The One-Handed Controller Usable in Either Hand

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I. Abstract

The problem we are addressing with our controller is that there are no light and simple one-handed controllers in today's market. This is important because people with only one hand can purchase large bulky controllers or complex mods to existing two-handed controllers. We felt that people who have only one hand functioning need a good controller to start playing video games. The outcome of our project is a cardboard prototype with limited functionality.

II. Introduction

We have done some research on what one-handed controllers are on the market. Some of the controllers looked lightweight and some of the looked simple. None of the controllers we have found look lightweight and simple at the same time. We felt that people who only have full function with one hand do not have a good way to start getting into gaming, after they get used to playing games with our controller they can go onto more complex controllers to meet whatever needs they are looking for. We decided the best way to make a simple and lightweight one-handed controller is to reduce the number of inputs and focus on games that use fewer inputs like party games and menu RPG games. Our solution is the Ambi Controller a one-handed controller that can be used with either hand. We wanted to make a controller that can be used with either hand because not everyone who only has one functioning hand has their right hand only functioning.

III. Literature Review

Our first work was a study done on symmetrical and asymmetrical controller. This study was made to test how effective either type of controller is. They tested how fast game tasks could be completed with the different controllers and saw that the asymmetrical controllers got the tasks completed faster. The study concluded that asymmetrical controllers had the fastest completion time compared to the symmetrical controllers. This led to us deciding on the asymmetrical placement of our inputs as it's been seen to complete tasks faster than a symmetrical design. The other work we found talked about a one-handed keyboard designed to allow players in VR to type with one while playing with the other hand. Although this controller was designed purely for accessibility for players it has similar design choices that we have. They found that focusing on the simple design to make it easily usable and easy to get used too since it needs to feel natural in a players hands. Their controller was designed to be comfortable and easily usable for anyone with one hand, which is the same design principles as us to have our controller easily usable and comfortable to hold with one hand.

The two devices we looked at which would compare to ours. One of the controllers is a custom made PS4 controller with the full functionality of a normal one. This was made by Bejamin Heckendorn, he say that play station had no one handed controllers for their console so he decided to make on himself. He made the entire thing with 3D printing,, but his design was only for the right hand and another one needed to be printed for the left. We took this concept but wanted to create an ambidextrous controller so we simplified the controls to make it simpler which would also make the controller more usable. The other device we saw was a custom 3D printed mod for a Playstation three controller. It was designed to support part of the controller onto a leg or table then extended buttons to be able to click everything with one hand. Unlike the previous example this was designed as an attachment to a normal controller which made it uncomfortable for people to use. This was another inspiration to our idea but as we mentioned the controller was uncomfortable which we wanted to fix with a ergonomic grip in our design.

IV. Methods

Our flowchart (Figure 1) shows our thinking process and approach to creating this controller. We started off with our idea which was the ambidextrous one handed controller. Once our idea was confirmed we researched into alternatives that existed so we could get the best and worst of their designs and combine them into our final product. With the design finalized after the research we begun prototyping our controller. Once a prototype was created we would go through the common

practice that many creators do which is to make iterations on the idea and continue evolving the prototype until the best possible iteration was made. This process would go on for a bit as we never had many iterations as we only had two 3D models made and the other prototypes were made out of paper. But nonetheless this process was completed until our final design was confirmed and allowed the final prototype to be created.(Figure 1)

V. Results

Our timeline for this project (Figure 2) is kind of short as our design was really simple, and we just needed to make the controller ergonomic for players. Our first paper prototype was made just to figure out what the design of our controller could be. This version was just to figure out the design of the case and the placement of the controls. With this information we found the optimal locations for the controls now we just had to figure out the wiring and 3D print for the controller. This leads to our second concept which was our first attempt at a rotating top. Since it was our first try we made the handle just a straight cylinder instead of curved because we wanted people to see if the rotating mechanism was good. The results we got from this prototype was that the rotation method was good but of course our grip was not ergonomic at all. Then onto our final fusion model, which had three large finger grooves which were designed to make any hand size have the space for their hand to rest in it. As well as changing the top of the controller to be slanted so the controls would be leaning toward the person using the controller which would also improve it's ergonomics. Finally our last paper prototype was a paper prototype of our final design as we could not get the 3D print done so we designed a paper one. In this final iteration the analog stick was not modeled into the controller because we could not get it working and we figured out if a gyroscope was implemented we would have no need for making room for the analog stick as well as a sleeker controller since the rotating buttons would be a lot easier to do than a joystick.

When we conducted our QFD (Figure 4 Figure 5) and SUS (Figure 3) evaluations it was done with our second fusion 360 model since we did not have the physical prototype done yet. Of course this means the results of our graphs were done with a hypothetical controller rather than the physical paper prototype we had in the end. What we learned from both evaluations was that our idea was a good concept and people liked the idea of a ambidextrous controller. Compared to other controllers our design was seen to be comfortable and the rotating mechanism on the top of it would make it a good competitor against other accessibility controllers since there are not many controllers that exist with an ambidextrous functionality.

VI. Takeaways

We learned many things during the course of this project. The main thing that we learned was creating a controller from scratch requires a lot of iterations to come up with the final product. We also learned to focus on the basics of designing a controller before the complicated parts. During our design process we were more focused on designing the twisting method before thinking of the basic wiring for the controller. This led to a major mistake in our design process since we ended up having our ambidextrous method completed but since we did not think about how the wiring and electronics will sit in the controller we had to start from square one to figure it all out again. Overall this process was still a good learning experience in how to create a controller and the issues that come with designing it. This process has helped us learn the difficulties and struggles of making a controller but also problem solving skills to fix issues and streamline the creative process of making one. The main thing we would have done differently would be to focus on the basic electronic placement and organization on our controller rather than the rotating mechanism first. It would have helped a lot with the designing process and saved us from many complications during the project.

VII. Bibliography and Appendices

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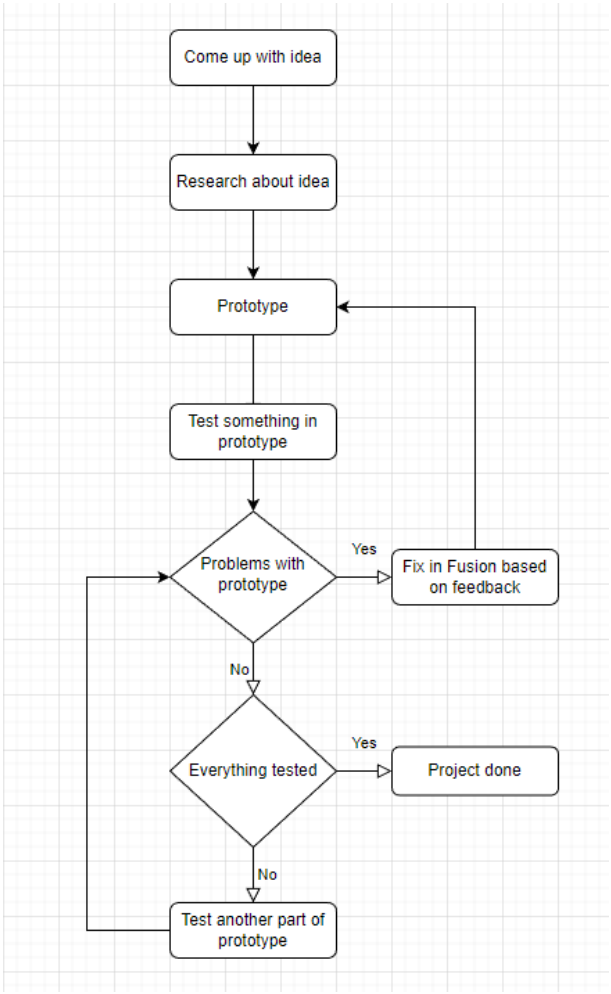

Fig. 1. Work flow

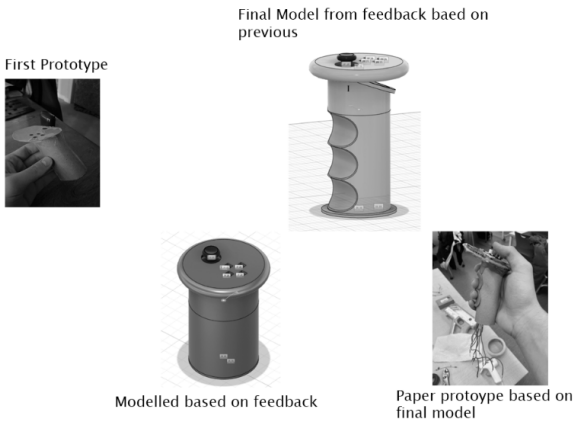

Fig. 2. Timeline

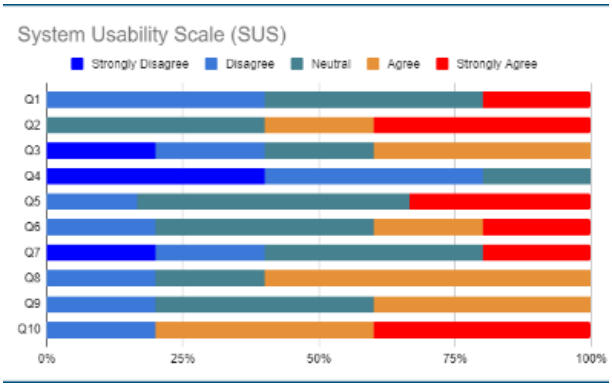

Fig. 3. SUS evaluation

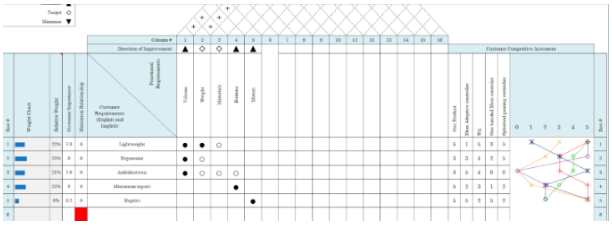

Fig. 4. Top of QFD

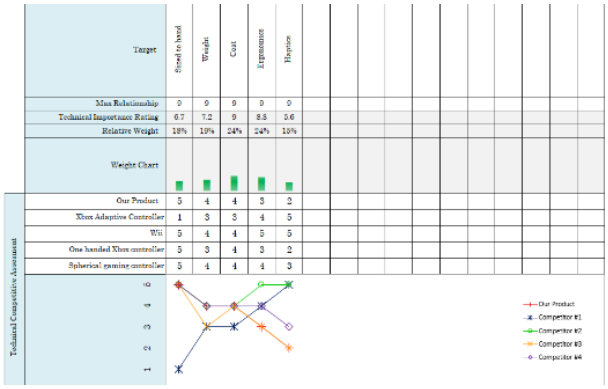

Fig. 5. Bottom of QFD

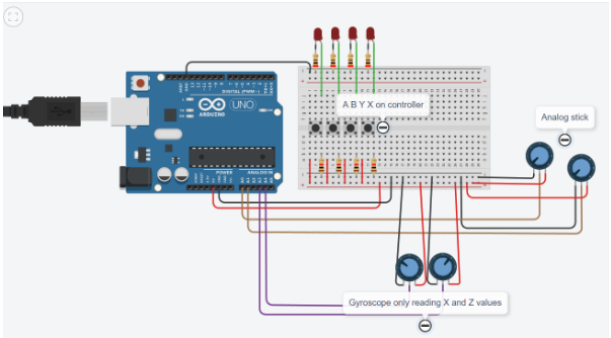

Fig. 6. Electronic

Electronics.

Component	Amount	Price	Role	Supplier
Arduino Pro Micro	x1	$32.98	Main Microcontroller	Arduino Store
Analog stick	x1	$6.50	Main movement	Amazon Store
Push Buttons	x1	$10.99	Main inputs	Amazon Store
USB micro b	x1	$7.60	Power/Send inputs to computer	Amazon Store
Magnet	x1	$8.21	Locking mechanism for rotation	Esty
Protoboard	x1	$1.83	Secure placement of buttons in controller	Retro Amplis

Fig. 7. Bill of Materials

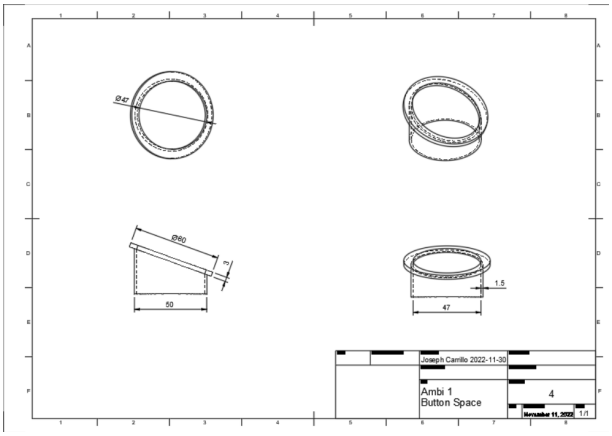

Fig. 10. Wiring Space

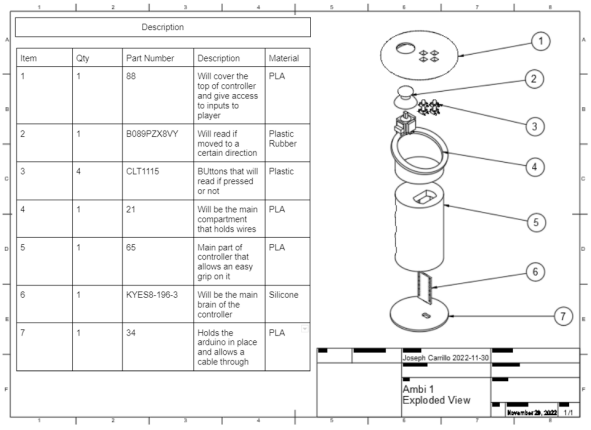

Fig. 8. exploded View

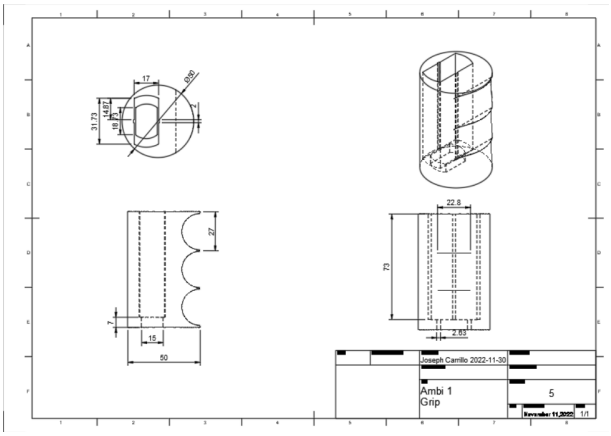

Fig. 11. Grip of controller

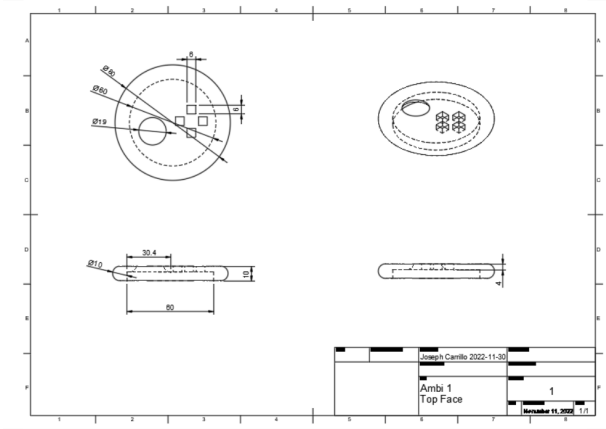

Fig. 9. Top of controller

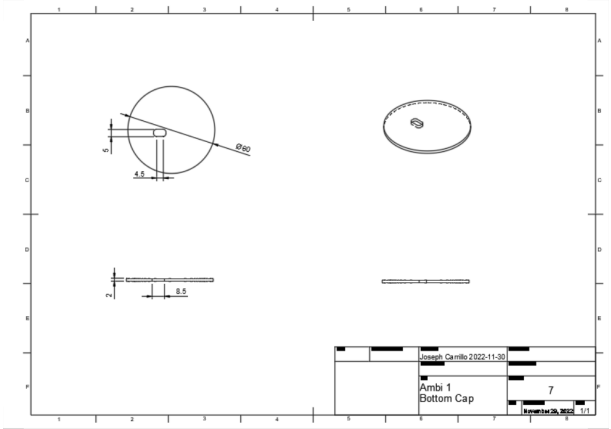

Fig. 12. Bottom of controller