Motion Control Hammer

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***Abstract*—Motion controllers often have the issue of differentiating vertical and horizontal movements with diagonal lines, therefor we wanted to make a motion controller that will solve this issue and be able to correctly differentiate between the different user inputs and to present these differences accurately on screen, this is important as instances where the wrong movement is calculated can displace the player away from the game and cause them to disengage the game, therefor solving this problem can prevent players from losing interest in the game and gaining frustration towards the controller.**

I. Introduction

The issue with motion controllers is that sometimes it calculates the user input to register it as either a horizontal, vertical or diagonal movement, with games often taking priority with horizontal and vertical movements diagonal movement is sometimes calculated as a vertical or horizontal move. Its relevant to solve this issue as some players want a more accurate display and calculation of their movement with the motion controller in games, when this issue is present it can disconnect the player from the experience and the player can gain a frustration towards the controller as the issue persists, therefore by creating a solution the player will be less likely to displace themselves from the controller due to frustrations and be able to use it longer and find it more enjoyable. Our motion controller addressed this problem by having two gyroscopes connected to our controller, this is to get a better recognition of the players movement. In this paper we will be going over multiple things about our motion controller Hammer, such as a literature review, methods of our iteration process and workflow, the results or our project and takeaways including what we learned from this project.

II. Literature Review

In terms of responsiveness of controllers, there have been multiple studies done when it comes to how people react and respond to them. What all of them have in common is that if the interaction between the controllers and the games are not on point with each other, the players will have a negative reaction and perception of the game that is presented to them.

In the article "Spatial presence and perceived reality as predictors of motion-based video game enjoyment"from the Presence: Teleoperators and Virtual Environments journal, the study investigates the impact of motion based video game control systems on spatial presence, perceived reality, and enjoyment of video games. Two experiments were performed, involving university students playing video games on either a motion based controller or a standard controller. It was discovered that the interactivity of a motion controller increases the feelings of enjoyment alongside perceived reality and spatial presence. Having an interface that feels more natural to a player when interacting with the game creates a more immersive, and fun experience for the player. The moment that there is a disconnect when it comes to controlling video games in that manner, the immersion would be ruined also leading to less enjoyment of the game as the perceived reality of interacting with the game lessens.

In the article "How Responsiveness Affects Player Perception in Digital Games", it covers the importance of how a player can promptly control their character. This specifically goes over how delays affect player perception. It goes in depth about the impact of responsiveness on a player's experience. The research shows that having quick responses is crucial actions that demand precision. It also confirms that delays increase the perceived difficulty of a game , reduces the quality of performance and causes more frustration. This is relevant to our topic because in a way, the game calculating a movement wrong causes a delay in one's intended actions. And since there is a delay, it does cause frustration just as the study's conclusions say.

III. Product Comparison

A. Wii

The Wii remote was created in 2006 for the WII console, it was an integral part of the sudden success of motion based games. It received 2 upgrades over the course of its life the first upgrade was the Wii motion plus extension which took the remote from a single IR sensor Pointer to have a gyroscope and accelerometer built in allowing it to be capable of what it essentially was always planned to do but was somewhat unsuccessfully doing up until this point in 2009 the 2nd upgrade came later and it was the integration of the external Wii Motion Plus accessory directly into the main remote making it far smaller then the regular wii remote with the motion plus accessory essentially returning the remote to its original size before the hardware upgrade. The Wii motion plus integrated wii remote was the main remote of the WII U home console and was also compatible with the original WII.

B. PlayStation Move

The Playstation Move was Created in response to the success of the wii remote taking a similar concept and working it into the motion controller the move works on similar principles to the wii remote. The move also is now used in conjunction with PSVR acting as controllers for that new venture.

C. Nintendo Switch JoyCon

Our main competitor is the Joy con they are the modern motion controller created by Nintendo to replace the aging nintendo Wii motion controller they are smaller and built using similar technology to the Wii remote controller. The joy cons are currently the most successful modern motion controllers on the market at this time and they are a generalist controller meaning they can also be used for non motion controls based games.

IV. Methods

In the following image is a flowchart of our work and iterative process (figure 1), we started off with a simple idea of what our controller would be and look like, followed by this initial idea we began to prototype in tinkerCAD on how this controller would work internally during the tinkerCAD prototype we also worked towards getting our first report done to better solidify our idea and what issues we were specifically targeting. After the tinkerCAD prototype we were able to begin a fusion 360 model of our controller and the list of materials needed for our controller, we worked on these two things simultaneously, as the fusion 360 design needed to be changed to fit the materials sizes and for everything to fit. Once this was done we were able to get to work on printing the design and working on the assembly of the inner mechanics of the controller, as printing finished we got feedback on the design and its fit and we decided to redesign the controller in a more hammer like object with a handle for comfort, so as assembling was still going on we continued with printing for our prototype, and that's where we are now, with a completed prototype version 2.

V. Results

Timeline of our project, our project started in the middle of September of 2022 during this early stage of our project we discussed how and what our controller would be, what it would look like and how we would put it together we did this by coming up with tinkerCAD example to figure out some base for wiring and needed components followed by this tinkerCAD example (figure 2) and a simple blender model of what we wanted our controller to look like (figure 3). We then came up with a list of needed materials for the project, this included an Arduino kit, this kit had included a breadboard, wires, Arduino board, lights, and resistors, other materials needed were buttons, and 3 accelerometer gyroscope. Once materials were bought and began shipping, we focused our priorities on making a concrete design of the controller through fusion 360 (figure 4), this is where we figured out our initial idea of a slim sword like model wasn't going to work with the

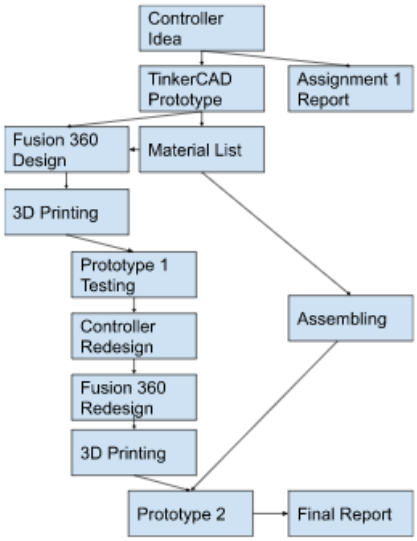

Fig. 1. Flowchart

component sizes and thus changing the initial design of the controller. This fusion model was slightly tweaked and edited in order to be 3D printed for out controller's casing (figure 5), once this casing was printed and we were able to hold it and get some opinions on it from others we realized and were advised that this model was bulky and could not be held comfortably by users, however with this advice we could not slim down the device as its size was due to holding all of the necessary components inside, thus we hand to go back to the design process where we slightly moved the location of the button and lights as well as adding a handle to the middle of the controller, changing our initial design of a sabre like controller, to a hammer (figure 6).

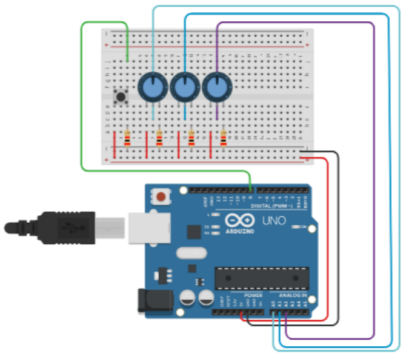

Fig. 2. TinkerCAD prototype

VI. Takeaway

Over the course of this project our group has learned many things, for example when it comes to designing in the future we need to take into account the different component sizes and how they will come together within the design, this is an issue we found our group in multiple times throughout the

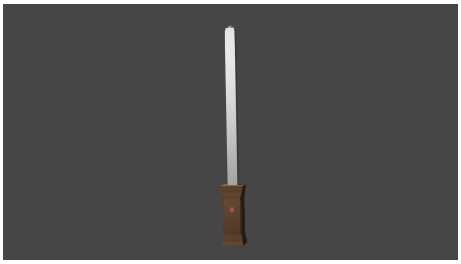

Fig. 3. Blender prototype

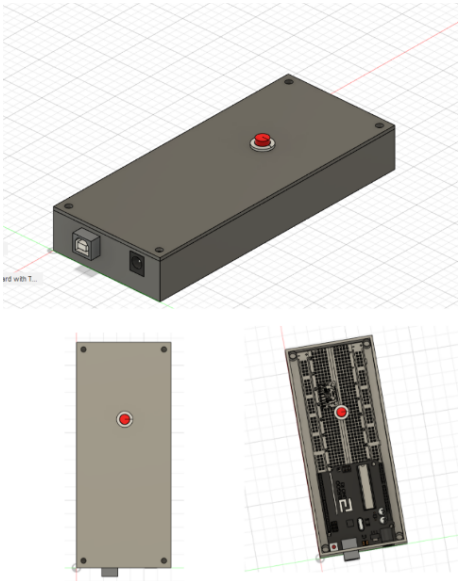

Fig. 4. Fusion 360 prototype

project as more things were added and removed we quickly realized that our design needed to change to accommodate parts, wiring, sensors, etc. Another takeaway we learned was from the prototyping phase of our project, and that was how often and quickly small changes are made and need to be included or removed from our design this often had us going back and forth between the prototyping and designing as prototyping phase revealed issues in the design hence the often back and forth, therefore a big takeaway is to take the amount of time and back and forth into consideration when creating a timeline. One thing to takeaway from the assessment procedures is to have more time allotted to surveys and other assessment procedures, this is so we can get even more people involved and get more survey data. In addition to all of the above things we also learned some very important lessons from our attempt at soldering such as the need to always wear gloves when soldering so to avoid oils from your hands getting onto the computer chip which disrupts the ability of the solder to apply properly we learned this the hard way and now that we know we need to either wipe the chip down properly or risk issues like that occurring or simply wearing gloves when handling them for now on.

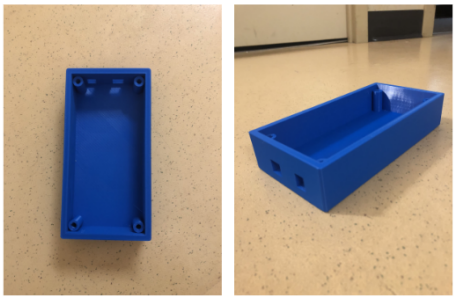

Fig. 5. 3D Printed Model

Fig. 6. Hammer Prototype

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