

Increasing Tactile Sensations for Virtual Card Games

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Abstract—Card games are able to be played in a physical and virtual environment. Virtual card games have a lack of tactile feedback and immersion that is prevalent in physical card games, this problem effects players that play these card games because they're missing out on an important and immersive part of the game. We aim to create a game controller that can be used to play virtual card games that achieves the same or similar tactile feeling that a physical card game gives the player. We aim to achieve this by integrating immersive components into the controller such as a physical card that communicates with the controller using RFID/NFC technology to emulate a physical card being placed. The results obtained and takeaway show that immersion can improve player enjoyment and more people play physical card games over virtual card games which is a result of the less immersion present. Other methods of attempting to solve this problem include using AR and Camera technology, VR equipment, and NFC chipped cards that communicate with an app.

I. INTRODUCTION

THERE are multiple different ways to play Card Games. They can be played with physical cards in person or digitally via a wide variety of video games and virtual instances. However, the main difference between the two is the physical interactions had with the physical cards. When playing with physical cards, players are able to feel the actual weight of the cards and they are also able to feel the satisfaction of physically interacting with the cards, i.e "slamming" the cards down on the table to play them.

The apparent problem is the lack of physical interaction and tactile feel with the current methods to play a virtual card game. This can lead to a lack of immersion that would be present while playing a physical card game. This problem affects players trying to get an authentic and immersive experience while playing virtual card games. Current solutions to this problem include devices that use Augmented Reality software to connect multiple physical areas virtually [5] and devices that incorporate NFC chips to allow physical cards to communicate with devices allowing for a better tactile feel [9].

If this problem is not solved multiple groups would be effected. Players that want to get the same physical feeling of playing a card game but can only play in a virtual setting would be effected since they would have to play in the virtual setting. Statistica shows that in 2017 there were around a million players playing physical card games. [10] Meanwhile, SteamDB shows that the 5 most played virtual card games on their platform have had a cumulative all time peak of 366,531 players [1]. This shows that physical card games are played

much more often than virtual card games. A user on Quora asked "What is the appeal of playing with physical cards as opposed to digital cards?" [2]. Another user responded by saying that the tactile sensation is satisfying and the physical and sensory feeling of the cards add depth and immersion to the game [2]. Jennett et al.[4] describe how immersion is important for player enjoyment. The player disparity between physical and virtual card games suggests that there is a large difference in immersion levels between the two.

The players that can only play virtual card games will be effected since they wouldn't be able to experience the tactile sensations and immersive feeling of a physical card game. The game designers and developers making virtual card games are also effected by this problem since card game players would rather play physical versions of card games for the enhanced immersion and tactile sensations.

II. BACKGROUND REVIEW

THE keywords we used for our search for resources were "Card game, tactile feeling, immersion, Virtual Reality, Augmented Reality, Controller Naturalness, and interest". We used these keywords because they all relate to the problem we are trying to solve and potential resources using these keywords will give us different insights into the problem. In total we found **16** results, we included **11** of the results and we decided to analyze them because they were the most informative, related the closest to our problem, and gave us better insight. We discarded **5** of the results because upon further reading they went in a different direction than we anticipated and wasn't related to the problem close enough.

Jong-Hyoun Kim and Teresa Cho address the problem of how current virtual card games can't immerse players into the game by conducting experiments that integrate Camera and AR technology to create a link between a physical game area and a virtual environment [5]. Smart-Tec have a line of products that are similar to this but instead of using cameras and AR, they use physical cards with NFC and RFID chips to communicate with an app on the user's phone [9]. This solution of using NFC and RFID technology was discussed in a reddit thread. The thread was mostly negative because users thought the current product by Smart-Tec, the *Fusionplay-Heroes* was too gimmicky and that it was weird you had to use the physical card **and** an app to play with no option for one or the other [3]. The takeaways from these resources are that NFC and RFID technology can be used for a project like ours, just in a way different from how Smart-Tec has done it and that bridging the gap between physical and virtual card games will not only increase player immersion levels but their enjoyment.

These resources all address being immersed in games. Jennett et al. addresses the problem of if immersion is measurable and quantifiable by conducting three different experiments. These experiments included having the participants switch from an immersive to non immersive task, measuring haptic information such as eye movements during immersive tasks, and investigating effects of an imposed pace of interaction on immersion. The results and takeaway from these experiments showed that not only can immersion be measured but that immersion be negative as well as positive [4]. Their research benefits other researchers aiming to involve immersion into their projects or reports.

Rory McGloin, Kirstie Farrar and Marina Krcmar paper titled Video Games, Immersion, and Cognitive Aggression: Does the Controller Matter? [7] and Kevin D. Williams' [11] paper titled The effects of dissociation, game controllers, and 3D versus 2D on presence and enjoyment addressed the problem, does realism of game controllers increase player's immersion and enjoyment of the game? The two scientific papers discover how immersion of a controller brings higher cognition Players within the card game community and researcher would benefit from this as it provides ideas and reasons in making stronger realism in controllers.

Besides just focusing on controller realism, card game companies like Konami have different approaches like add in as many features a real life yugioh card game would have into the game as possible. One of their digital card games, Yu-Gi-Oh! Master Duel [6] contains zone placements that is relatively the same as the in person card game organizations. For example as shown on the Yu-Gi-Oh! Master Duel tutorial section, the field contains main deck, graveyard, and banishment is on the right side and extra deck is on the left. Another approach Konami took is to introduce the game into virtual reality, which virtual reality itself has been known for the immersive gameplay experience. Within VR, the first thing being noticed is how the game simulates the draw action and it would be great to have a draw slider on our controllers[8]. Placing buttons or controls on familiar spots like in real life would give a better immersion experience to users.

Both papers address the problem through comparing results of participants under different conditions. Rory McGloin, Kirstie Farrar and Marina Krcmar paper compare players' cognition of the game through four different conditions, a combination between high/low realism and high/low controller naturalness[7], and the result shows a higher realistic controller creates greater immersion for the player[7]. Kevin D. Williams' paper compares the enjoyment of the game through different types of controller, like steering wheels vs normal controllers[11], and the results indicate that participants would have a higher enjoyment with steering wheels in a racing game compared to normal controllers [11]. The takeaway is that in order for users to enjoy the game more, a controller with higher realism and providing an immersive experience is an excellent approach.

III. RESULTS

A. Task Analysis

Task analysis can be found in Appendix: A

B. Design Thinking Process

Design Thinking Process can be found in Appendix: B

C. System Architecture

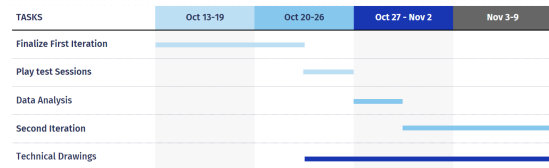
System Architecture can be found in Appendix: C

D. Electronics Simulation

Electronics Simulation can be found in Appendix: D

IV. CONCLUSION

The problem of lack of tactile feedback and sensations while playing virtual card games opposed to physical card games effects the players playing but also the developers making these card games. This problem has been addressed previously by implementing AR and Camera technology in different play areas allowing them to communicate over long distances, creating an app that communicates with a deck of NFC chipped cards, and utilizing virtual reality hardware. Immersion is an important part of game enjoyment, being able to replicate the tactile sensation wouldn't just increase immersion but also enjoyment. The future work that has to be done is finalizing the first iteration of our controller, conducting play test sessions with multiple people, analyze the data acquired from those sessions, and then improve the design of the controller. Technical drawings will be made of the different iterations of the design, the final design will have the most detailed technical drawing.



Gantt Chart showing future scope and workflow of project

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- [12] Doan Winkel. Design thinking 101: Design the ideal wallet, 2 2021. URL: <https://www.teachingentrepreneurship.org/design-thinking-101/>.

APPENDIX A TASK ANALYSIS

A. Before Use Case 1:

Playing a virtual card game

Actor: Player

Basic Flow: Prepare a deck list Start an online game Draw a starting hand Proceed game phases through touch screen/mouse

Standby phase: Move cursor to phase and click next phase Confirm going to next phase

Main phase: Move cursor to phase and click next phase Confirm going to next phase

Battle phase: Proceed battles between cards Do damage calculation Repeat previous 2 step until satisfied or out of attacks Move cursor to phase and click next phase Confirm going to next phase

Main phase: Move cursor to phase and click next phase Confirm going to next phase

End phase: Move cursor to phase and click pass turn Confirm going to pass turn

B. After Use Case 1:

Play virtual card game with our controller

Actor: Player

Basic Flow: Prepare a deck list

Start an online game

Draw a starting hand

Proceed game phases through touch screen/mouse

Standby phase: Press next phase button

Main phase: Press next phase button

Battle phase: Proceed battles between cards Do damage calculation Repeat previous 2 step until satisfied or out of attacks Press next phase button

Main phase: Press next phase button End phase Press end phase button Confirm going to pass turn

C. Before Use Case 2:

Get the same feeling of playing a physical card game in a virtual environment

Actor: Player

Basic flow: Prepare a deck list Set up a camera to capture your physical play area Join the virtual environment that allows players to see each other's areas and cards Proceed with game phases physically while monitoring other players camera feeds

Standby phase: Agree to move onto the next phase

Main phase: Physically interact with your cards if you need to Agree to move onto the next phase

Battle phase: Battle with cards Physically place down your cards Physically remove any cards that need to be removed Do damage calculations

Main phase: Physically interact with your cards if you need to Agree to move onto the next phase

End phase: Show that you are going to pass your turn

D. After Use case 2:

Get the same tactile feel of placing physical cards down that you would get in a physical card game while playing an online card game

Actor: Player

Basic Flow: Set up controller and physical play area Prepare a virtual deck list Proceed with game phases virtually while interacting with the controller

Standby phase: Agree to move onto the next phase

Main phase: Use controller to interact with what you need to interact with Agree to move onto the next phase

Battle phase: Battle with cards

Use controller to select move, use button to select options, and use pedestal to place cards

Remove card from pedestal, use controller buttons to remove any cards you need to from game

Do damage calculations

Main phase: Use controller buttons to interact with game and place cards if needed

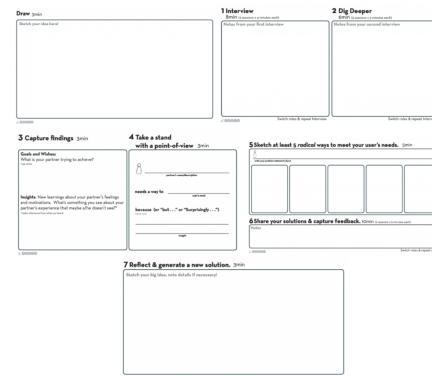
Select option to move to next phase

End phase

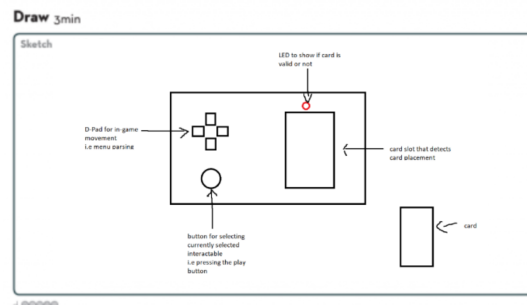
Pass your turn

APPENDIX B DESIGN THINKING PROCESS

For the design thinking process, we used this template while conducting the interviews. In total, 6 different people were interviewed.



The Design Thinking Template [12]



The Draw Stage of Our Design Thinking Process

For the first 3 interviews, participants were shown the first iteration of the controller (image above) and asked how

they would make a virtual card game more immersive while thinking about the design shown.

A. Initial Interview Stage

During the initial interview stages, the participants made comments related to how the card state changes get displayed (health, mana, etc.), how many spots will they be able to place the cards on the controller, what happens if a game doesn't use all or needs more slots, what sound effects and auditory feedback will there be, the design of the controller is too bulky, the NFC and RFID component is nice, the tactile feel of a card game is a nice addition, why the user would prefer this controller over a normal controller or keyboard and mouse, the card sensor design is an interesting thought, and discussion of whether a card game controller should use directional pad or joystick..

B. Dig Deeper / Elaboration Stage

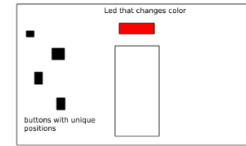
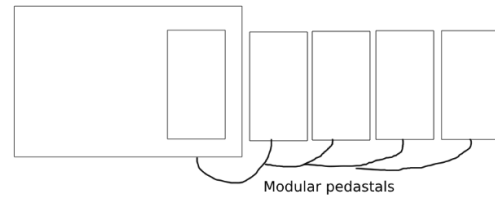
The participants elaborated on their points by saying and info sensor could be added to let players inspect their cards states and stats, tactile feel increases immersion and fun, auditory feedback could include replicating the card "thunk" sound via speaker or vibration motor, the buttons should be of varying sizes and position to easily and quickly distinguish them, and that there should be more LEDs to increase visual feedback. Some feedback with LEDs participants wish to have would be indicating different phases of the game like draw, main, and end phase, etc. Participants also suggested to have the controller less bulky smoothing the edge of the iteration and making it more suitable for holding. Two of the participants hold separate opinions on the iteration using direction pad, one believes joystick is easier to control for the user and the other believes since card games are like a grid based moving pattern it would be best to use direction pad instead.

C. Capture Findings and Take a Stand/Point of View

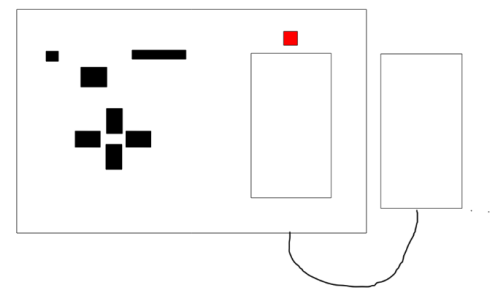
Using these new insights the problem statements gathered for each participant are: John needs a way to play his favorite card game while immersed. Unexpectedly, in his world there is no way to capture the tactile feel of an actual card game while playing an online card game. Clayton needs a way to play with the controller without it falling off of his desk but it is to big to not do that. Ryan needs a way to play virtual card games but the sense of immersion and link between bodily sensations and what's happening in the game are lacking. Max needs a way play card games but there isn't any local store nearby. Thomas needs a way to feel like he is playing physical card games online but currently he can only play it with keyboards and mouse. Ryan needs a way to simulate draw card action in card game because keyboard, mouse, and ordinary controller cannot simulate such action.

D. Iterations

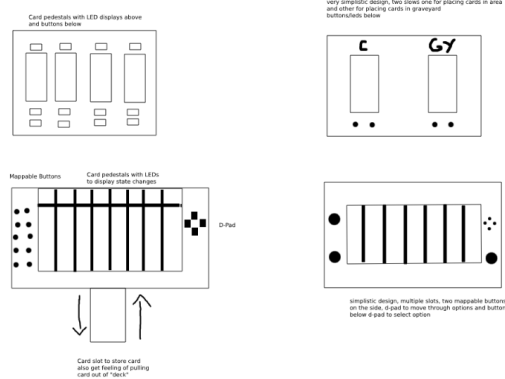
The iterations based on the newly acquired insights are as follows:



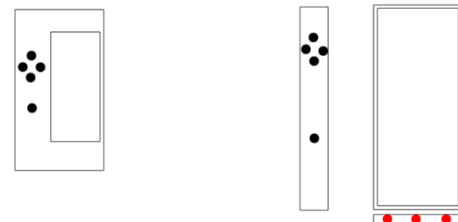
First Iteration



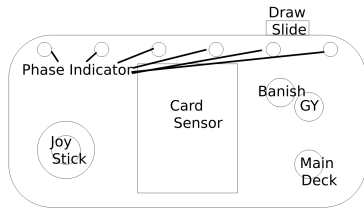
Second Iteration



Third Iteration



Fourth Iteration



Fifth Iteration

To access a 3D model of the current paper prototype, visit this link:

<https://skfb.ly/prGRr>

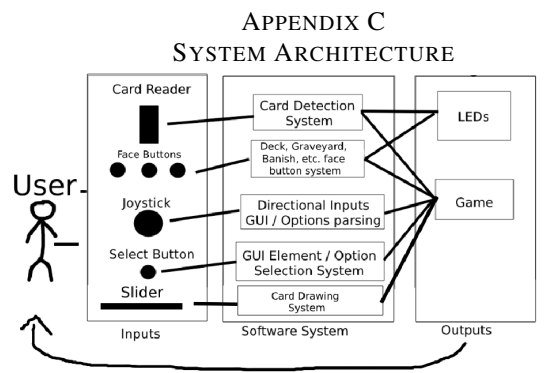


Image of the System Architecture

The user interacts with the inputs which then communicate with the Software System which communicates with the outputs. The software system consists of systems built in the Unity Engine. These systems relate to the card states and game states of the game being played and how the controller interacts with them.

APPENDIX D ELECTRONICS SIMULATION

To access the online simulation of the electronics, visit this link:

<https://wokwi.com/projects/411195323705681921>

To access a video of the simulation, visit this link:

<https://www.youtube.com/watch?v=9TmPfCNKFD4>

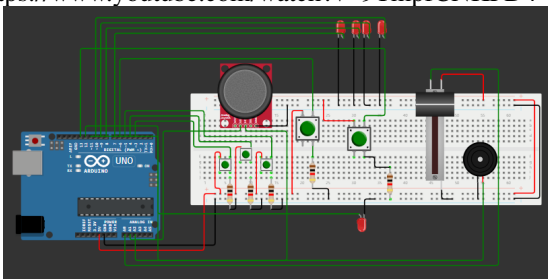


Image of the Virtual Simulation

To access the video of the physical components working with unity, visit this link:

<https://www.youtube.com/shorts/aqaCJXqFzM>