INFR3380U Assignment 1: The Hard Hats

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***Abstract*—Youtube Link: https://www.youtube.com/watch?v=uBPFKQtnP8Q**

***Index Terms*—Ergonomics, Modular, Controller**

I. Project Description

The button placements on modern controllers should accommodate every user's preference. Currently, standard controllers have buttons in permanent positions on the controllers. The lack of flexibility for changing button placements may lead to cramped and stressed hands. To prevent discomfort with the controller's user the controllers should allow the user to change the position of the D-Pad, buttons, and joysticks. Making the controller modular, where the button can be taken out to be interchanged with another should accommodate those with different preferences. Justification: If the problem is not solved, certain people may get hand cramped or not feel the most comfortable when playing games for an extended amount of time. Similar problems may occur on keyboards, industrial controls, and other controllers. In a conference proceeding by Yesodha et al (2001), there was an academic paper that went through an ergonomic evaluation of video controllers, most particularly the Xbox and PS4 Controller. This paper had a focus group where it stated, "10 out of 12 gamers preferred the Xbox one controller because of their bulkiness and the comfort while playing specific games. Eleven out of 12 gamers liked the button layout of the PS4 controller since it had the traditional button layout." (Yesodha, et al 2001, p. 386) A research journal article created by Bhardwaj (2017) ran tests on different types of controller to find the most ergonomic setup controller in terms of button position, hand grip, etc. The PS4 controller seemed to earn the most points in the positions of the buttons. The end result of this research shows that the controllers are made solely for gaming, and not for comfort, however what if there was a controller that can be used for both? On a medical website by Physiomed, someone by the name of Wilson (2021) talks about the problems with carpal tunnel and how it relates to gaming. This website says, "When gaming, the same buttons or keys are pressed continuously, and this repetition is unnatural for the muscles and tendons of the body. It increases the risk of injury by putting excess strain on the affected parts of the body, in this case, the wrist, forearm, thumb, and hand, causing swelling and stress on the carpal tunnel and the median nerve." (Wilson, 2021) In the same site, it was mentioned that handheld controllers already are ergonomic in its shape. If this is true, then gaming using any controller will lead to health problems, and if that is the case, why not make it so the position of the buttons are in positions where the user feels the most relaxed in.

II. Ideation

To get a proper understanding of what users might want out of a fully adjustable controller, 5 people were interviewed and their responses recorded.

- Ergonomics: Many interviewees stressed the importance of establishing a base design with ergonomics as the main consideration. This was noted because interviewees were worried about how comfortable the controller would be with different button and stick layouts. It was expressed that players are weary of how wide the controller may be to accommodate all the design features.
- Extra buttons: Interviewees expressed interest in having extra buttons on the controller that are also able to be swapped. It was found that players would also like the freedom of swapping and programming more than the standard buttons found on stock PlayStation and Xbox controllers. The back of the controller was expressed to be the most suitable area for these buttons but the handles and other areas on the face are also options.
- Easily Interchangeable: Interviewees are concerned with how fast and simple it will be to swap out the buttons and sticks to their preferences. 1-2 minutes was said to be a sweet spot for the total time to switch between layouts. Players do not want a complicated product as the controller should be able to be used by kids and adults alike. Players also expressed that a satisfying click or snap sound would make them feel more confident in the product
- Durable: Interviewees made it clear that they are looking for secure connections within the interchangeable parts. Customizable parts of the controller should not fall out or break easily. Interviewees also expressed that shaking or holding the controller upside down should not have any effect on the overall utility of the controller.

Insights: Based on the Comments of the interviewees, the team will be adjusting the original design of the controller to better reflect what the players imagine the ideal customizable controller to be. Shape of the controller is one of the biggest concerns for the team as we will ensure that the controller is comfortable but satisfies the needs of the user. The controller should be a simple and stress free experience and the design of the controller will reflect that.

POV: Jamian needs a way to change the d-pad on his controller because he likes the layout of the sticks but dislikes the how the d-pad feels to press.
Gagan needs a way to completely rearrange the configuration of his controllers because he believes he plays fighting games better with one configuration and races better with another.
Sasha needs a way to satisfy the differences in her kid's opinions of controllers because they can only afford one controller at this time but her kids have varying preferences for controllers.

Ideation outcome:

- Idea 1: Diagonal Button layout to give the player the opportunity to dictate how close or far sticks and buttons are to each other.
- Idea 2: Customizable buttons on the back of the controller to give the player complete freedom and the opportunity to have extra inputs that they wouldn't otherwise have access to
- Idea 3: A latch or switch that will allow the user to remove the buttons or sticks attached to the controller. This allows for secure components until the user is ready to switch them out.

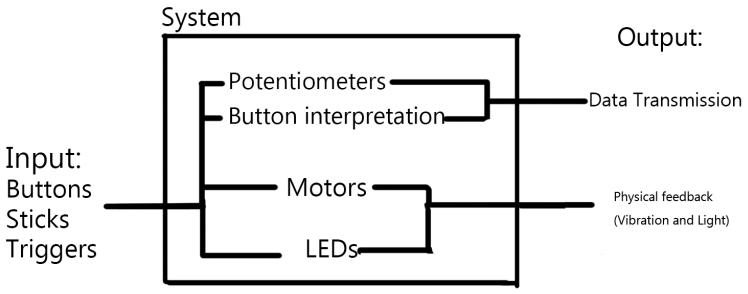

Fig. 1. Figure of Basic System Architecture

Fig. 2. Figure of Product Comparison

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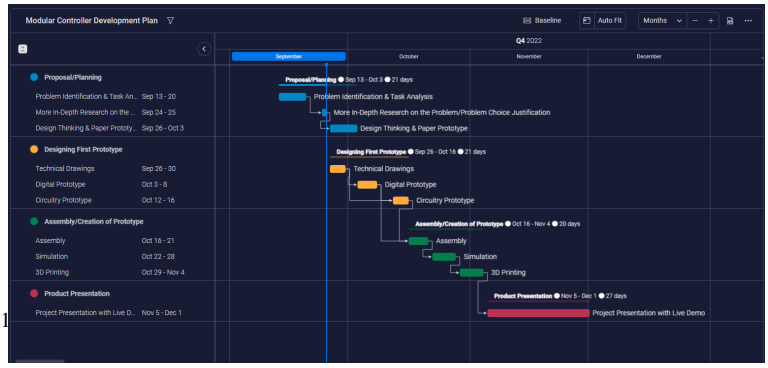

Fig. 3. Figure of Project Planning

III. Appendix

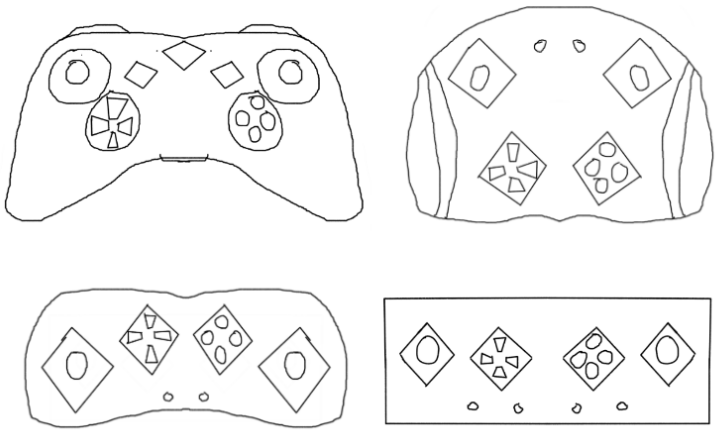

Fig. 4. Figure of Concepts for the Controller

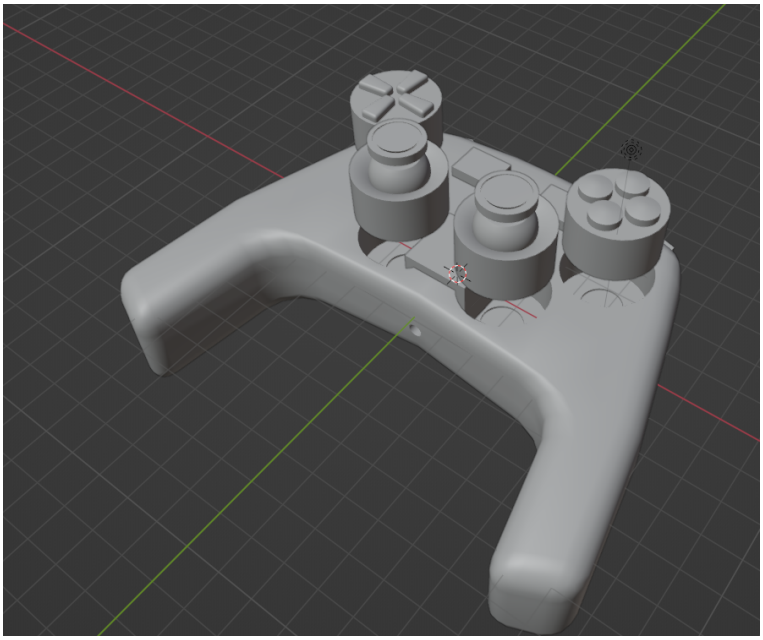

Fig. 5. Figure of near Final Concept