the games that played from the middle of first series until the current series become one type, which is YUGI-OH! Duel Monster.

YU-GI-OH! Duel Monster is a Trading Card Game (TCG) where there are 2 players who have 40 cards in their decks and 4000 life points for each player [5]. Both players fight in an arena by contesting monster cards, spell cards and trap cards that are owned by each player to reduce the opponent's life point for each turn. A player lose if:

- Life Point <= 0

  Each player's life point will be reduced when the player receives an attack from an enemy monster or is hit by a spell or trap card. If the player's Life Point becomes 0 or less, the player will lose

- Cannot draw card

  Each turn, one player draws at least 1 card from deck to his hand. If the player cannot draw cards (number of cards on deck = 0), the player will lose.

- Surrender (surrender)

  The player declares that he cannot continue the game.

YU-GI-OH! Trading Card Game adapt YU-GI-OH! Duel Monster. Either the traditional types or the video games types, the gameplay follows the YU-GI-OH! Duel Monster with a few changes. Although this game is one of the famous game series, the user experience offered by the newer version is not much different from the older version. The improvement for each series is either change slightly the gameplay, or improve the game graphic (but the game still in 2D form). Fig. 3, 4, 5, and 6 show the game changes in each series (These figures limited only for the games that adapt YU-GI-OH! Duel Monster and release not only in Japan).

Fig. 3. Yu-Gi-Oh! Dark Duel Stories (First Series) [6].

Fig. 4. YU-GI-OH! Forbidden Memories (Second Series) [7].

Fig. 5. Yu-Gi-Oh! Power of Chaos: Yugi the Destiny (Seventh Series) [8].

Fig. 6. Yu-Gi-Oh! Duel Links (Fourtieth Series) [9].

C. Game Popularity

One indication of the success of a game can be seen through the level of popularity of the game. The more popular a game is, the more successful the game. There are many parameters that can be used to measure the level of popularity of a game. Among the many parameters, the most common and most easily is the total number of downloads and reviews of the game itself. Table I and II show the level of popularity of a game with the number of downloads and reviews. The data in these table were collected on October 2018.

TABLE I. TOP 3 GROSSING GAME (GENRE: ALL) IN PLAYSTORE [10].

Games	Total Review	Total Downloads	Genre
Mobile Legend	8944447	100000000++	Action
Free Fire	7633516	100000000++	Action
Lords Mobile: Battle of Empire	3299387	100000000++	Action

TABLE II. TOP 3 GROSSING GAME (GENRE: MUSIC) IN PLAYSTORE [10].

Games	Total Review	Total Downloads	Genre
AuSuperstar-Ayo sing and dance	13758	500000++	Music
AyoDance Mobile	39944	500000++	Music
BanG Dream! Girls Band Party!	38921	1000000++	Music

From the table 1 and 2, it can be seen that the games that enter the top grossing game have a total download and total review far more than the games that do not enter the top grossing game. In other words, the popularity of a game is directly proportional to the number of game downloads and reviews.

Also from the table1 and 2, it appears that action games are far more popular compared to music games. One reason is that action games have far more complexity than music games, so the user experience offered by action games is far more than music games. In other words, the level of popularity of a game will be higher if the user experience offered by the game is more complex.

D. HoloLens

Microsoft HoloLens is a mixed reality-based smart glasses developed and produced by Microsoft [11]. Microsoft HoloLens is also known as the Baraboo Project, where the project is still under development. However, HoloLens was the first head-mounted display running the Windows Mixed Reality platform under the Windows 10 computer operating system. The result of mixed reality implementation by using HoloLens is shown at Fig. 7.
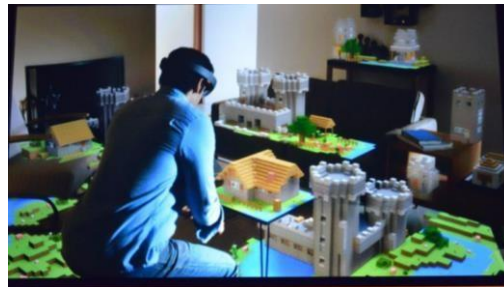

Fig. 7. Example of Mixed Reality implementation by using HoloLens [12].

2. System Design

In this project, there are 2 design. First is card construction, the second is card movement mechanism. Card construction is about what type of card and what variable that is needed to construct a card. On the other hand, card movement mechanism is about how the card is moved and what effect if the card is moved. Card movement mechanism divided by 3: Open Card, Rotate Card, Flip Card.

A. Card Construction

There are 3 types of cards made:

- Monster Cards

Monster cards are cards used to summon monsters to the arena. Monster cards are used to attack opponents or defend against opponents' attacks.

- Spell Card

Spell card is a card used to activate magic into the arena.

- Trap Card

Trap card is a card used to activate a trap into the arena.

The cards that are made have a variety of variables, including:

TABLE III. CARD CONSTRUCTION VARIABLES

Card Variable	Monster Card	Spell Card	Trap Card
Card Name	✓	✓	✓
Type Card	✓ (Monster)	✓ (Spell)	✓ (Trap)
Type of Monster	✓	-	-
Monster Shape	✓	-	-
Monster Attribute	✓	-	-
Attack Point	✓	-	-
Defend Point	✓	-	-
Card Level	✓	-	-
Type of Spell	-	✓	✓
Type of Trap	-	✓	✓
Card Effect	-	✓	✓
How to activate the Effect	-	✓	✓

B. Card movement mechanism 1) Card Open

Card open is mechanism of card movement that only happens when the card is in the arena and the face of the card faces up. This mechanism activates the selected card. The activation card has different effects according to the type of card where:

- Monster Cards
  Opening the monster card will make the monster summoned (summon) to the arena.
- Spell and Trap Cards
  Opening a spell or trap card activates the effect of the card being opened.

2) Card Rotation

Card rotation is a mechanism of card movement where the card can only be rotated at the direction 12 o'clock and 9 o'clock. The rotation of the card can only be done by monster cards where:

- 12 o'clock position = monsters in attack mode.
- 9 o'clock position = monsters in defense mode.

This mechanism happens when the game receives input button on the monster card.

3) Card Flip

Card flip is a mechanism of card movement where the card can only be rotated from a closed (inactive / set) to an open (active / activation) state. Flip cards can only be done when the game input button on the closed card only.

3.   System Implementation

There are several points that will be achieved in this project:

- Card Construction
- Card Movement Mechanism
- Integration to HoloLens

A. Monster Card

There are seven variables that is needed in order to construct monster card. The variables is shown at

Tables III. Fig. 8 and 9 show the monster card that already has been constructed.
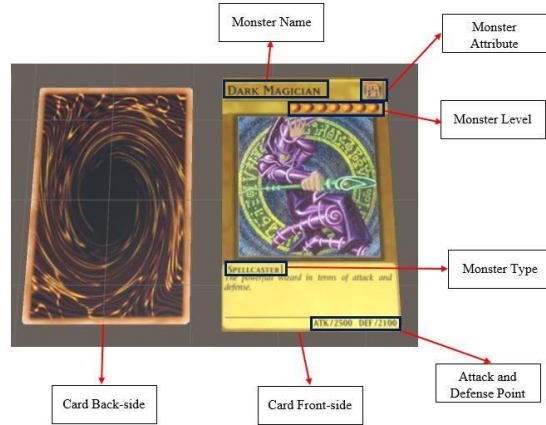

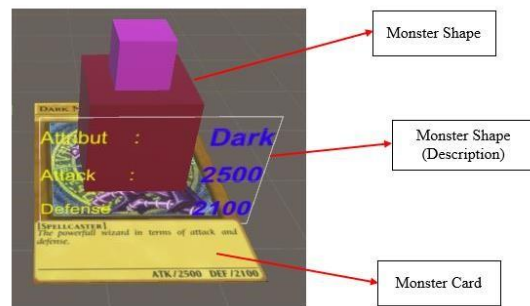Fig. 8. Monster Card Detail (monster: Dark Magician)

Fig. 9. Monster Card Condition when Summoned on Arena (monster: Dark Magician)

Every monster has different data for the same variable. The differences will change the card appearance depend on the data. Fig. 10, 11 and 12 show how every monster affect the card appearance.

Fig. 10. Monster Card (monster: Blue Eyes White Dragon)

Fig. 11. Monster Card (monster: Dark Magician)

Fig. 12. Monster Card (monster: Red Eyes Black Dragon)

The movement mechanism of a monster card while in the arena consists of:
- Monster cards can be set in open or closed state. Monster cards can be rotated towards 12 o'clock (attack position) or 9 o'clock (defense position).
- Monster cards can only be flipped from closed to open state.
- When a monster is placed in a closed position, the card will perform flip attack mechanism (the position of the open card in attack mode) when receiving input from button/player, and will perform flip defense mechanism (the position of the open card in defense mode) when attacked by the opponent's monster card.

All the movement mechanism for the monster card are shown in Fig. 13, 14, 15, and 16
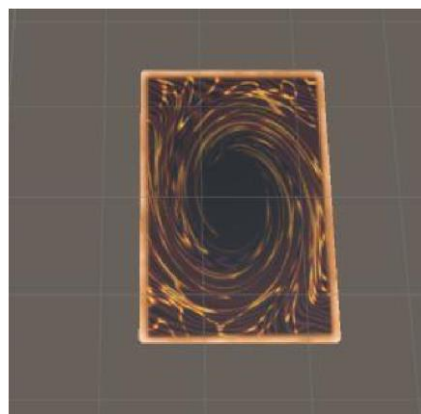
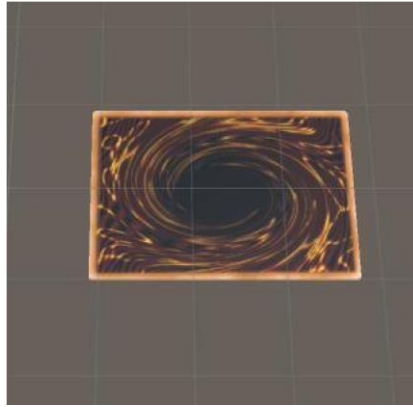Fig. 13. Monster Card in close state and attack position (monster: Dark Magician)

Fig. 14. Monster Card in close state and defend position (monster: Dark Magician)
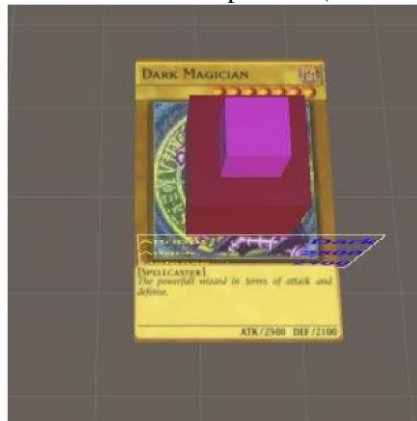

Fig. 15. Monster Card in open state and attack position (monster: Dark Magician)
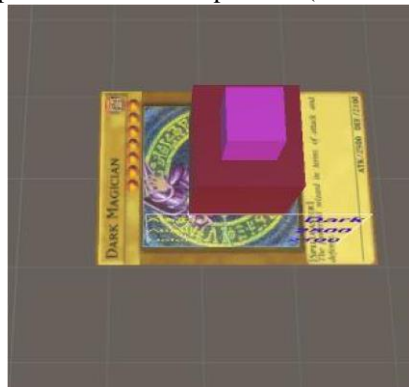

Fig. 16. Monster Card in open state and defend position (monster: Dark Magician)

Monster card has "monster shape" variable. This variable include the monster design in 3D form and the animation while the monster is attacking the enemies. All monsters in this project only have monster design, excluding "Red Eyes Black Dragon" which already has monster design and attacking animation. Fig 17, 18, and 19 show "monster shape" variable for by using "Red Eyes Black Dragon" Data.

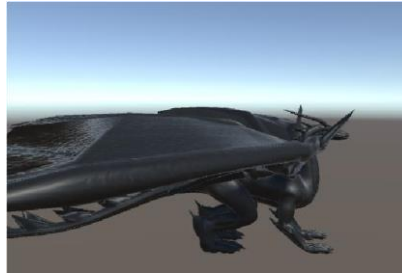Fig. 17. Monster Card + Monster Design in 3D form (monster: Red Eyes Black Dragon)

Fig. 18. Monster in idle form (monster: Red Eyes Black Dragon)

Fig. 19. Monster in attacking form (monster: Red Eyes Black Dragon)

All the movement mechanism for monster card can be run and have no issue during running the mechanism. This means the monster card is ready to use in 2D platform. However, the 3D monster shape is still in simple form and the monster still doesn't have attacking animation, excluding "Red Eyes Black Dragon" monster. However, this card can be integrated in HoloLens although it is only in view stage.

B. Spell Card

There are four variables that is needed in order to construct spell card. The variables is shown at Tables III. Fig. 20 and 21 show the spell card that already has been constructed.
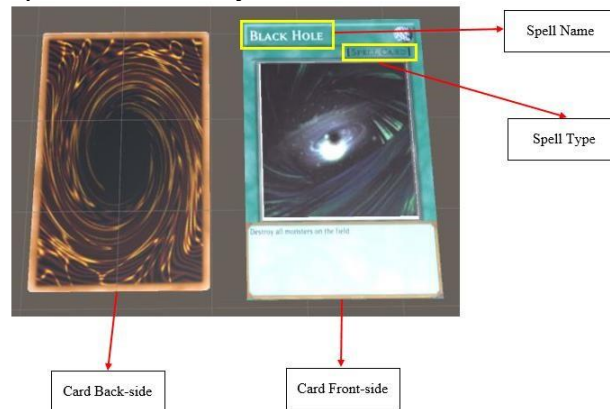

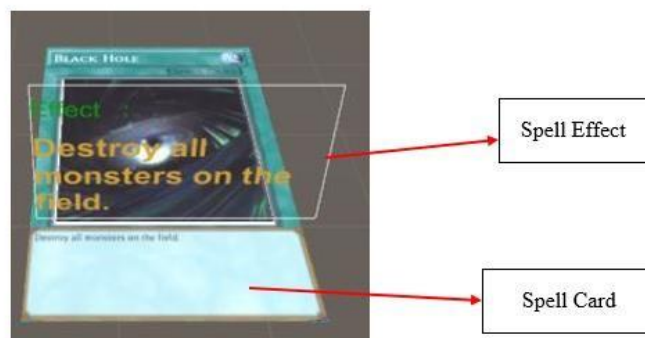Fig. 20. Spell Card Detail (spell: Black Hole)

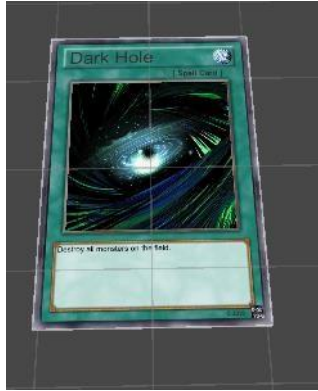Fig. 21. Spell Card Condition when Summoned on Arena (spell: Black Hole)

Fig. 22. Spell Card (spell: Black Hole)

Fig. 23. Spell Card (spell: Monster Reborn)

Every spell has different data for the same variable. The differences will change the card appearance depend on the data. Fig. 22 and 23 show how every spell affect the card appearance.
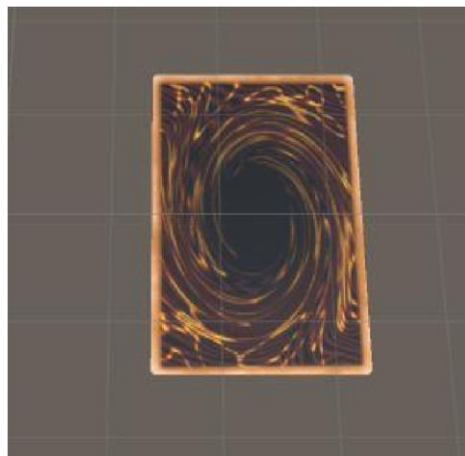

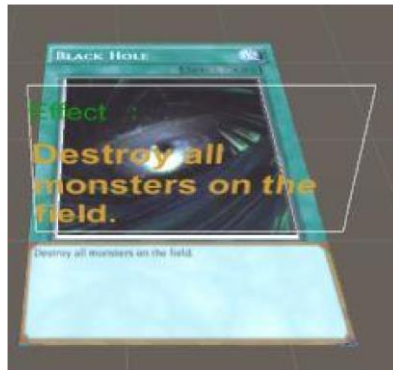Fig. 24. Spell Card in close state (spell: Black Hole)

Fig. 25. Spell Card in open state (spell: Black Hole)

The movement mechanism of a spell card while in the arena consists of:

- Spell cards can be set in open or closed state.
- Spell cards cannot be rotated.
- Spell cards position can only be in 12 o'clock.
- Spell cards can only be flipped from closed to open state.

All the movement mechanism for the spell card are shown in Fig. 24 and 25.

Fig. 26. Trap Card Detail (trap: Trap Hole)

Fig. 27. Trap Card Condition when Summoned on Arena (trap: Trap Hole)

Every trap has different data for the same variable. The differences will change the card appearance depend on the data. Fig. 28 and 29 show how every trap affect the card appearance.

Fig. 28. Trap Card (trap: Trap Hole)

Fig. 29. Trap Card (trap: Trap Hole)

The movement mechanism of a spell card while in the arena consists of:

- Trap cards can be set in open or closed state.
- Trap cards cannot be rotated.
- Trap cards position can only be in 12 o'clock.
- Trap cards can only be flipped from closed to open state.

All the movement mechanism for the spell card are shown in Fig. 30 and 31.
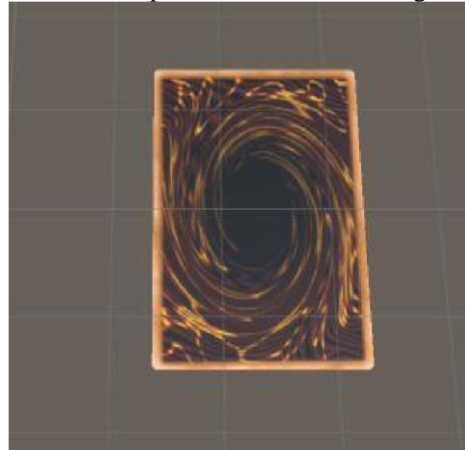

Fig. 30. Trap Card in close state (trap: Trap Hole)

Fig. 31. Trap Card in open state (trap: Trap Hole)

All the movement mechanism for trap card can be run and have no issue during running the mechanism. This means the trap card is ready to use in 2D platform. However, the 3D trap card effect is still in simple form. This card also can be integrated in HoloLens although it is only in view stage. The view stage for this project is shown in Fig. 32.
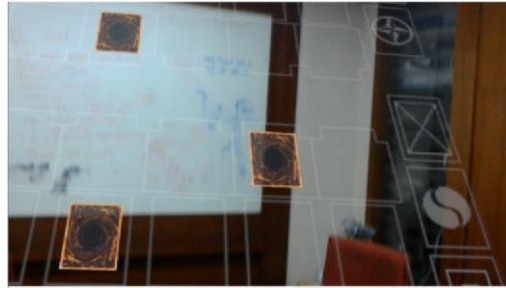
Fig. 32. The card implementation using HoloLens (view stage)

From the implementation that already been done, he result of the current project are:

Card Mechanism	Monster Card	Spell Card	Trap Card
Card Construction			
Card Name	Done	Done	Done
Type Card	Done	Done	Done
Type of Monster	Done	-	-
Monster Shape	Done (one monster)	-	-
Monster attacking animation	Done (one monster)	-	-
Monster Attribute	Done	-	-
Attack Point	Done	-	-
Defend Point	Done	-	-
Card Level	Done	-	-
Type of Spell	-	Done	Done
Type of Trap	-	Done	Done
Card Effect	-	Unfinished	Unfinished
How to activate the Effect	-	Halffinished	Halffinished
Card Movement Mechanism			
Card Open	Done	Done	Done
Card Rotation	Done	Done	Done
Card Flip	Done	Done	Done
HoloLens Implementation			
HoloLens	Unfinished	Unfinished	Unfinished

4. Conclusion And Future Work

From the project result, the card movement mechanism is working well. The card construction is working well too, although there are some variable that is unfinished or half finished. The half-finished or unfinished variable is the variable which are related to 3D-Animation. At this point, the cards are ready to use in 2D games.

There are several points that lacks in this project, including:

• The shape for every monster, excluding red eyes black dragon is still imperfect.
• The animation of monster attacks, spell and trap card effects that still cannot be realized. ☐ HoloLens integration only in view stage.
These deficiencies can be used as basis for further development.

5. References

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