Inventing A Game Controller To Increase Engagement At Ontario Tech University's Annual Student Game Con Event

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I. Introduction

The goal in this assignment is to iterate and improve on the previous design and build a physical, functional prototype of the controller. This report describes what is new, in addition to the improvements made, and the results from informal user testing. Since the last report, there were notable improvements made primarily on the box and the hammer to prevent wear and tear, to dampen noise, and to improve usability. To prevent wear and tear, a cable management solution was added, wires were soldered in place, and a circuit board was added and secured to the box. To dampen noise, the original idea of using a foam pad to absorb the hammer strikes evolved into a triple layer of felt. The hammer was improved by changing the way that the top sensor was activated, and by color coding each face for readability. Overall, feedback from team members and fellow student testers was positive.

II. Materials and Methods

A. Wear and Tear

In order to improve wear and tear resistance, a cable management solution was added to lock down the external cables connecting the hammer and pedal to the box. Since all three components are attached together, the wires can get pulled and cause excess force to be applied on the circuit board, which is a component that needs protection. The solution for this was a sort of cable trap that locks the cable in place, which turned out to be very effective. In addition, all wires used in this system are solid core wires and are soldered in place. The rigidity of the wires makes for fewer moving parts, which is good to reduce wear. Finally, a proper prototype circuit board was made for the same reason as the solid core wires. The circuit board is a seat for the Arduino that connects to all peripherals with a 10 kiloohm pull-down resistor on each joystick and sensor input pin (see appendix A). Appendix B is a simplified view of the entire circuit in the controller.

B. Sound Dampening

The original sound dampening idea was to use a polyurethane foam pad to absorb the shock of the hammer striking the box. The foam did not work as I expected, it was unsuccessful in dampening the noise. This made me hypothesize that there needed to be some shock absorbent material on the inside of the box, so I glue pieces of a heavy-duty shock absorbing rubber mat to the inside walls and ceiling of the box. This test turned out a failure as well. Testing other materials including fabrics, I found that felt worked. I decided to make a three-layer felt pad to give it some absorption while keeping it thin. In the end, it makes a small, but noticeable difference.

C. Usability

The hammer was also subject to improvement. Some feedback I received on the design of the hammer suggested to use a spring to control the top sensor action. After some reflection on the idea, I implemented it, and the result was that it made it feel much better to press while also simplifying the design of the hammer head. Then, I added colored foam to each strike face. The purpose is to help the player associate an attack to each face of the hammer to make it more readable and intuitive to use. After multiple tests with other students, no confusion or dissatisfaction was expressed towards the hammer.

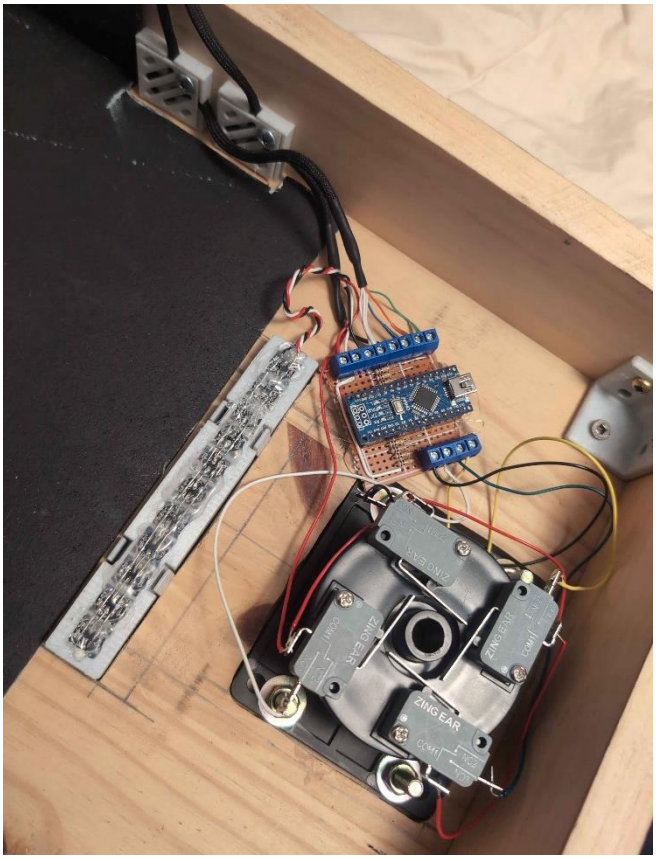
III. Results

Informal user testing was carried out with four students who did a system usability assessment survey. Appendix C and D show the result of this survey. Included in this survey, I ask for any other comments or feedback. Some noteworthy comments stated that the controller felt fragile and that using this standing doesn't feel great and makes the foot pedal awkward to use.

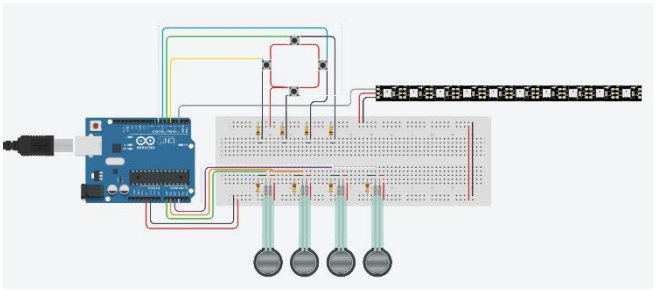
IV. Takeaways and Recommendations

The most important takeaway is to never underestimate talking to different people for feedback. Asking questions is extremely important and powerful in that the best feedback is usually the most unexpected feedback. Similarly to the last report, another important takeaway is that I should put extra effort into learning the development tools that I'm using, especially if it wasn't on the professor's or the TA's recommended list of tools. With that statement, I am referring to FreeCad [2]. If you aren't an expert, you will waste a lot of time figuring out work arounds for the software's limitations. My recommendation for future students is to beware of FreeCad [2]. It is a good software, it has its perks and it can do everything you need it to, but Fusion360 [1] is simply better. Overall, my GDW team and I are very happy with the controller so far. I intent to polish it further in preparation to Game con.

Appendix A: The circuit board and the connections to its peripherals.



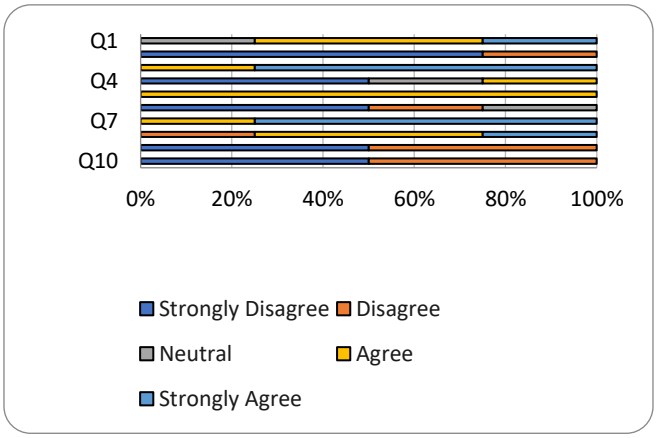
Appendix B: The equivalent circuit of the system.



Appendix C: Table showing the result of the SUS survey.

Paticipant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
	I think th	I found t	I though	I think th	I found t	I though	I would i	I found t	I felt ver	I neede	Score
1	3	1	5	1	4	1	4	4	2	2	72.5
2	4	1	5	1	4	1	5	5	1	1	75
3	5	1	5	4	4	2	5	2	1	1	75
4	4	2	4	3	4	3	5	4	2	2	62.5

Appendix D: Graph visualizing the result of the SUS survey.



References

[1] *Autodesk fusion: 3D CAD, CAM, CAE, & PCB cloud-based software*. Autodesk. (2024, November 7). https://www.autodesk.com/ca-en/products/fusion-360/overview.

[2] *Your own 3D parametric modeler*. FreeCAD. (n.d.). https://www.freecad.org/.