**Background**

Our task was to make a video game that is fully controlled with HID-compliant eye-tracking hardware and intuitively teaches users how to use common gaze Interactions.

The motivation behind this goal is to make the process of learning the eye-tracking interface simple and swift. This is especially important for users who live with ALS or other conditions that otherwise limit interaction with technology. Ideally, the user will be able to identify the different interactions taking place in the game and apply them to other computer applications, thereby eliminating the need for training that traditional eye-tracking technology requires. HID-compliant eye-tracking hardware is much more accessible from a cost perspective when compared to current Augmentative and alternative communication devices, meaning that this technology has the potential to dramatically improve the quality of life for these users by providing a means of communication that is readily accessible.

**Gods of Calamity** is a top-down perspective survival game that tasks the player to defend a village from hazards

- Utilize HID-compliant eye-trackers to capture player eye-movements, allowing interaction with game exclusively with eye gestures
- Game should intuitively teach users how to perform common gaze interactions
- Individuals living with ALS and other conditions that limit computer interaction must be able to play the game with ease
- Game will be available on the Microsoft Store

**Project Definition**

**Gods of Calamity** is a top-down perspective survival game that tasks the player to defend a village from hazards

**Architecture**

*Gods of Calamity* was designed around the Entity Component System Architecture. This architecture breaks down nearly everything into either an entity, a component, or a system. It’s often used in game design, including in popular game engines Unreal and Unity. Our Entity Component System is implemented using Monogame.Extended.

An entity is an object, a component is an attribute of an entity, and a system manipulates a component.

**Implementation**

*Gods of Calamity* is built with the Monogame framework on a Universal Windows Platform application. We chose to use the Monogame.Extended extension library for its Entity Component System library.

The Monogame back end acts as the game engine. This is where the game loop can be found. It consists of an update call and a draw call. Each of the systems created for this project inherit from one of these two calls.

**Systems Implemented:**

- **Animation**
- **Movement**
- **Entity Creation**
- **Rendering**
- **Entity Destruction**
- **Fire Propagation**
- **Update UWP Front End**
- **Disaster Spawning**

**Interactions to note:**

- **Entering:** When gaze enters the bounds of the target
- **Fixation:** An unconscious focus on the target
- **Dwell:** A prolonged and conscious fixation on the target
- **Exit:** When gaze leaves the target

**Eye-Gaze Interaction**

The Tobii Eye Tracker 4C is the hardware used in the development of this project, however the Gaze Interaction Library (created by Microsoft Research) works with any HID-compliant eye-tracking device. The Gaze Interaction Library is used to facilitate gaze interaction functionality. This library allows us to create event handlers for a number of interactions.

**Usability Testing**

The nature of this project called for extensive user acceptance testing. We conducted a number of tests on different versions of the game in two stages.

**Stage 1:** Users tried 3 versions of the game: “easy”, “medium”, “hard”
- All users in this stage use a computer with a traditional keyboard and mouse
- No users had previous experience with eye trackers
- The majority of users preferred the “easy” version of the game with slower spawn and movement rates.
- Ease of Control Avg: 6.5 (out of 10) - Ease of Learning Avg 7 (out of 10)

**Stage 2:** Finalized graphics and balancing implemented. Users try only version
- One user lives with ALS, one user lives with Quadriplegia
- Both users control computers with specialized equipment
- Both users had prior experience with an eye tracker

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