

# Industrial Design for Game Hardware

## Assignment 1

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### Abstract

Haptic Sound Controller for the visually impaired.

## 1 Project Description

We hope to create a controller for visually impaired or even blind people to play video games with a higher sense of immersion as an alternative to braille keyboards or controller add-ons.

Last year a member of our group made a Unity game with the concept of making a simple game for the blind. The game is a small maze in which each movement plays a sound cue that tells players which paths are open and which are closed, using these sounds they try to escape the maze in as few moves as possible.

The controller we intend to design is a cube-like shape in which an accelerometer can turn rotation into movement in the Sound Maze. In the controller, we will also house a select and a start button to launch the Unity game.

Additionally, the controller will house four vibration motors placed in the north, east, south and west quadrants of the controller respectively, which will give the directional haptic feedback required for blind game play.

## 2 Problem Definition

Creating a controller more accessible for the visually impaired and blind that can be reused for games with varying controls. The final controller submitted will be designed solely for the Sound Maze, with the goal of creating a controller that will allow future games to be designed around.

As for where and when the problem takes place in this industry. "Research in the field of computer gaming usability and accessibility is lacking. Very few empirical studies have been carried out to understand the software design requirements of visually impaired gamers." [5.2]

It is hard for the visually impaired to play video games with standard controllers due to a lack of innovation and inclusion. Very few if any games are optimized for the visually impaired or blind player base. This is due to when visually impaired players try they simply don't get sufficient feedback from the controller. The papers we reviewed both came to similar conclusions when testing the accessibility of playing games for the visually impaired. The first is "The sense of touch plays a prominent role when engaging with traditional games." [5.1] Haptic feedback is extremely important for visually impaired players. The second major conclusion was that audio feedback can lead to significant improvements in accessibility and usability. The three major areas where the infusion of sound effects would have the biggest impact are navigation, in-game effects, and identifying enemies. [5.2]

This problem directly affects the visually impaired and blind players of the gaming community as they don't have the same resources as other players. In 2017 Canada, an estimated 1.5 Million Canadians identified themselves as having sight loss. [5.3] Blind people who are looking to be able to participate in gaming, free of the usual issues raised are also directly affected.

The solutions or attempts that have been made to solve the problem are to create specific games designed to fit the needs of blind players or to design controllers and add-ons to those controllers with things such as braille, sound or vibration to make the experience enjoyable.

## 3 Justifications

If the problem is not solved blind gamers who want to play and are unable to will continue to be left out, without help or not thought about when developers create games or controllers. Awareness needs to be raised to begin with. Representation is also very important in game development and everyone is always thinking about whether people are included; this project helps reach that goal of

considering everyone.

People who will most feel the consequences will be blind people for the most part obviously but the gaming community and industry as a whole. Less accessibility and usability for all players means less of a welcoming and giving community. Most importantly, the blind community of people who want to experience gaming in some sense but will be denied the capability to do so because of the lack of controller support.

In terms of companies trying to help Microsoft is doing fairly well. They created the Xbox adaptive controller which allows users to fully customize the controller and is equipped with accessible buttons (Figure 1). This is definitely a step in the right direction, yet more work could be done specifically for the visually impaired.[5.4]

Microsoft also has had a patent since 2018 for the creation of a game controller with haptic braille play capability. The controller configurations include various adaptations that provide alternative input and outputs helping sight-impaired or blind users. It's nice to see they are trying to help but they still have nothing available to the public.[5.5]

This problem is relevant all over the world and in aspects outside of gaming. Blind people or other people with disabilities/anything changing the way they live, or are able to do something, constantly struggle with getting access to things like this. For example, many buildings do not have necessary accessibility options like ramps along with stairs. Even if it is required or given, sometimes it is in an ineffective way like something as simple as too narrow of a ramp for a wheelchair to go up. Blind people specifically are unable to physically see a movie or other media, so options like closed captioning (providing a detailed description of something happening on the screen) were introduced.

## 4 System Architecture

In terms of our design, we are prioritizing our design to cater for great haptic feedback. Our design emphasizes large buttons with differentiating braille patterns on them. Large buttons make them easy to find and press and the use of braille patterns helps provide another layer of haptic feedback.

Our controller also utilizes a gyroscope to measure x and y movements. We want to use physical movements for our controller to minimize button presses to increase accessibility. We also have four integrated rumblers in our controller. These rumblers with help to provide haptic feedback in four directions which will help to further convey in-

formation to the player (Figure 2). Another big feature for us is an ergonomic design. We want to make the controller easy to hold, comfortable and easy to orientate properly. This will help to minimize issues visually impaired players will encounter. We have many additional images and schematics posted in our GitHub.

## 5 Bibliography

### 5.1

Walia, Angel, et al. "HapTech: Exploring Haptics in Gaming for the Visually Impaired." Conference on Human Factors in Computing Systems - Proceedings, ACM, 2020, pp. 1–6, doi:10.1145/3334480.3381655.

### 5.2

Chakraborty, Joyram, et al. "Designing Video Games for the Blind: Results of an Empirical Study." Universal Access in the Information Society, vol. 16, no. 3, 2016, pp. 809–18, doi:10.1007/s10209-016-0510-z.

### 5.3

Blindness in Canada. CNIB. (n.d.). Retrieved September 27, 2022, from

<https://www.cnib.ca/en/sight-loss-info/blindness/blindness-canada?region=on#:~:text=Today%2C%20an%20estimated%201.5%20Million,Canadian%20Survey%20on%20Disabilities%202017>

### 5.4

Xbox Adaptive Controller: Xbox. Xbox.com. (n.d.). Retrieved September 27, 2022, from

<https://www.xbox.com/en-CA/accessories/controllers/xbox-adaptive-controller>

### 5.5

Patent - WO2019083751 - HAPTIC BRAILLE OUTPUT FOR A GAME CONTROLLER Available:

[https://patentscope.wipo.int/search/en/detail.jsf?docId=W02019083751&\\_cid=P21-L8L08Z-32919-1](https://patentscope.wipo.int/search/en/detail.jsf?docId=W02019083751&_cid=P21-L8L08Z-32919-1)



Figure 1: Xbox Adaptive Controller

## System Architecture for Sound Controller

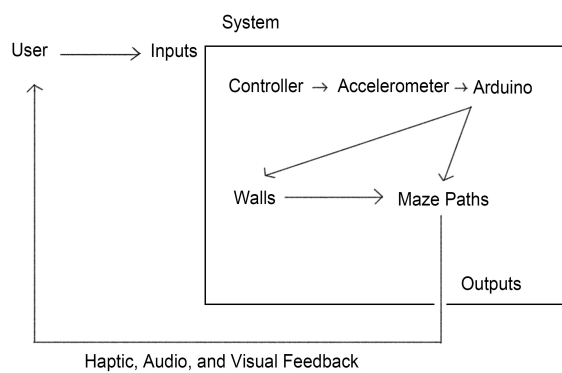


Figure 2: System Architecture