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Enhancing Traditional Games with Augmented Reality Technologies

Introduction

Augmented reality (AR) is the real-time use of information in the form of text, graphics, audio, and other virtual enhancements integrated with real-world objects. Namely, the technology allows for augmenting our perception, opening new horizons for humanity. This phenomenon might redefine the reality we are living and affect every part of our life.

Consequently, the major project aims to discover how augmented reality may change traditional games like board games. It was noticed that board games, including card games, provide many opportunities to augment them with digital features. Accordingly, it was suggested that AR could enhance the gaming experience for traditional kinds of games. Furthermore, this could be a new way of entertainment combining the benefits of digital games and board games.

The final result of the project is an augmented reality card game. The creation of the application was a way to learn AR technology and games development. Thereby, it was also possible to state the main limitations of programmers regarding the implementation of augmented reality.

Moreover, the research concerned analysing previous approaches to the digitalisation of traditional games. In this case, the studied example was the World of Warcraft Trading Card Game and its successor Hearthstone.

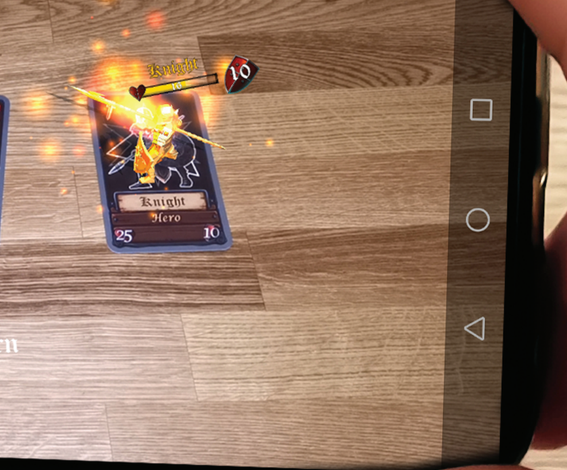
Aims & Objectives

Research question: How to enhance the gaming experience by using new technologies?
Research objective: To enhance the gaming experience by the development of an augmented reality card game.

Research question: What are the difficulties and restrictions in incorporating augmented reality technology in games production?
Research objective: To identify barriers and concerns related to the development of augmented reality games.

Research question: Can computer games development contribute to a better understanding of augmented reality technology?
Research objective: To analyse the augmented reality technology implementation process.

Research question: How traditional games have been digitalised in the past?
Research objective: To study the examples of physical games which have been recreated in digital form.



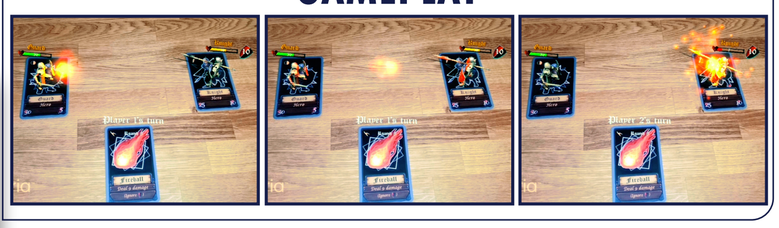
Design & Implementation

The core of the designed game is based on a two-player physical card game that can be augmented due to the developed mobile application. The program has been developed with Unity Game Engine and Vuforia SDK.

Furthermore, the game is playable without digital add-ons. However, users can use their mobile devices to enhance the gaming experience. Therefore, the camera of a device adds digital reality features to the played cards. Additionally, using the application allows for hearing sounds made by characters while they are performing an action. Thus, the developed techniques improved the immersion of the gameplay.

The theme of the designed game is an arena battle between two medieval fantasy heroes whose aim to defeat the opponent. Players choose their heroes and arrange decks of cards representing various abilities of the hero. Cards are played one by one regarding the current turn. Moreover, at the start of the combat, the user is asked to find a flat surface. It is processed by a Ground Plane game object that enables recognising flat surfaces like tabletops or floor. The presence of the square marker indicates the available flat area on the screen. User can touch the screen to confirm the position of the marker, which is also the position of the displayed UI.

GAMEPLAY



Conclusion

The result of the study is an augmented reality card game that combines the characteristics of board games and video games. Also, the project proved that augmented reality has the potential to be the future of a new way of gaming experience.

However, the technology is still maturing, and the evidence of that is that there are not many advanced AR applications on the market. The reasons for that are the limitations of augmented reality. It was discovered that AR apps need much computational power to run. Hence, they overload mobile devices causing overheating and quick battery draining.

On the other hand, during the development process, it was noticed that available developer tools regarding augmented reality not always provide working solutions. For example, the recognition process was limited as the default Vuforia camera tended to block autofocus mode. As a result, the display was blurry, and the detection of image targets was impossible. The solution was to implement the script which keeps autofocus on while the application is run. Moreover, the issue was previously notified by other developers but never solved by Vuforia.

Also, some of the problems were fixed by modifying the game's design rather than by coding. The good examples are the cards that required adding unique graphical shapes due to better detection capability.

Nevertheless, it is possible to enhance physical card game with augmented reality features. And this project is proof of that.

Unfortunately, because of the pandemic, it was impossible to conduct user testing as the created game requires face to face contact with others. This limited my ability to know the opinion of potential users.

SHADOWS



Additionally, realistic shadows have been applied to improve the immersion of characters within the real world. It was done by attaching the plane game object under a character and setting a specifically prepared material and shader called ARShadowSurface. Namely, the shadows cast by characters are displayed on the surface of the attached plane. Thereby in the game, the players can see the illusion of shadows cast on real surfaces like a tabletop. This approach blends the digital elements with physical ones effectively.

CARDS



Designing cards was a key process in developing the augmented reality application. Thereby, the cards had to be easily detected by the camera. This was determined by the requirements of ideal target images stated by Vuforia standards.

After conducted experiments and studies regarding how image targets are detected, the final version of the cards has been produced. The cards are made of pre-made assets from the Humble Bundle website and Unity Assets Store. However, they were modified and redesigned in Adobe Illustrator.

Lighting

Characters lighting in a game was problematic at the beginning. The primary source of light was directional light placed in the scene at a static position. Consequently, the models looked dark, and they did not match the real environment around them.

The other tried solution was to bake lights for models so they would be better visible. However, this approach added false effects, which also negatively affected the scene's appearance and its integrity.

Finally, the last idea was to attach directional light to the camera game object, representing the camera of a mobile device. Due to the movement of the camera, the position of the light changes accordingly. As a result, the primary source of light is dynamic, and it illuminates characters more realistically.

Recommendations

The suggestion for further work is to research other devices, which can be used instead of smartphones, to detect and track image targets. In addition, because the developed application requires physical elements to play, it might be inconvenient to simultaneously manage the cards and hold a smartphone during the game. Therefore, it would be worth considering the creation of a holographic display for the game. The other idea is to use augmented reality glasses instead.

Moreover, further studies should focus more on user testing. As was previously mentioned, it was impossible to present the game to users because of the pandemic restrictions. The gathered data would help better understand how augmented reality can affect the new gaming experience. This approach will also investigate if this technology is the future of gaming or just a temporary trend.

The last recommendation is to keep tracking augmented reality technological changes and study them as they go. Furthermore, it might be worth starting research on non-commercial tools to work with AR. Namely, such tools would contribute to the further development of this technology.

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