Oregon State University
College of Engineering

FALL TERM CS CAPSTONE DESIGN DOCUMENT
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DRAW AND PLAY VIDEO GAME

PREPARED FOR
OREGON STATE UNIVERSITY
WILLIAM PFEIL

PREPARED BY
GROUP 5
DRAW AND PLAY
JACKSON EGGERS
GANG LI
GAVIN THOMPSON

Abstract

This document describes the design components of the smartphone application draw and play video game. It will contain an overview section discussing the purpose, audience, definitions and context of the project. This is followed by the design principles that will be used to develop the game, design views, and rationale. The final section will describe the major components of the application: GUI framework, Camera functionality, Level building, and accelerometer controls . This section will be explained in depth and related back to the design description.

Contents

7. Timeline

This section contains a tentative Gantt chart going over our current application progress plan. If the base game is implemented sooner than expected, more games will be implemented to fill the gap.

1. Introduction

1.1 Purpose

A draw and play game is a game that allows users to try out the games that they love or appreciate. The game experience is principally based on the player's preferences. Players will be able to develop pictures of mazes, take their photographs, and in our application, the mazes will be transformed into 2-dimensional playable mazes.

1.2 Intended audience

The video games' intended audience will be people with smartphones and a picture they want to transform into a 2-dimensional maze. The marketing will focus more on children due to their love to draw and create compared to most adults. Due to its affordable cost, requiring a one-time purchase for unlimited playtime, the audience will entail individuals from any income level. Players can exchange mazes to experience different creations or to compete to determine the most enjoyable mazes.

1.3 Project Scope

The game will be developed for iPhone operating systems with the intention of pushing for an android adaptation as well. As of the beta release, we have been unable to get a working android adaptation, so the game will be developed and tested on the iPhone operating system.

2. Overall Description

2.1 Product Perspective:

2.1.1 Accessibility

The application will be available for ios and android operating systems. The application will be purchased from the apple App Store and android Google Play Store. No age limitation is expected. The game will be available globally and additionally can be purchased through Alibaba Express and PayPal payment integration systems.

2.1.2 Playability

The application is playable through a smartphone or a tablet. The game will also have default mazes to give the player the game experience before developing their own mazes, and will allow users to connect with other users to access other mazes, either freely or through purchasing.

2.2 Product Features

2.2.1 Creativity

Users create their mazes by drawing clearly on a white card. The more creative the player is, the better is his or her experience while playing. The game can thus be instrumental in improving the players' creativity. Users can also exchange mazes. This will be actualized by connecting them through the game's Twitter and Facebook social networks. Users can also develop other players' games to their preferences.

2.2.2 Exploration

In addition to free maze maps, the game also offers a few purchasable maps. Users are also able to sell their creations on the games website. This is to encourage the creation of enjoyable maps. Therefore, even players who cannot create interesting mazes can enjoy exciting games. Users are also able to connect with other players and develop friends creating an emotional bond with the game. Creating an emotional bond is purposeful in influencing engagement with the game, popularity, and purchases.

2.2.3 Connection

To play the game, users do not need to connect their smartphones to the internet. However, to upload maps, users have to have a stable internet connection. A stable connection also allows users to receive messages from the game and thus determine beneficial developments. Users will have to download purchased maps from the game's website. To communicate with other users, players will also have to connect to the internet.

2.2.4 Steps to play the game

The player provides an image of a maze so that the app can process the image and transform it into a maze. There are two ways to transform the image into a maze. One, a player can upload the photo of the drawn maze from their camera roll. Two, a player can hold the maze drawing in front of the screen. Image and space recognition allows the measurement of two-dimensional relationships and enables the app to accurately determine the drawn maze and reproduce it. This occurs through image processing by running through the image pixel by pixel in order to determine pixel color. If the pixel is not white, then it is considered part of the maze and will be converted into objects appropriately.

2.3 User Classes and Characteristics

2.3.1 Players Who play Draw and Play Games

Most players are draw and play game enthusiasts with such background, for example, enthusiasts of Minecraft. Other players are beginners in the draw and play game, while others are passionate about art and want to turn them into exciting games. Others are there to make money through the application by creating connections, exciting maps, and selling them via the game's website.

2.3.2 Creators

The creators of the application are divided into application designers and video game designers.

Application designers will be concerned with designing the application that makes it possible to play the game, while video-game designers will create maze maps belonging to the application.

Application designers must be conversant with computer software systems, their limitations as well as programming languages. Video game designers should be exceptional in graphic design and animation.

2.4 Operating Environment

2.4.1 Game Interface

A game interface is a menu that enables the player to play the game by providing controls (Micah, 2020). The main interface is simple, containing three buttons Play, Upload, and Quit. The Play button leads the user to various maps

to select. The user plays the selected map. The Upload button provides two choices; using the phone's camera to capture a maze and the phone's gallery. The Quit button closes the application.

2.4.2 Maze Interface

After selecting the preferred map, the application opens the maze interface. The maze interface allows the user to choose between tilt controls and the joystick to control the subject. However, both serve the same purpose. The interface also displays the game's settings: the pause, the choice of subject, sound settings. The interface also displays the remaining time.

2.5 Design and Implementation Constraints

2.5.1 Resources

Unity Game Engine will be used to develop the game. Aa application designer with c# language background and experience is also needed since Unity uses c#. Scripts will be written in this language to inform the Unity Game Engine of the instruction and the game's preferences. (Unity Technologies, 2020).

2.5.2 Engine Constraints

Unity Game Engine lacks in providing high-quality graphics. The engine does not provide tools to create extraordinary graphics (Potenza Info, 2020)**.** The management will have to purchase expensive licenses to obtain high-quality graphics or settle for simple more simplistic graphics.

2.6 Assumptions and Dependencies

2.6.1 User Capabilities

The application is relatively easy to use, enabling users to use it well. The game also provides adjustments depending on user preferences, such as sound, choice of control type, and even the subject, making the user form an emotional connection with the game.

2.6.2 Assets

The initial maze picture is selected and scanned by the device's camera. The application then reproduces the maze with more accuracy in drawing and better graphics. In order to do this, the application must have access to the phone's camera.

3. Functional Requirements

3.1 Creativity

The game allows users to utilize their creative juices as well as practice hand drawing. This is because the better the created game, the better the experience.

3.2 Photos

Through the upload button, a user can select an image in the gallery. The user must first permit the application to do so. One can also upload an image from the camera.

3.3 View

Although the maze gaming experience depends on the original maze, the game improves its graphics to make it more interesting.

3.4 Interaction

The games' social platforms connect players who may share maps for playing the game. The game's website is also a platform to buy or sell plans. Users can also comment here on needed adjustments.

4. External Interface Requirements

4.1 User Interfaces

4.1.1 Graphical User Interface

The graphical user interface includes the application's visual components that enable the user to interact optimally with it (Computer Hope, 2019).

For the draw and play video game, the important parts of the interface include: buttons for the games menus for easy navigation, and options for tilt controls or joystick controls so that the user can play how they want. If the joystick controls are enabled, the interface will display a joystick in the bottom left corner of the screen that the user can move around.

4.1.2 Library

Players keep a library of their maps. The players can add to or delete maps from the library. Users are also able to arrange their library depending on their favorite maps. This fosters an emotional connection with the game. An emotional bond which influences the buyer's engagement with the game.

5. Nonfunctional Requirements

5.1 Performance Requirements

For the application sensors to accurately read the maze, the drawer must draw using relatively high precision.

5.2 Safety Requirements

A stable network should be accessible for faster upload and download speeds. When purchasing maps, the application managers handle the transactions to ensure harmonic buying and selling.

6. Approach

6.1 GUI Framework

The first step to developing the game will be to create a good looking graphical user interface. This will include all screens (start-up screen, maze selection, settings menu, map browser and gameplay screen) and will be the first impression of our game on the users.

6.1.1 Concerns

The main concern of the graphical user interface is the limitations of Unity UI. Since we plan on using Unity UI for the graphics, we will be heavily impacted by its features and limitations.

6.1.2 Approach

The important aspects that we need to understand in order to develop a good looking interface are:

- The first step is we need to be familiar with the features of Unity UI and to be able to handle its various features.
- Next, we need to have some sort of aesthetic sense of direction. Even if all of the features are there, if they aren't set up in a pleasing way, it will cause people to turn away from the game. It will need to be sensible and sleek.
- Third, we have to make sure our interface will fit any device. Pre-set aspect ratios will cause the interface to look strange on devices that do not fit our original design.

6.2 Camera Functionality

One of the main features of the game is being able to design your own mazes with a pencil and paper. In order to add user created designs into the game, the game will need access to a camera with which to scan in a maze.

6.2.1 Concerns

The main concern with using the camera is if it will be able to properly capture the design of the maze. This can be hindered by a number of things including but not limited to: smudges on the camera, distance of the camera to the drawing, and the size of the drawing itself.

6.2.2 Approach

There are a few ways that we can approach these issues, but the main points that will need to be covered are:

- The first thing that needs to be done is to ensure that the application has access to (and is able to properly use) the smartphone camera.
- Next, there will have to be a set of rules for the drawing to follow to ensure that the picture will be able to be properly converted into a maze.

6.3 Level Building

Level building is the process that the game goes through to turn an image into a maze. In order to accomplish this, there will need to be design regulations that the level builder is able to recognize.

6.3.1 Concerns

The main concern for the level building function of the application is its ability to discern faults. Since one of the stretch goals of our app is to allow the maps to be shared between users, if a faulty maze is created it will lower the enjoyment and expectations of the users.

6.3.2 Approach

The main points to consider in level building are:

- The application must be able to properly sense edges. That is, the application must be able to identify the walls of the maze, as well as the space in between the walls of the maze.
- The level building must have a fault system in place. An initial list of possible faults (which will no doubt increase in the future):
    - The maze cannot be read properly (not enough white space in between the walls of the maze).
- It is likely that a maze that is impossible to finish can be built. In this case, the game will allow for the maze to exist, but a maze that has not been finished at least once (by the creator) will not be allowed to be shared with other users

6.4 Accelerometer

The accelerometer is the sensation of the tilt of the smartphone. This will be used to play the maze by moving the ball through the tilt of the smartphone.

6.4.1 Concerns
The primary concern is that not all devices contain an accelerometer. In the future, other device-feature recognition will have to be implemented, but for now there is the option of playing with a joystick to bypass this issue.

6.4.2 Approach
The main points to consider when adapting the accelerometer to the application include:
- Ensure that the orientation of the tilt is set up correctly. (Make sure the ball will travel in the direction of the tilt).
- Make sure that the level position (zero tilt) is set properly. The orientation for zero tilt will be when the smartphone is parallel to the ground.
  - There may be a decision to include an option for changing the level position.
- If the user isn't able to use their accelerometer or chooses not to, they can instead use a virtual joystick.

7. Timeline

This section contains a tentative Gantt chart going over our current application progress plan. If the base game is implemented sooner than expected, more games will be implemented to fill the gap.

Fall Term Gantt Chart (Weeks)

	1	2	3	4	5	6	7	8	9	10
Project Statement			■							
Project Requirements				■						
Design Document Draft					■	■	■			
Technology Prototype						■	■	■	■	
Design Document Final								■	■	■
Fall Progress Report									■	■
Client Verification										■

Winter Term Gantt Chart (Weeks)

	1	2	3	4	5	6	7	8	9	10
Team Task Board	■									
Code Review #1			■							
v0.0.1 Alpha		■	■	■	■	■				
Code Review #2							■			
Final Progress Report									■	■
v0.0.2 Beta							■	■	■	■

8. Design Review Clarification

This section will go over all the questions left on our document over its reviewing process. A short form version of the question will be listed as well as an answer.

Q: Will more variation in the added games be considered to be more inclusive to different age groups?
    A: No, the game currently planned was picked for its simplicity and wide audience potential. If more games are implemented then relative difficulty will be considered, but not for the first one.

Q: Will purchasing levels use in-game or real currency?
    A: The level buying feature will use in-game currency exclusively. There is the possibility of purchasing this currency however through in-app purchases but this isn't a priority.

Q: Will edge detection, scene matching, or similar algorithms be used for the image to Unity level portion of the game, and is there a better method?
    A: Basic image processing and pixel-color-matching was used for the image to maze conversion.

Q: Will people unable to use specific social media platforms be unable to share their maps or connect with other users?
    A: Users will make a basic account through our database which will have the ability to be connected to various social media accounts. Social media isn't needed for core functionality. The document has been updated to better reflect this.

Q: Will users without a camera be able to make levels in the game?
    A: Yes and no. Users have the option of taking a picture of something within the app, but also of using a pre-existing photo in their phone's camera gallery. Where they get the photos in their gallery is up to the user, but there will only be options of generating levels with photos. No built in level editor is planned.

9. Changes Since the Last Release

This section will go over everything that has been changed since the last release. Future version changes will be denoted by subheadings beneath the section header.

V0.0.2 "beta" release
-Updated the table of contents to reflect changes made to the outline's structure
-Edited the wording or added information to the following sections:

-1.2
-1.3
-2.1.2
-2.2.2
-2.2.4
-6.4.1

Code Freeze "release"

The game has been changed to allow the user to place the ball and goal by clicking anywhere in the maze. The first click places the ball, the second places the goal. If a wall is clicked, the objects will be moved to a free area.

Further testing will have to be done on the picture taking feature in order to achieve optimal results.

A script to use photos from the device's camera roll has been implemented. Interestingly, this works fine when using an emulator, but when we try this on mobile devices it does not work. This will require more extensive research and testing to figure out the intricacies.

Game menus have been added including settings, how to play, and pause. Currently, all of the menu buttons work properly but the screens are empty. Text will have to be added to the various menus.

Movement using joystick controls will be implemented in the future. We have been very stuck with the picture selection issue.

IMPORTANT NOTE
For some reason, the only emulator that we have been able to get working is the Nox emulator available at www.bignox.com

EECS Project Showcase update

A problem when selecting a photo from the camera roll where the image selected would be the maze that was generated, but not the maze that would display is fixed. The maze that you select from the camera roll will be the maze that is generated and displayed.

The game menus now have text and are properly filled. In the settings menu, there is an option (slider) to turn on/off the joystick controls.

References

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