# Microsoft Eye-Tracking Game Development

## Requirement & Specifications

The MS Eye Tracking Game Project's goal is to develop a video game where the player is able to play the game exclusively with eye movements. This game must teach the user how to use the basic gestures of eye tracking technology.


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# I. Introduction

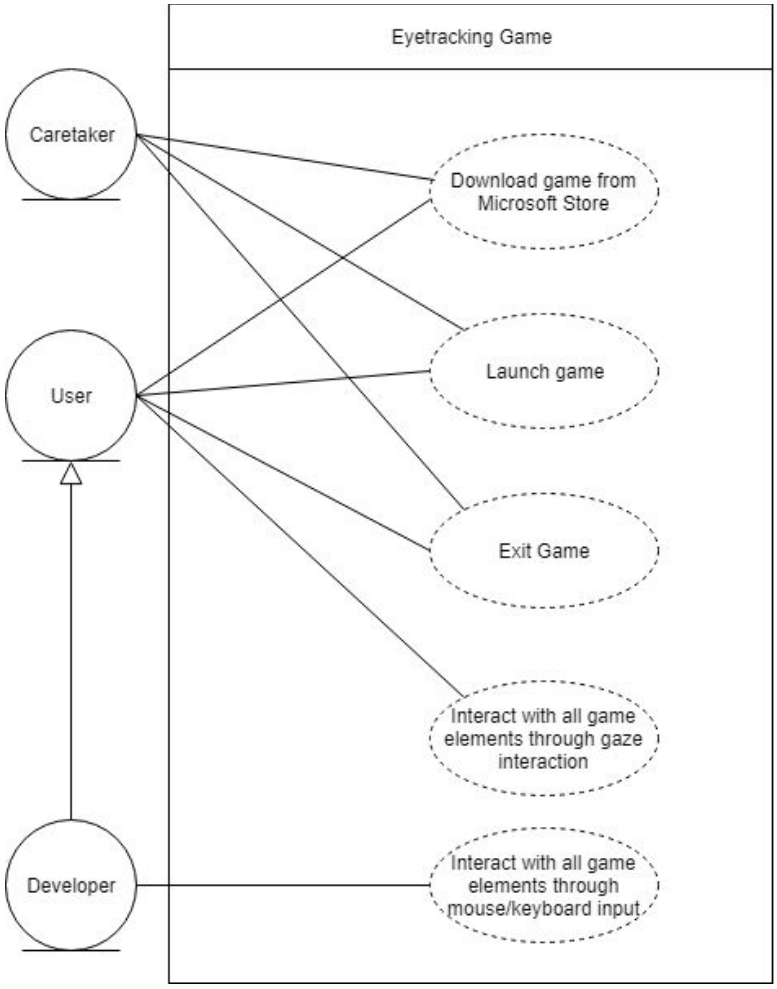
The Microsoft eye-tracking game development project's goal is to develop a video game that can be played exclusively with an eye-tracking interface so that normal users or users with ALS can play the game without the use of a mouse or keyboard. The game will be designed to teach people how to use basic eye-tracking gestures, similar to how Solitaire and Minesweeper were designed to teach how to interact with a computer by using the mouse [3]. By the end of the semester next spring, we should have a product that can be published on the windows 10 store so that any user with eye-tracking hardware can download and play the game.

Our goals for the project are to demonstrate how eye-tracking technology works for any potential user of the game, physically impaired or not, and to intuitively teach the end user how to operate the eye gaze user interface so that they may extend that interaction to other applications. A side goal is to include a multiplayer component in the game so that people can have some sort of social interaction with other users, especially if they are a patient with ALS who have a hard time trying to interact people outside their homes. Our project should be able to accomplish these goals, try to accomplish our secondary goal of multiplayer, and expand upon our ideas if we complete our goals soon enough in development.

# II. Systems Requirements Specification

## A. Use Cases

1. Caregiver for user downloads the game from the Microsoft Store
2. User downloads the game from the Microsoft Store
3. Caregiver launches game
4. User launches game
5. User interacts with all elements of the game with gaze interaction
6. Developer interacts with all elements of game with gaze interaction
7. Developer interacts with all elements of game with mouse/keyboard input
8. User exits game
9. Caregiver exits game



# B. Functional Requirements

1. Primary game menu
    - Source: All users
        (1) Stakeholders: All users interacting with the game
            (a) Needs: Ability to play the game
    - Priority: 1
2. Gaze interactable UI elements
    - Source: All users interfacing with gaze interaction
        (1) Stakeholders: Physically impaired users / users wishing to play the game through gaze interaction interface.
            (a) Needs: Game must be playable via eye-tracking interface.
    - Priority: 1
3. Game Interface
    - Source: All users
        (1) Stakeholders: All users interacting with the game
            (a) Needs: communicates vital information about the game.
    - Priority: 1
4. Pause Functionality
    - Source: Users that need to pause the game frequently
        (1) Stakeholders: Users that cannot commit to long periods of concentration.
            (a) Needs: Ability to step away from the game to attend to other pressing matters.
    - Priority: 1

5. Multiplayer
    - Source: All users that desire the ability to play against other users.
        (1) Stakeholders: ALS Patients and players who desire multiplayer functionality.
            (a) Needs: Social interaction.
    - Priority: 2

# C. Non-Functional Requirements

1. Controllability
    - User should be able to utilize the eye tracker with ease with the gaze input and interactions in such a way that feels natural to the user.
2. Accessibility

- While the game program may be used by a normal audience, it is important to make the game specifically accessible to our target audience (i.e. individuals with ALS, paralysis, movement disability, etc.)
- The game should not utilize tools that are inaccessible to impaired individuals with limited movement, i.e. the mouse/keyboard controls.

3. Performance
    - While utilizing the eye-tracker, the interaction time between the gaze input from the user and the interactive environment (e.g. buttons) should have reasonably instantaneous response time.
    - The game itself should run without
4. Compatibility
    - During the initialization of the game, it is important to identify all the available input devices connected to the program and whether or not such devices are compatible with the game (e.g. mouse, Tobii eye tracker 4C, Tobii EyeX eye tracker, oculus, etc.)
5. Modifiability
    - In terms of the software code itself, its classes, variables, settings, etc. should be easily be able to be modified when required. Given that the game will follow a “God-Simulator” theme, it is important the developers have to ability to tweak certain properties of the characters, AI, setting, etc. in order for everything to function with one another effectively.
6. Reliability
    - The game program itself should implement reliability tests in order to keep the number of times the program fails to a minimum. If such an error or failure were to occur, it should print the failure message to the player/programmer and be resolved through reliability tests and code modifications to prevent further errors.

# III. System Evolution

A lot is going to come into consideration with designing our video game. We will be making a paper prototype for our video game in order to get an idea of a base design. At this point, we will be under the assumption of what the game's interface will look like but it will evolve as we continue to build it, especially after the alpha prototype.

The group is unfamiliar with using Tobii's APIs and how it will plug in and work with Unity. In the future, we may have to work with a different set of APIs. In addition, there is the possibility of updates to the API package or the eye-tracker hardware can create problems that would need change.

The eye-tracking game is aimed towards the Windows platform on a computer with Windows 10. In order to play the game, the consumer must have an eye-tracker device plugged or built into their computer of choice. There may be issues where the user needs changes. As a group, we are under the assumption that the caretaker will be able to set up the eye-tracker device and be able to download and install the video game off of the Microsoft Store. In addition, the Microsoft Store is our gaming platform. There might be future hardware evolutions but those assumptions are out of our reach for the time being.

# IV. Glossary

## A

AAA: (Also known as AAA Games or Triple A Games) A classification term for video games with the highest development budgets and levels of promotion. A game that is considered Triple A is expected to be a high quality game and among the year's best selling video games.

AAC device: Augmentative and alternative communication device. A device used to facilitate communication with a nonverbal patient.

ALS: (Amyotrophic Lateral Sclerosis) A progressive neurodegenerative disease that affects nerve cells in the brain and the spinal cord

API: (Application Performance Interface) A set of commands, functions, protocols, and objects that programmers use to create software or interact with an external system

Animation: A medium in which images and/or objects are manipulated to look like they are moving images. Traditional animation is drawn by hand. Today, most animation is created with computer-generated imagery.

## C

Compatible: Refers to hardware or software system that can successfully use interfaces and data without modification

Computer Graphics: Images generated by a computer

## D

Dialogue: A voice recording where two or more characters are conversing

Dwell: A conscious fixation on a point. Intentionally looking at an object for an extended amount of time. (In this case an extended amount of time is just over 200ms, however this can be adjusted as necessary)

## E

Effects: Also known as EFX, FX, or Special Effects (SFX). Any animation that is not a character or prop, such as smoke, water, fire, explosions, etc

Extended View: An eye tracking control in video games that allows the user to move the in-game camera with their eyes and head.

Eye Tracking: Is a sensor technology that enables a device to know exactly where your eyes are focused

Enter/Exit: Used to describe when a user looks at or looks away from a point.

# F

First Person (Point of View): Refers to a graphical perspective rendered from the point of view of the main character's perspective

Frames per second  (FPS): The rate at which images must be displayed in order to achieve real time playback

Fixation: A term used to describe a quick focus on a point. Not to be confused with dwelling, which implies a longer gaze.

# G

Game Controller (or controller): A device used with video games or entertainment systems to provide input for a video game, where it typically controls an object or character in the game

Graphics: Images generated by a computer. In the context of video games, graphics are generated in real time, and often dynamically change according to different circumstances.

Gaze interaction: The basic gestures of eye-tracking technology. These gestures are defined for our purposes as the following; saccade, fixation, dwell and enter/exit.

# I

Indie: An independent video game. Usually developed without the financial backing of a publisher during development, but may still be distributed by one.

# L

Lighting: The process of lighting an environment in a program, like Autodesk Maya, is to create a sense of atmosphere and to bring life to the scene

# M

Microsoft: A leading global vendor of computer software; hardware for computer, mobile and gaming systems; and cloud services. Microsoft's corporate headquarters is located in Redmond, Wash., and it has offices in more than 60 countries.

Multiplayer: A mode of playing a computer game or video game where two or more players can play in the same game at the same time, cooperatively as a team, head-to-head competitively, or using a leaderboard.

Minesweeper: A single player puzzle game where the objective is to clear a board containing bombs without causing them to detonate.

# O

Operating System: The software that supports a computer's basic functions, such as scheduling tasks, executing applications, and controlling peripherals.

# P

Pan: A camera movement where the camera moves along a horizontal axis. The camera pans to the right or left.

# R

Rendering: The process involved in the generation of a two-dimensional or three-dimensional image from a model by means of application programs. Rendering can be done in applications like Autodesk Maya and some Adobe Products

Rigging (3D): The process of creating a skeleton for a 3D model so that it can move. Characters are often rigged before they are animated because if a model does not have a rig, then they cannot be moved.

# S

Scenario: The first draft of a story that outlines the plot and is usually one page in length.

Solitaire: A card game where the objective is to sort cards together from king to ace.

Saccade: A rapid movement of the eyes from one point of focus to another.

# T

Target at Gaze: An eye tracking control in video games where a player can target an enemy or item with their gaze.

Third Person (Point of View): A perspective in which the player can visually see the entire body of the character they’re playing

Tobii Gaming: A Swedish high technology company that sells products for eye tracking and eye control

# U

UI: User Interface

Unity: A cross-platform game engine developed by Unity Technologies

# V

Video game: A game played by electronically manipulating images produced by a computer program on any sort of display screen, such as a television or computer.

# V. References

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