Saber Support

A Virtual Reality Controller Extension for Immersive Swordplay

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***Abstract*—This document details the early design stage of the Saber Support project. It describes the research done toward the project as well as the justifications of its purpose. The project will consist of a sword peripheral that will attach to existing virtual reality controllers to add both auditory feedback and passive haptic feedback in order to increase immersion for the user.**

I. Introduction

This document details the results of the ideation process for a virtual reality sword peripheral.

II. Problem Statement

Virtual reality swordplay has become visually and auditorilly very immersive and allows users to imagine they are using a sword. Current virtual reality controllers lack the weight and presence that allow users to physically emulate the feeling of holding a real sword. Different applications require users to perform virtual reality swordplay at varying levels of proficiency and precision. This project will attempt to determine a way to physically emulate the feeling of a real sword for realistic virtual reality sword combat simulations.

III. Justification

This solution attempts to take advantage of the existing visual and auditory feedback present in virtual reality swordplay experiences and expand off of them. By adding in a physical sword representation and implementing additional auditory feedback outside of the game, users will have a much more accurate representation of weight and more closely connect to the actions they take.

A. Problem Left Unsolved

Without these additions users are still able to construct fictional experiences and simulate the use of the sword themselves, but they would need to do so intentionally which can break immersion. For frequent virtual reality users and enthusiasts immersion can be one of the most important pieces of the overall experience.

B. Potential External Benefits

If this project is found to be successful, similar controller extensions could benefit from the results. This could include other kinds of melee weapons being designed as extensions in a similar way, or creating uses for sports equipment like baseball bats or golf clubs to increase immersion in other kinds of virtual reality experiences.

C. Relevance

According to S&P Global Market Intelligence, out of the top 10 highest grossing virtual reality games of 2020, 60% of the listed games include some level of virtual reality swordplay or knife combat. The number one game on that list, Beat Saber, consists of only swordplay.[1] If an effective improvement to how users experience swordplay was introduced it could have a considerable impact on a large majority of those who play virtual reality games.

IV. Ideation Process

Five total outside individuals were a part of the ideation process. These individuals were interviewed in order to gather data and perspectives on the current pros and cons to existing virtual reality swordplay solutions.

A. Virtual Reality Swordplay Experts

Two interviews were conducted with individuals who can be considered experts in virtual reality swordplay, some of the current highest rank beat saber players in Canada. These interviews were conducted for the purpose of collecting in depth information and details on how controllers are being used and the most important aspects to consider while designing for virtual reality swordplay. These essentials include a large focus on comfort and freedom.

If the controller becomes uncomfortable to use, many will seek alternative solutions to remedy this discomfort. Additionally, tension on the wrist and fingers can cause pain if experienced over long periods of time which should be avoided as best as possible. Finally the center of mass of the controller itself should be positioned as closely to the center of the user's palm as possible to allow more precise and intuitive control over the virtual sword.

B. Inexperienced Virtual Reality Users

Three interviews were conducted with infrequent virtual reality users. This was to see what the expectations of those not necessarily accustomed to a specific method of virtual reality swordplay would be, and how they differed from those with experience in the matter. These less experienced users were able to raise concerns about the current experience that those with experience may have grown to accept. The main points of improvement expressed were in forms of real world feedback

that could enhance immersion for users. These enhancements would come in the form of adding additional weight to the controller to more accurately represent the weight of a sword, and providing an additional piece of feedback outside of the space of the game itself.

C. Final Takeaways

The outcome of these interviews has resulted in a controller extension in the form of a sword-like peripheral to the existing controller. This extension would include a way to house the controller into the hilt of the sword peripheral. It would also include a false blade that would extend outwards from the controller to give the correct sense of scale to the user. The blade portion will hold additional weight near the tip to give an accurate sense of weight on the sword. Additionally the sword hilt will include a speaker that will produce sounds based on the amount the sword is being moved. For Additional Details of the Ideation Process, see the included document "Design Think Process.pdf"

V. Existing Product Comparison

Virtual Reality has existed in some form for decades. In the scope of this project, the existing technologies that were primarily used are those commercially available. However two additional, non-commercial projects were investigated as well.

A. Researched Projects

Firstly a weight shifting controller developed in 2019 that was intended to allow users of the device to more accurately feel like they were holding the object they saw in virtual reality. The weights would change their distance from the controller and the angle of their movement in attempts to find what distribution would best fit with the presumed feel of the virtual objects.[2] The other project that was investigated took a different approach to simulating weight through the use of drag. The aptly named "Drag:on" controller housed two attached fans that would unfurl to create significant wind resistance while moving. Although the fans themselves did not add much weight on their own, the users ability to move them noticeably feels more challenging.[3] A potential downside would be that these fans when unfurled only account for movement on one axis. For example moving the controller side to side may have added air resistance but moving vertically would not, which may potentially remove the immersion players were given if they are able to notice the difference.

B. Commercial Products

Virtual reality has been commercially available for roughly 8 years ever since the release of the HTC Vive in 2016.[4] Since it's commercial dawn, significant changes have occurred any many parts of the design can be seen changing over the years as we approach the current year. As time has progressed their are certain trends that seem to emerge. Controllers are becoming smaller, more light-weight, and are focusing on keeping the center of mass in the middle of your hand. External base stations used for tracking have begun to be phased out, now being replaced with in-headset tracking. While still in its infancy wireless virtual reality headsets are beginning to emerge more frequently as well being led by the "Meta Quest/Quest 2". Finally looking forward to the future, although it is merely speculation at this time, it is not unlikely that soon we may see virtual reality headsets that do not require any controllers at all. Virtual avatars could be controlled from hand tracking or perhaps even be fully embodied with full body tracking. For more details about commercial virtual reality controllers from 2016 to now see the attached file "Commercial VR Controller Timeline.png"

C. Comparison Takeaways

Comparing this project to the current virtual reality trends, this product is not likely to reshape the direction that current commercial are taking, but it may lead to a new branch on the path. This project intends to improve the existing technologies that are lacking pieces of feedback that could create a more immersive experience. It should allow those with existing headsets to improve their experience, while using the technology they already posses.

There exists a final product with similar intentions that this project takes inspiration from, the Beat Saber handle grips developed by KnoxLabs. Their product adds a larger grip that more closely resembles the grip of a sword, allowing players to feel more closely connected to what they are doing through the way they hold the controller.[5] This project aims to extend this thinking beyond just the way the controller is held and expand into creating a full physical sword that users would wield. This should allow users to stop fabricating the physical swordplay experience while in virtual reality and physically feel their virtual actions in the real world.

References

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