CAD Prototype and Assembly for Economic PC Gun Controller

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***Abstract*—To further expand on the proposed gun controller, we created a CAD prototype based on our previous clay prototype. Three important aspects to consider for the prototype are its capability to house each component in areas that need them, such as the fire button needing to be located at the trigger, the ergonomics of the controller for comfortable use over long play sessions, and durability to withstand regular use, and accidental drops. For the first problem, we partially hollowed out part of the grip to allow wires to be connected from the micro:bit in the barrel to other components, we've also created a housing structure for the micro:bit to secure it during play. For our second problem, we've based our current prototype's shape on our previous clay version, which was made to fit comfortably in the right hand. Lastly, the durability was tested using Autodesk Fusion's simulations, and it can greatly withstand the expected 110N for regular play. Our solutions resulted in a prototype that satisfied all our problems with some slight changes from the clay prototype, such as widening to accommodate the micro:bit and hollowing out the grip, with this prototype, we can continue with printing, assembly, testing, and iteration.**

***Index Terms*—Gun Controller, Immersive.**

I. Introduction

In our previous report, we aimed to propose an economical alternative to current-market gun controllers by using motion tracking over light sensors. Our design uses a micro:bit which contains a built-in accelerometer and gyroscope, that when combined could track the controllers' movement in the real world and translate it to the gun's movement in the game's world. The controller would also use two input buttons, one for firing, and the other for reloading, an LED to indicate the power status of the controller, and a buzzer for additional feedback whenever the gun is fired.

For our CAD prototype, we based the body's design on the clay prototype [Fig. 5] we made to be ergonomically comfortable to use. We also have created a housing structure for the micro:bit located in the barrel to secure it, and a removable case to allow for the micro:bit's placement or removal. To be able to house and connect all of these components to the micro:bit, we created holes, 2 at the side, and one at the trigger, for the LED, and the buttons, and hollowed out the grip to allow wires to connect the components to the micro:bit. To ensure that the durability can still withstand the use intended for the controller after being hollowed out, we reevaluated the controller through Autodesk Fusion's simulation and have confirmed that it can withstand the 110N expected during regular play.

II. Results

When designed, we split our controller up into three parts; Top (Lid), Middle (Body), and Bottom (Grip) [Fig. 1]. The split allows parts, such as the micro:bit and the buttons, to slide into it with support inside. The lid is hollow [Fig. 4], to act as a housing structure for the micro:bit, with other parts using infill to distribute weight to the controller.

To make sure all the components can fit safely into the controller, we widened the frame to limit potential sizing issues. The micro:bit in particular is 51.60mm wide itself, which is wider than most lightguns on the market, so we had to adjust with that in mind. The clay prototype was initially modelled to be (12cm (L) x 4cm (W) x 12cm (H)), with us only expecting to change its length and height for our previous vision of our CAD model. We attempted to make the size similar to other commercial products such as the Sinden Lightgun[**??**], which is approximately (26cm(L) x 4cm (W) x 10cm (H)) and the AimTrak Light Gun[2] (25.4cm (L) x 4.4cm (W) x 19.1cm (H)). On our clay prototype, we modelled the grip [Fig. 2] with clay to feel good in the hand and transferred our comfortability findings to the 3D-printed version. The referenced commercial products do not have such ergonomics for the grip. To avoid having loose cables, we opted to place the components near the micro:bit limiting the length of the cables, with a hole through the structure roughly 30mm in front of the micro:bit to house the micro USB [Fig. 3]. The controller grip and body were designed in two parts to avoid having buttons drop into the structure upon being pressed/pushed but will be printed as one to keep the supports together between parts. We ensured that the controller can withstand regular use through Autodesk Fusion's simulations where we found that the current prototype can greatly withstand the maximum amount of pressure (110N) that is expected.

III. Conclusion

The main takeaway from this assignment is that it's important to ensure that all components can fit securely in the casing of the controller, taking into account the possibility of iterating on the original design for better-fit components as it should be an expectation. We were able to create a promising CAD prototype by focusing on what was most important to us, which was cable and component management, and ergonomics which caused us to make some sacrifices regarding where our components such as the LED would fit on the controller. In the future, we will 3D print this prototype and iterate on it as needed for the best possible user experience. We created a Kanban on Trello to track our progress [Fig. 6]

Appendix A
Contributions

- Alexander Phillips

  - Controller Mesh
  - Results
  - Technical Drawing
  - Conclusion
- Ethan Zafra:
  - Abstract
  - Introduction
  - CAD Modifications
  - Exploded View Animation

APPENDIX B

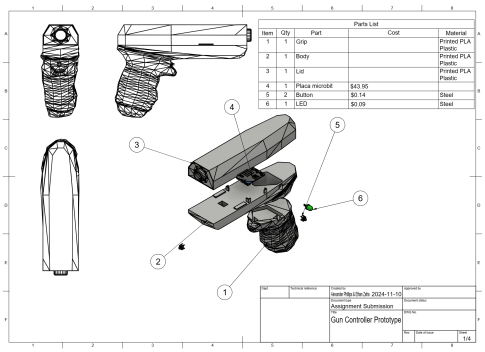

Fig. 1. Assembly

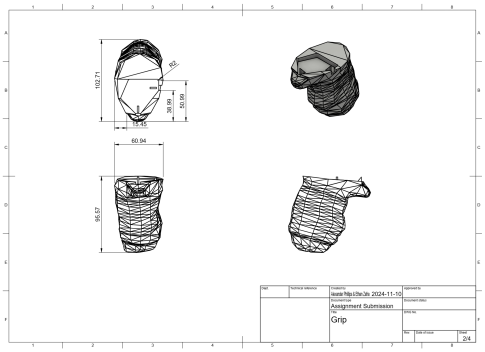

Fig. 2. Grip

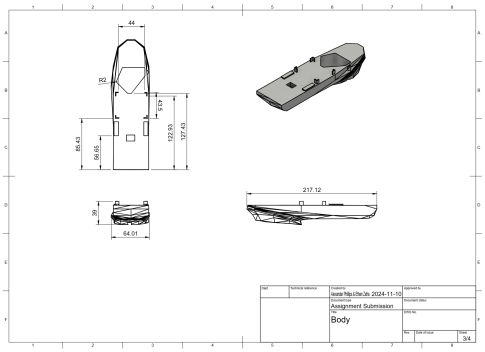

Fig. 3. Body

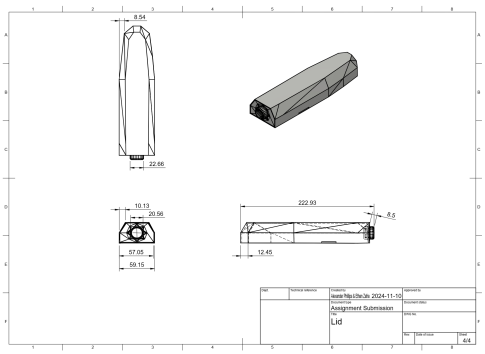

Fig. 4. Lid

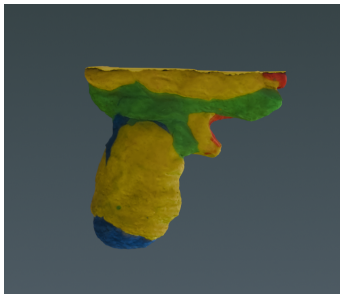

Fig. 5. Clay Prototype

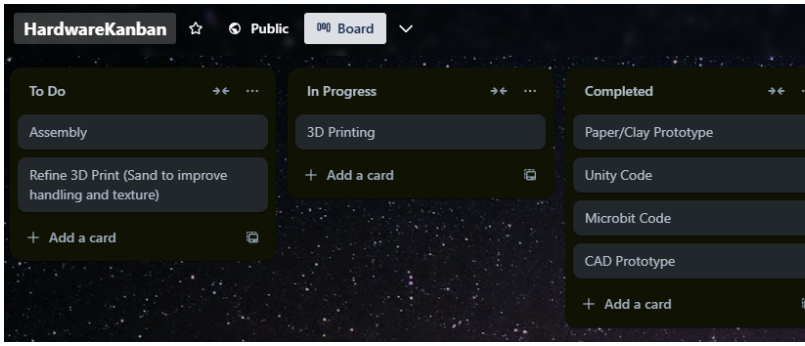

Fig. 6. Kanban: https://trello.com/b/6jwWlNMP/hardwarekanban

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[2] "Aimtrak Light Guns." Light Guns AimTrak Light Guns, www.ultimarc.com/light-guns/aimtrak-light-gun/. Accessed 14 Oct. 2024.