Prototype Review of Economic PC Gun Controller

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

I. Introduction

In our first report, we have ideated the design of a gun controller that could serve as a more economical alternative to the current market's light guns. This design would use the Microbit's accelerometer and gyroscope over the light sensors typically used by light guns to track the player's movement and apply it to the game world. The choice of using a Microbit was to reduce the cost of the device to about $45.

In our second report, we created a 3D CAD prototype of the frame/casing of the controller, based on a 3D scan of a clay prototype. We started with sizing up the controller to be able to fit all the components, mainly the Microbit, which would be lying on top of the main body of the controller. We then created a cover to put on top of the controller to prevent accidental disconnections of the wires inside, and finally, hollowed out part of the grip for wiring and added holes to where the LED, Trigger, and Reload buttons would be. The final result would be 3D printed, and assembled with the components for our current prototype.

II. Methods and Materials

Since our second report, we have constructed and 3D printed our CAD Prototype using Bambu Lab printers. The initial print had to be scrapped after the discoveries of some issues with its design, mainly with the housing and holes being too small for their components. After increasing the size of the main body and the holes to fit the Microbit and buttons better, we would have the current prototype's frame.

During assembly, the buttons were easily secured in their place as we had a tight 0.2mm tolerance to where they would be placed. The Microbit fitted perfectly in its housing and had minimal movement during play. The only problem encountered was during the electronics connection as we had the choice of connecting the Microbit to the components through a soldered connecting wire or through alligator clip wires. We chose the latter option to prevent any possible accidental damage to the Microbit, however, it is still considered a possible improvement for future iterations of the controller if we were to continue using the Microbit.

During our testing, we explained briefly how the controller works and its controls to the participants before playing. Throughout testing, most early participants gave a recommendation regarding the sensitivity of the controller in-game, which allowed us to tune the sensitivity to a more comfortable level. Afterwards, we recorded other responses regarding the controller itself that could be added in future iterations of the controller, such as shrinking the size of the grip to allow for better one-handed control.

III. Results

When testing our controller, we found that the testing group had a positive response to the functionality of it. We tested our controller amongst a group of 9 participants, with the majority having experience with an arcade gun controller, lightgun and the like. It was evident the controller had a replayability factor as the concern of frequency of play was met with results ranging from moderate, to "strongly agree". [Fig. 1] It was relatively easy to learn for new players [Fig.2], although the range of understanding was slightly scattered among participants, raising the question of how we can make our system more intuitive. The majority of players agreed that the system was too inconsistent [Fig. 3], which aligns with the customer requirements in QFD regarding maintenance and aim. We found a common theme in the feedback we received was there should be more haptic feedback upon shooting, the controller should be smaller to fit the hand better, and we witnessed how our LED's function of showing ammo loss wasn't clear.

IV. Takeaways

We accomplished our task of creating an aiming system with a gyroscope and accelerometer. Still, there were good and bad techniques inhibited by this project, and other areas of design we should improve upon. A fault in our development cycle was the lack of prototype testing early in the project, which would've allowed for more iteration later. When comparing our controller to others on the market such as the Sinden Lightgun [1], and the AimTrak Light Gun[2], we should've taken more inspiration as to how they determined the measurements of their respective controllers. For future projects, it would be in our best interest to work with and test cardboard prototypes with electronic integration early on in the project to better prepare for later stages. For the future, we would find a smaller, and better alternative to the micro:bit like the XIAO nRF52840 Sense, as the micro:bit forced us to make structural changes due to its width. We are going to continue iterating on the controller, aiming to allow for more input, have a calibration button to avoid maintenance issues, and focus on testing ergonomics.

Appendix A
Contributions

- Alexander Phillips
  - Results
  - Takeaways
  - QFD and Survey Review
- Ethan Zafra:
  - Introduction

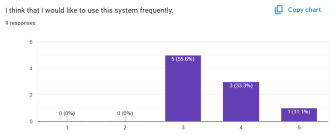

Fig. 1. Chart-1

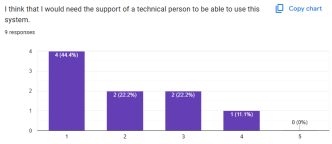

Fig. 2. Chart-2

- CAD Modifications
- Electronics Assembly
- Methods and Materials

APPENDIX B

REFERENCES

[1] "Sinden Lightgun®." Sinden Lightgun, sindenlightgun.com/. Accessed 14 Oct. 2024.

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

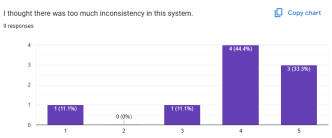

Fig. 3. Chart-3