**A  Mother’s Nightmare: A Game Control System for Asteroids using BBC micro:bits**

**Introduction**

This project aims to revolutionise HCI by blending physical computing with a classic game. Using a BBC micro:bit, we offer a new dimension of user engagement, aiming to go beyond screen interactions. Guided by Muggeridge’s (2007) principles of human-centred design, and Ishii’s (1997) concept of seamless integration between physical and digital realms, our project aims to redefine the gaming experience, making it both intuitive and novel.

**Design Philosophy**

The design philosophy centres on maximising user engagement and creating fun for all the family. The micro:bit serves as a natural extension of the player, inviting exploration through audible feedback and intuitive controls. We prioritise clarity and responsiveness which are essential for an immersive gaming experience. Krug’s principle of self-explanatory user interfaces influenced our mapping of micro:bit controls, minimising the cognitive load required for gameplay (Krug, 2000).

**Input and Output Mappings**

I adopted a multi-modal interaction framework to augment traditional gaming controls. The control mappings are based on principles outlined by Hinckley et al (2005) who stresses using multiple sensory dimensions for an immersive and dynamic experience. Our system is two players, and has two controllers. Controller one focuses on offence, while controller two focuses on navigation. Radio communications synchronise the two.

**Controller one:**

* Button A: fires main weapon
* Microphone: loud noises fire secondary weapon
* Accelerometer: shake for shield and flip to pause or unpause
* LEDs: lives left are shown in the first row, a skull appears upon death and the final score scrolls across at the end

**Controller two:**

* Button B: teleport
* Accelerometer: controls rotation by rotating the micro:bit, and thrust by tilting forward or backward.

The control mapping can be seen in Figure 1

A pair of small electronic devices

Description automatically generated

**Implementation Challenges and Solutions**

The project faced significant challenges, including dealing with MakeCode’s monolithic constraint, and faulty hardware components. I refactored the code into units, thereby improving readability and maintainability. For hardware issues I employed a circuit debugging techniques -where feasible - and replaced defective modules, which enabled seamless integration between the micro:bit controllers and the Asteroids game. I would also like to thank Jason Jacques, Xu Zhu and Lorraine Clarke for helping replace missing components and aiding in spotting serial write bugs.

**Conclusion**

In conclusion, this project successful revolutionises Asteroids gameplay by innovatively employing BBC micro:bits for a dual-controller setup. Rooted in HCI principles, the system delivers a multi-sensory, interactive experience by focusing one controller on offense and another on navigation. Challenges related to code complexity and hardware were effectively addressed, making the system robust and seamless. The initiative paves the way for future HCI applications, blending physical computing with digital interactivity for an enriched user experience. It lays out in interesting path for family gaming, offering both fun and technical ingenuity.

References

 Erickson, T., & Kellogg, W. A. (2000). Social Translucence: An Approach to Designing Systems that Support Social Processes. ACM Transactions on Computer-Human Interaction, 7(1), 59-83.

Ishii, H., 1997. ‘Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms’, Proceedings of the ACM Conference on Human Factors in Computing Systems.

Krug, S., 2000. *Don’t Make Me Think: A Common Sense Approach to Web Usability*. New Riders.

Moggridge, B., 2007. Designing Interactions. MIT Press.