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Augmented Reality RPG Card-based Game

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Abstract—Role Playing Games allow users to impersonate characters whose skills are managed through rules and game mechanics. Some popular games use cards where the user summons creatures, spells and other resources for winning the match. An important factor in these scenarios is the player's imagination and the commitment to the role is playing, however, the game's set up require a physical space containing a table for drawing the cards and space for the players. With the spreading of gaming hand-held and mobile devices, the development of RPG card-based video games have been gaining momentum as a complimentary mean for mobile experience the games against the computer or others around the world. Another alternative for increasing immersion can be found in augmented reality where the game cards can be enhanced with compute graphics to boost user engagement and interaction. This project develops an augmented reality RPG game where the cards are the markers, this approach differs from others where black and white markers are used for both the board and summoned cards. From the validation, players found this approach helpful as it provide information related to the creatures and spells for better strategy planning.

I. INTRODUCTION

Role Playing Games (RPG) are characterized for providing players with the opportunity of engaging in creative, strategic planning and team work to achieved a goal, among many others [1]. An engaging feature of RPG games is the possibility of taking the role of any chosen character whose growth and skills engage the user through the game's formal, dramatic and dynamic elements [2]. RPG games are commonly available on cards, portable hand-held, smart phones, computers, tablets and videogame consoles, miniature sets, and game boards [3].

Traditionally, RPG games were available as board games with printed material such as books, novels, guides, and maps where the player uses its imagination and knowledge to believe in its role and actions [2][4]. Current advances in technology have resulted in massif use of mobile electronics with sufficient graphics processing power that inspired the development of interactive and immerse experiences to provide more realism [5].

RPG games rely on graphics and story through novels, art design, paintings and back-stories for the characters and recently, its digital counterparts have taken advantage of computer graphics and image processing for the player to better immerse within the game, through exploration and interactions with the environment, other players and the artificial intelligence with sensorial stimuli from sound, visual effects and animation [5].

Augmented Reality (AR) has gained momentum by allowing the enhancement of real objects with computer graphics [6]. In the field of RPG card games, research and studies have been done for providing more interactive and attractive experiences, this is the case of the Augmented Reality Table where a virtual board allows the user to interact with markers that display the character's actions through 3D animation and sounds, this development proved to caught the player's attention [7]. AR effects have also been studied to determine how would impact players accordingly to their personality [8], this case, the developed framework allowed identifying intrinsic motivation factors related to fantasy, challenges and curiosity. AR card games have also served as tools for studying how it can become a new form of transmedia storytelling by taking advantage of the player's interest on the story and game mechanics [9]. Currently, Nintendo and Sony have developed commercial AR games available on their systems [10][11], however only *The eye of judgement* used cards and AR for increasing player's immerse and interactive experiences, however, the game is not available any more through official Sony website, some information is available on Wikipedia [12]. The previous developments combine physical an digital features that enhance AR card games, however, they depend on each other and the game can not be experienced without any of its components.

This project presents the development of an AR RPG card game where the cards and board are the markers so the player can use it with or without the augmenting component. The board provides the summoning and fighting scenario and the cards present information regarding the creatures and spells' properties. The goal of the system is to provide a flexible yet immersive and interactive experience.

The document is organized as follows: In Section II the material and methods where de characterization and development is presented; In Section III the obtained results are presented; and finally, in Section IV the conclusions are discussed.

II. GAME DEVELOPMENT

For developing the game, the goal, rules, the user's participation and the feedback are designed [13]. The goal is for the player to destroy the opponent by diminishing his life points; the rules involve damaging the opponent through hit points caused by creatures or spells bought through the in-game currency; the feedback is provided by the amount of life, currency and the 3D animations resulting from the chosen actions; and finally, the participation is achieved through a

storyline created for engaging the player in taking sides and winning the game.

With this initial setup the game is defined through the inputs and outputs as presented in Figure 1. The inputs can be classified in two types, developer and player, the first receives mechanics, rules, 3D animations, new characters, new abilities, and sounds among many others, the second uses player choices accordingly to his choices. The main outputs allow the user to improve his strategy accordingly to the life and properties of each creature and spell on the board, a secondary set of outputs allow observing 3D animations of the chosen actions taking place over the board.

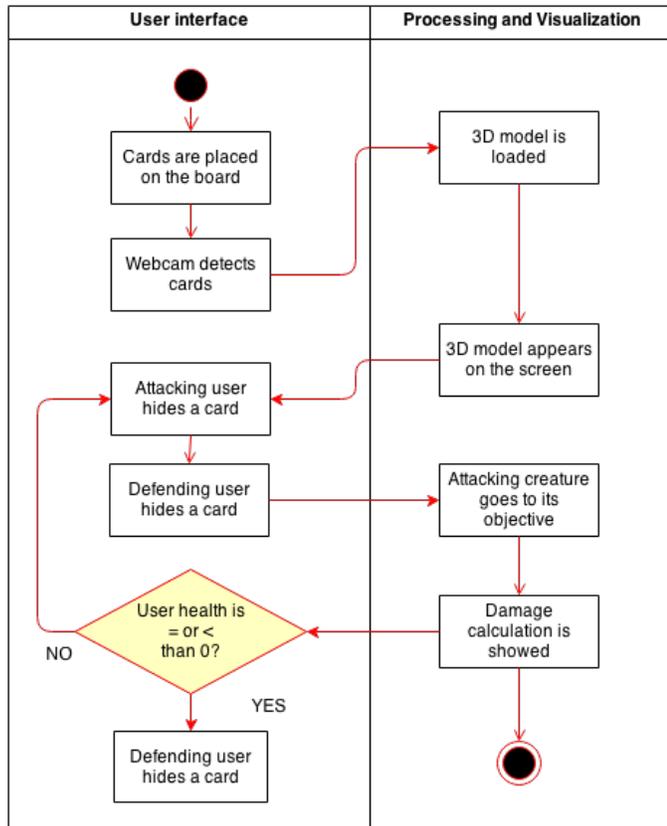


Fig. 1. Game's diagram

With the diagram presented in Figure 1, the following game characteristics are designed:

A. Story

The game story, art and gameplay are designed to attract players. The main conflict of the game is the battle between good and evil, so there is a premise that invites the users to be part of the battle by controlling one of those armies and choosing a side.

B. Art and Character Design

The characters were designed to represent good and evil, using cold and warm colors accordingly due to their associations with wisdom, calm, peace or wrath, fear and even aggression [14]. The form and physical characteristics of the

characters like horns and wings among many others, represent features that allow distinguishing good from evil, so the player can choose. A sample creature can be seen in Figure 2, this creature is based on a nymph [15], commonly known for being gentle and good, but it was transformed into an evil creature within the game's story. Each of the characters was designed from 2D sketches to 3D models that were textured, rigged and animated for the in-game interactions.



Fig. 2. Character creation

C. Card and Board Design

One of the purposes of the game is to be able to be played with or without AR, because of this, each card provides information about its side (good or evil), cost, characteristics (abilities, attack or defend), an illustration of the character or spell. The distribution of its elements allow the card to become the marker itself for using with AR. The cards offers information from top to bottom as follows: creature name, creature illustration, creature cost, creature description, creature features (attack and defense), and finally the artist's name, a card is presented in Figure 3.



Fig. 3. Evil Nymph game card's top and bottom

Another important part of the game is the board, it was designed to have a size of 50 cm x 50 cm to hold the battles between players with sufficient space for placing the cards and the characters to virtually fight. The board was also designed with an L shape for guaranteeing a proper field of vision so the camera recognizes it along with all the cards. This configuration is set to guarantee the correct display of all characters without any superposition that would affect the interaction. The design also allows a proper field of view from both players as presented in Figure 4.

D. Development tools

For the game development, the Unity 3D engine was chosen as it allowed rapid application prototyping and validation, with compatibility with several 3D files and scripting features,

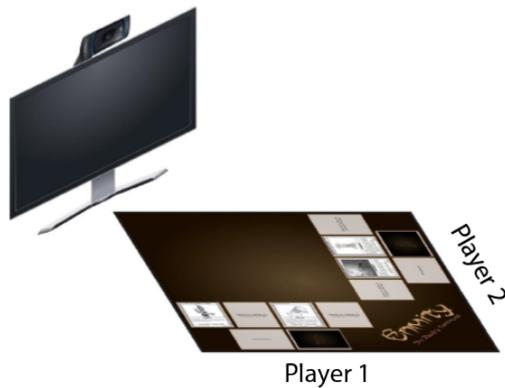


Fig. 4. Board setup and view from a TV

along with cross platform possibilities [16]. The AR module of the game was developed using Unity's IN2AR plugin due to its multimarker, virtual graphics user interface and frame rate performance [17]. The plugin allows obtaining information about position, orientation and color patterns from the multiple markers, making it a suitable solution for the game in this project.

E. Tracking Configuration

The system is composed of affordable elements so the game can be played by a wide range of users, they need the board, the decks, a computer, a standard definition webcam (at least 640 x 480 pixels). Two main scripts were used for the card tracking, *ImageTracker* containing all tracking objects, and *TracableBehaviour* containing each creatures' data such as ID, name, status, attack, defense, position and orientation.

F. Interaction

The user interacts with the game through the cards during the withdraw, summoning, attacking/defending and battle resolution phases. During the attacking/defending phase the player places the cards over the board, whose abilities are activated when rotated 90 degrees. This change in the card's orientation allows the software to determine the action that is going to take place, however, the system was configured to execute this task only when the player covers the card, thus, changing the state of the stored data. Even though, the game is turn-based, the first attack will be available to the player that first rotates and taps a card.

When the AR module is not activated, the game can be played as any other RPG board game, however, when using the AR, once the actions are activated, the player can watch the creatures fighting on the screen as well as the spells damaging each other on the battlefield. After the attack occurs, the damages are assigned and the corresponding points are subtracted from both creatures and players accordingly.

III. RESULTS

The development of this project resulted in an AR RPG card game using a real board with decks in a setup where the both players sit at two adjacent corners of the board, a webcam is positioned across capturing the battlefield, while a

TV provides visual feedback from the game as presented in Figure 5.



Fig. 5. Game setup

For validating the game, operative tests were performed to determine how webcam quality, illumination and card placement could affect the experience. From these, current available webcams on the market perform adequately with standard definition, and those with high definition provided faster recognition times, that did not affect the game as the difference was no noticeable due to times involved in each phase.

The final test was performed with several participants that played the game. The process consisted in presenting them the story, the game manual, the decks and the board, then they chose sides and started playing as presented in Figure 6. Players followed the phases without any problem, Figure 7 presents the executed actions, where *A* presents both players with creatures on the board; *B* presents *Player 2* covering his chosen attacking card; *C* presents *Player 1* choosing the selected defending creature; *D* presents *Player 1's* creature attacking and inflicting damage to *Player 2's* creature; *E* presents the damage being assigned; and finally in *F* presents the creatures moving back to their corresponding marker.



Fig. 6. Players gaming

After playing the game, 22 players were asked to participate in a survey with the following results: 55% were familiar with RPG card games, while 45% were not; those familiarized knew games like Yugi Oh, Pokemon, Magic and Vanguard; 95%

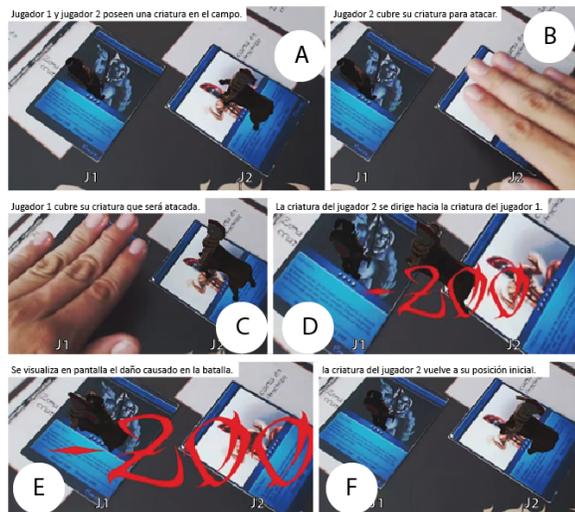


Fig. 7. AR screen capture of the game in progress

found the game very easy to play, while 5% found it hard; as to whether the AR improved the experience, 95% agreed, while 5% did not; finally, as to suggestions from the experienced RPG players, they agreed that the game could be improved with more decks, creatures, spells and virtual scenarios.

IV. CONCLUSION

We successfully implemented a pattern recognition system for an AR RPG card-based game that allows users to interact with real objects to control virtual objects in a simple and intuitive way. The system provides the capability of using the game with or without AR as the board and the cards have all the required information, unlike other solutions that use black and white markers without any information about the creature or spell, depending on a computer for providing this information. From the tests, users found the game very easy to use, even though the group had RPG experience and novice players. In a similar manner with other literature in the field, the use of 3D animations and AR proves to attract users, however, other aspects such as the character design, user manual, demo videos, and story, also proved to get the attention of the players, who picked in several occasions both sides.

Future works will focus on improving the game scenarios, increase the number of creature and abilities, online features and cross platform support.

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