Software Requirements Specification (SRS)
Project X

Team: 1
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Customer: Middle School grade kids
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1 Introduction

Our SRS document will give an overview of the project as a whole and the work that we have done since the beginning. This includes all of our diagrams that we have. The diagrams that we have are much more fleshed out in this document with much more descriptions on what each part means.

- Section 1: a general introduction to all of the topics for the SRS document
- Section 2: a description of the project and the software that we used to make it
- Section 3: a list of all of our requirements that we have to go into our project
- Section 4: our use case diagram, class diagram, and sequence diagrams. these provide descriptions for each topic on each diagram
- Section 5: information about or prototype that will be submitted
- Section 6: list of references for our project
- Section 7: point of contact

1.1 Purpose

The purpose of the SRS is to identify and describe the purpose of the software and its features. The SRS document explains how the system is going to behave and the documents involved in the planning process.

Our intended audience are kids in grades 4th-6th. Some of those kids will not know how to code or use a computer and have yet to learn a lot of concepts in general. From our point of view, we do not expect our audience to have the same attention span as a college student. Therefore, our teaching method will be done through games. Kids love games, thus prolonging their attention span.

1.2 Scope

Our software, Pixel Path: The Road to Code, will be educational game driven software. The game's design will be mini games that can be played by people at any given age. The benefits of the software are that by the end of each mini game, the user will become familiar with concepts related to coding. On the other hand, our software will not go out of its depth, it is solely an educational video game to teach kids about coding concepts and occasionally show them some lines of code.

1.3 Definitions, acronyms, and abbreviations

Game map - Overworld view of different paths containing multiple levels

Path - A series of levels that focus on one specific concept
Concept - A fundamental idea that programmers should understand. Consists of several smaller topics.
Level - One space on the game map. Could contain minigames, lesson, or boss level

Lesson - Teaches a topic meant to prepare the user to complete the minigames

Minigame - An interactive activity where the user will be able to perform actions such as matching terms, selecting an option from several choices, and moving their character. The minigames available are Asteroids, Whack a mole, Puzzle minigame, and sorting minigame. Upon completion, it awards the user with key-fragments

Key-fragment - Currency used to obtain customizable cosmetic items for the character. Also will unlock new levels when enough key-fragments are collected.

Boss level - Boss fight at end of path that will unlock a new path upon completion

1.4 Organization

The rest of the SRS will contain: an overall description of the the game itself, the product we are delivering, its functions, the user abilities, its constraints, the assumptions made, some dependencies, future plans, specific details about requirements, its modeling; a prototype of the game, how to play the game prototype, a real world example, references, and lastly, the point of contact.

2 Overall Description

This section of the SRS is going to be a description of the project. The Product Perspective will be a description of what the project is going to look like and what the inspirations were to make it. The Product Functions is going to be a description for how the systems work and work together. The User Characteristics section will go over what we expect out of a user and what we want them to be able to do for our game. The Constraints section will go over some constraints that might occur while playing or interacting with the game. The Assumptions and Dependencies section will go over the assumptions that we as the developers made in order to create this software. The Apportioning of Requirements section will go over requirements made by the client but have not been implemented yet in the current system.

2.1 Product Perspective

Learning to code can be a difficult thing for students of all ages. Programming is a new concept that contains many unique ideas and ways of thinking. If we are able to implement a good way to learn how to code and be able to teach kids at a young age, it could make learning programming a lot easier down the line.

Figure 2.1.1: A screenshot of the start screen of the game. Artwork done by Kristina Russell.

Our game, Pixel Path: The Road to Code, is aimed at young kids to be able to start the process of learning to code and with the aim of getting them excited and involved with programming. The interface offers a map of different games and activities you can complete in order to advance to harder topics.

Figure 2.1.2: A screenshot of the spawn point on the game map

The hardware limitations that come along with this game are the need for at least 4-8 GBs of RAM and a Windows operating system. The software limitations are that the player should only be able to control, customize the character, select, and complete the lesson.

2.2 Product Functions

The major features of the game will include being able to customize your character and play different kinds of mini-games in order to advance and unlock new paths. The user should be able to go from the start screen to the customization page (which then leads to the game map), the options menu, or exit the game. From the game map, the user should be able to select and get information on each level, play any unlocked level, or pause the game. The pause screen should have a resume, options, and exit features. The mini-games include matching, fill in the blank, asteroids, puzzle slides, and more. All of the mini-games can be paused at any time and will show the pause screen. There is also a return feature in every mini-game that will return the user to the map.

2.3 User Characteristics

We expect our users to be of any age. The target audience is younger kids in grades 4th-6th. The game is to be designed in a way that you start with easy concepts like variables or conditions and slowly make your way to harder concepts like stacks or recursion. The user will be able to go at their own pace and review when they need to, thus, ultimately the game could be played by almost anyone.

2.4 Constraints

The constraints for this project consist mostly of constraints from the Unity Engine. The game itself was created in the Unity engine. These constraints include the need for 4-8 GBs of RAM and a Windows operating system.

2.5 Assumptions and Dependencies

We assume that the user is running the game on a computer with 4-8 GBs of RAM and has a Windows operating system. These are the fundamental requirements to run the game. It's not going to be a super intensive experience on the computer and the game itself will be pretty simple. The user will only be able to input basic movement with the WASD keys along with clicking on the mouse. The user is going to be able to navigate the map and select levels.

2.6 Apportioning of Requirements

As of the first prototype, we have implemented the barebones UI for the start screen, options menu(s), the customization page, the map, an example level, and a pause menu. In order to create a finished product, we would need to populate the levels with lessons and mini-games, create a boss battle for the user to complete, and a rewards system. The rewards will include key-fragments that are needed to unlock the boss fight, along with currency to buy different outfits and accessories for your character.

3 Specific Requirements

1. Game Map
    1.1. Set up so there are multiple paths to choose but you will learn things in the order that they need to be learned in.
        1.1.1. Mini-games will be played in order to complete each section in a level.
            1.1.1.1. Rewards system for each lesson completed
                1.1.1.1.1. Coins to unlock customizations/pets
                1.1.1.1.2. Potentially other perks/functionality
        1.1.2. Lessons will also be included in the path along with mini games
    1.2. The player will be able to:
        1.2.1. Navigate the map using the WASD keys
        1.2.2. Select an unlocked level by clicking on its tile
            1.2.2.1. This brings them to a minigame focused on the particular topic
        1.2.3. View future levels and their topics
        1.2.4. View what is required to unlock the boss levels
        1.2.5. Go back and replay previous lessons
    1.3. There will also be buttons to open:
        1.3.1. Options
        1.3.2. Character Customization
        1.3.3. Save the game
    1.4. Organized by concept
        1.4.1. Variables
        1.4.2. If / Conditional statements
        1.4.3. Loop
        1.4.4. Functions
        1.4.5. What libraries used for (later grades)
        1.4.6. Stack/Queue
        1.4.7. Recursion
    1.5. Key-fragments or other checkpoint feature
    1.6. Boss fight after each level
        1.6.1. Unlocked after having appropriate number of key-fragments/checkpoints
    1.7. Pause screen can be accessed from here
2. Mini-games
    2.1. Mini-games will happen a few times per level
        2.1.1. Asteroids
        2.1.2. Whack a mole definitions or bits of code
        2.1.3. Puzzle slide
        2.1.4. Sorting Minigame (strings, ints etc)
    2.2. The minigame itself will vary depending on the topic at hand
    2.3. Presented with a disguised lesson in the form of a game to play

2.4. The player will be able to
2.4.1. Interact with some assets in manners such as:
2.4.1.1. Sorting (click and drag)
2.4.1.2. Choosing an option (left vs right via ‘a’ and ‘d’ or ‘up’ and ‘down’
2.4.1.3. Walk and interact (via ‘wasd’ and left clicking)
2.5. Once the minigame has been finished:
2.5.1. An autosave will occur
2.5.2. If won
2.5.2.1. The lesson will be marked as completed on the map and the path will update.
2.5.3. If failed
2.5.3.1. The lesson can be redone in order to move on
2.5.3.2. Can potentially offer supplemental material to aid in understanding
2.6. Minigames will be able to be replayed after they are completed
3. Start Game Screen
3.1. Player can choose to:
3.1.1. begin the game via the start button (this will bring them to the character select screen)
3.1.2. Change their sound settings via the options button
4. Boss Screen
4.1. Unlockable once corresponding pieces have been collected via winning levels
4.2. Will show what topics are relevant
4.3. Once the boss level is cleared, a new section of the map will unlock
5. Pause Screen
5.1. Edit options
5.2. Save game
5.3. Exit game
6. Character selection
6.1. The player will be able to:
6.1.1. Pick a player model
6.1.2. Change color scheme
6.1.3. Add/remove any accessories they have unlocked
6.1.4. Name their character
6.2. Once done, this will bring the player to the map screen
7. Options Screen
7.1. Master volume (controls both the music and sounds volume)
7.2. Sounds volume (in game noises)
7.3. Music volume
7.4. Option to go back to start game screen

4 Modeling Requirements

Figure 4.1: A screenshot of the use case diagram

Use Case Name:	Start Game
Actors:	Student
Description:	This is the user starting the game and running the program. This will open the startup screen
Type:	Primary
Includes:	None
Extends:	None
Cross-refs:	Requirement 3
Uses cases:	This is used whenever you want to open and play the game. The game must be started before you can play

Use Case Name:	Character Selection
Actors:	Student
Description:	This happens when you start a new game. you are able to select from a multitude of different characters for the game.
Type:	Primary
Includes:	Character Customization
Extends:	None
Cross-refs:	Requirement 6
Uses cases:	This is used whenever you want to start a new game. the player is able to select which character they would like to play as.

Use Case Name:	Character Customization
Actors:	Student
Description:	This is a customization feature that will allow you to customize your character that you have already selected with accessories that you have already unlocked.
Type:	Primary
Includes:	None
Extends:	None
Cross-refs:	Requirements 6.1.2 - 6.1.4

Uses cases:	When the user unlocks new accessories for their character they can go to the pause menu and to the character selection screen in order to add or get rid of things off of their character.

Use Case Name:	Navigate the Game Map
Actors:	Student
Description:	The user is able to navigate all around the game map and to multiple anywhere on the map
Type:	Primary
Includes:	View Level Requirements
Extends:	None
Cross-refs:	Requirement 1.2.1
Uses cases:	The user wants to make it from lesson one to lesson two. They are able to control the character using the WASD keys to get there.

Use Case Name:	View Level Requirements
Actors:	Student, system
Description:	The User is able to view what is required to view any given lesson at any given time.
Type:	Secondary
Includes:	None
Extends:	None
Cross-refs:	Requirements 1.2.3, and 1.2.4
Uses cases:	The user wants to move to a new topic but is unsure what is needed inorder to go there. They are able to navigate to the lesson itself and view the requirements to be able to access the level.

Use Case Name:	Check if Boss is Playable
Actors:	System
Description:	The system must be constantly checking if the boss level is playable for the user, if it is then it must be unlocked.
Type:	Primary

Includes:	None
Extends:	View Level Requirements
Cross-refs:	Requirements 4
Uses cases:	When the user collects the required material to unlock the boss then the system must check that and then unlock the level for them.

Use Case Name:	Play Minigame
Actors:	Student
Description:	The student is able to go and play a minigame that is currently unlocked, they are also able to replay any minigame that they want to.
Type:	primary
Includes:	Unlock level
Extends:	Earn Rewards
Cross-refs:	Requirements 1.1, 2
Uses cases:	The user is able to navigate themselves towards any game they would like, if the game is unlocked then they are able to play it as many times as they would like to.

Use Case Name:	Earn Rewards
Actors:	Student
Description:	Once a game has been completed for the first time the User will receive rewards, including currency and material needed for the boss at the end of the level.
Type:	Secondary
Includes:	None
Extends:	None
Cross-refs:	Requirements 2.5.2
Uses cases:	The user will collect the currency in order to purchase accessories for the character, and can collect material in order to unlock future bosses

Use Case Name:	Unlock level

Actors:	System
Description:	When a lesson is complete the system will automatically go and unlock the next lesson, unless the next lesson is a boss then it will use that process instead
Type:	Secondary
Includes:	None
Extends:	None
Cross-refs:	Requirements 1.1
Uses cases:	The system needs to unlock these levels for the user so that they are able to continue on their journey.

Use Case Name:	Pause Game
Actors:	Student
Description:	The User is able to pause the game at any point on the map screen or any lesson or boss. this will bring up a button to access saving the game, options screen, or exit game.
Type:	Primary
Includes:	None
Extends:	Quit, Save, Settings
Cross-refs:	Requirements 5
Uses cases:	The user needs to be able to pause the game and access these settings at any point during their gaming session.

Use Case Name:	Quit
Actors:	Student
Description:	The option to quit the game is accessible through the pause menu. this option will auto save the game and close the application
Type:	Primary
Includes:	Save
Extends:	None
Cross-refs:	Requirements 5.3

Uses cases:	The user can quit the game at any time, the game will automatically save and the application will be exited

Use Case Name:	Save
Actors:	Student
Description:	The User is able to save the current point that they are at in the game to be able to be accessed later on.
Type:	Primary
Includes:	None
Extends:	None
Cross-refs:	Requirements 5.2
Uses cases:	The user needs to be able to save their progress in order to access it later.

Use Case Name:	View Level Requirements
Actors:	Student, system
Description:	The User is able to view what is required to view any given lesson at any given time.
Type:	Secondary
Includes:	None
Extends:	Check if Boss is Playable
Cross-refs:	Requirements 1.2.3, and 1.2.4
Uses cases:	The user wants to move to a new topic but is unsure what is needed inorder to go there. they are able to navigate to the lesson itself and view the requirements to be able to access the level

Use Case Name:	Options Screen
Actors:	Student, system
Description:	The User is able to edit setting like the volume of the game
Type:	Primary
Includes:	None
Extends:	None

Cross-refs:	Requirements 7
Uses cases:	The user is able to change the volume of certain objects and the main game through the options menu.

The use case above describes all of the different processes and settings that the user and the system are able to access. These use cases are what make up the core concepts of the game and what are able to be done by the user and by the system.

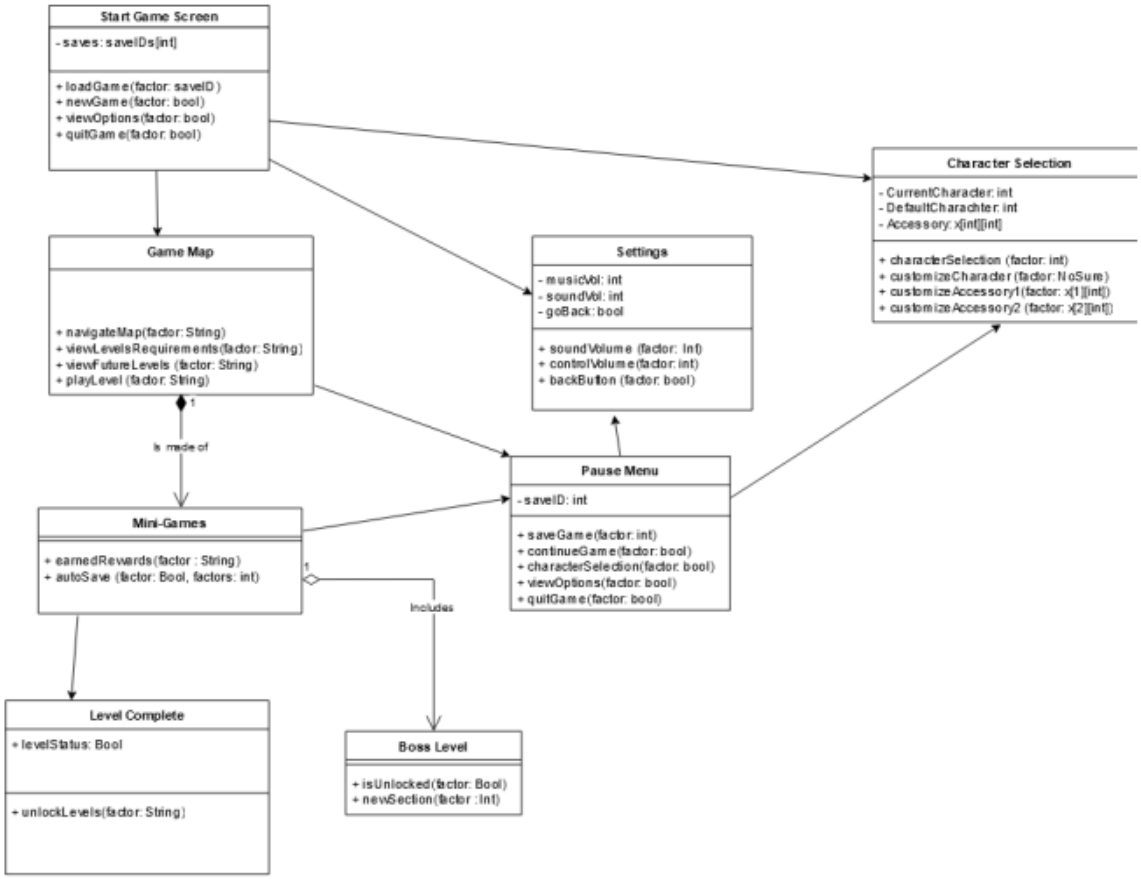


Figure 4.2: A screenshot of the class diagram

The class diagram above is a description of all the classes that we feel is necessary for the system to be able to accomplish all of the use cases that we described above. All of these classes are vital for the system as a whole.

Start Game Screen	
-saves:saveIDs[int]	The start screen is able to access previously saved games so save files get

	passed in if it's needed.
+loadGame(factor: saveID)	This function would take in the saveID and load the saved game for the user
+newGame(factor: bool)	This function starts a brand new game if selected and it would bring the user to the start game screen
+viewOptions(factor:bool)	This function would bring the user to the options screen in order to edit the settings
+quitGame(factor:bool)	This function would quit the game when it is used.
Class description: This class is the starting screen when the game is opened. it will display options to load, and save games, also to edit the settings and to quit the game	

Game Map	
+navigateMap(factor:String)	The User uses the WASD keys in order to navigate around the map and get to different lessons in the level.
+viewLevelRequirements(factor:String)	This will display the current requirements needed for the selected level.
+viewFutureLevels(factor:String)	THis function would allow the user to be able to preview each future lesson that they would have to complete.
+playLevel(factor:Strings)	this function will allow the user to start the minigame that currently selected
Class description: This class is the game map itself. the user can navigate around the map and interact with the lessons as they go around. Game Map is made of Mini-Games	

Mini-Games	
+earnRewards(factor:String)	This function decides what rewards you receive upon completion of the level.

+autoSave(factor:bool, factors: int)	This function will auto save the game once the minigame is complete
Class description: This class is the minigame class that controls what happens after a mini game is completed for the player. Class includes Boss Level	

Boss Level	
+isUnlocked(factor:Bool)	This function checks if the requirements to enter the boss level have been met.
+newSection	This function unlocks a new path after the boss has been defeated.
Class description: This class is a special level that features a boss fight at the end of a path and unlocks a new path once completed.	

Level Complete	
+levelStatus: Bool	Whether minigame was completed successfully or not.
+unlockLevels(factor:String)	This function unlocks the next level if the current one is completed.
Class description: This class checks if the minigame was completed and allows the user to progress to the next level.	

Pause Menu	
-saveID: int	ID of current game state to be stored.
+saveGame(factor:int)	This function saves the current game state to one of the save slots.
+continueGame(factor:bool)	This function closes the pause menu and returns the user to the game state before pausing.
+characterSelection(factor:bool)	This function allows the user to change to

	a different character.
+viewOptions(factor:bool)	This function would bring the user to the options screen in order to edit the settings.
+quitGame(factor:bool)	This function would exit the user back to the game map and autosave the current game state.
Class description: This class is a menu that allows the player to stop in the middle of a minigame to save, continue, or quit the game in the current state and also allows the player to access the settings.	

Settings	
-musicVol: int	Volume of background music.
-soundVol: int	Volume of other sound effects.
-goBack: bool	Whether the player wants to return to the previous menu or not.
+soundVolume(factor:int)	This function sets the volume according to the user input.
+controlVolume(factor:int)	This function allows the user to increase or decrease the volume with a slider.
+backButton(factor:bool)	This function returns the user to the previous screen, either the start game screen or pause menu.
Class description: This class is the settings menu that allows the user to set the volume to the desired level and applies the volume setting to the game.	

Character Selection	
-CurrentCharacter:int	ID for current character model
-DefaultCharacter:int	ID for default character model
-Accessory: x[int][int]	Additional cosmetics applied to the base character model.

+characterSelection(factor:int)	This function lets the user select which character model to use with arrow buttons and sets it as the current character.
+customizeCharacter(factor:bool)	This function allows the user to view available accessories.
+customizeAccessory1(factor:x[1][int])	This function allows the user to set the accessory in slot 1.
+customizeAccessory2(factor:x[2][int])	This function allows the user to set the accessory in slot 2.
Class description: This class controls the character that will be displayed and allows the user to change the character or equip accessories.	

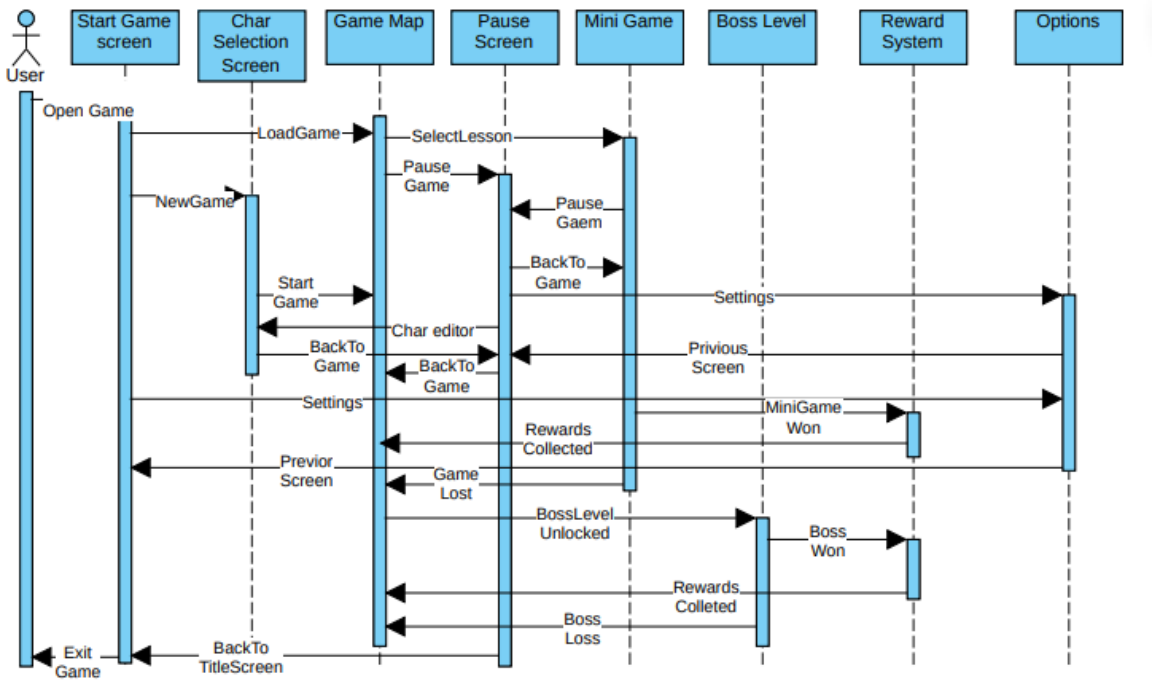


Figure 4.3: A screenshot of the sequence diagram

This is the sequence diagram for the user of the game. In short, you can access most things from most places. From the start screen you are able to load the game map or start a new game, change the settings on the game, or quit the game altogether. From the

game map you can access an unlocked level and the pause menu. From the pause menu you can save the game, edit characters, or quit the game.

5 Prototype

Our prototype will be able to show the user navigating through the map. By default only the first path is unlocked. The user can enter levels by interacting with level tiles. A placeholder level is shown in the prototype which will be replaced with a minigame. The user will be able to quit, save the game, or open the settings. From there the user would be able to do things such as manage volume or set the display to fullscreen or windowed.

5.1 How to Run Prototype

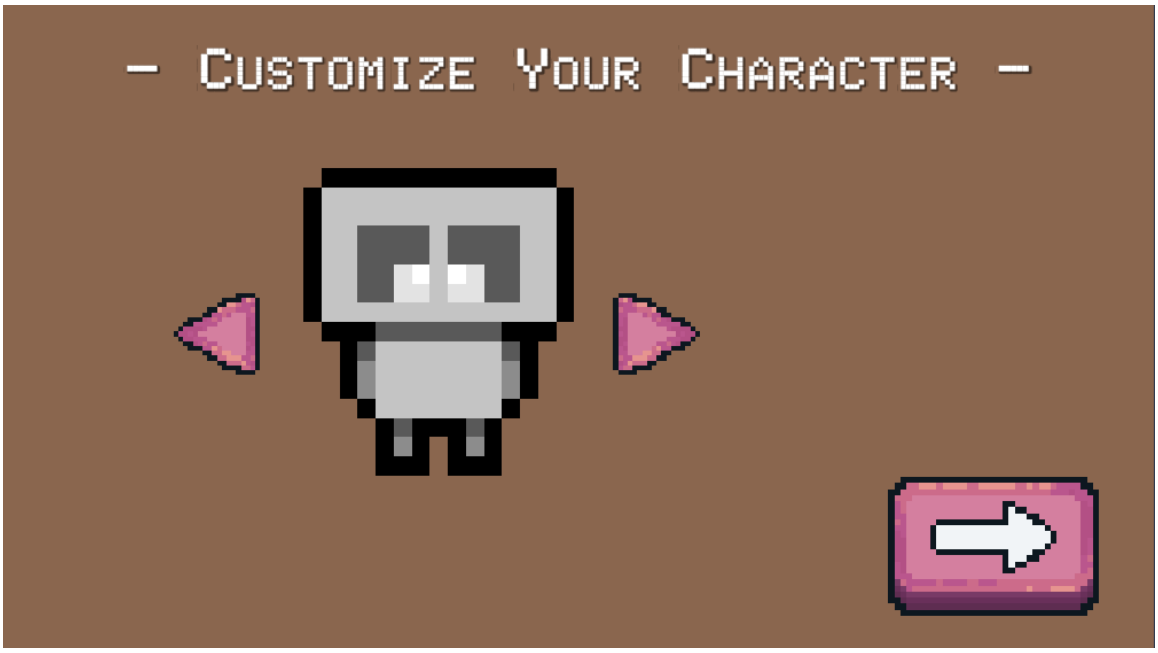
The prototype of the game needs to be run on a Windows computer with 4-8 GBs of RAM. The game is not super intensive and should be able to run on almost any computer that you have available. It is in the form of a .exe that the user will need to run in order to start the game.

5.2 Sample Scenarios

A student wants to learn a specific programming concept such as variables. The student will click Start from the start screen and customize their character. The student will then be shown an open world map with the character. The student will navigate their character using the WASD keys to the Variables path. In the prototype the path is represented as placeholder level 1. Moving along the path, the student will encounter level tiles. The student will move the character to an available level space that they want to play and press ‘e’ to start the level.

The student is shown this start screen upon launching the program.

After pressing start, the user will customize their character.



After customizing their character, the student will be brought to the world map that shows a character controllable with WASD.

The student will move their character along the path and encounter several levels along the way.

Levels are represented by red blocks. The student will move their character over the block and press e to interact with it. Pressing e will start the level if it is unlocked.

The student will be able to start a lesson or play a minigame upon starting the level. Currently a placeholder level is shown below.

6 References

[1] "Coding Games for Kids by Kidlo: Learn Programming Online." Kidlocoding.Com, IDZ Digital, www.kidlocoding.com/. Accessed 17 Nov. 2023.

[2] Technologies, Unity. "Creating a 2D Game." Unity, Unity, docs.unity3d.com/Manual/Quickstart2DCreate.html. Accessed 17 Nov. 2023.

[3] Unity. "Beginner Scripting." Unity Learn, learn.unity.com/project/beginner-gameplay-scripting?tab=overview. Accessed 17 Nov. 2023.

[4] Kottke, Jason Aleksandr. "Silkscreen." Silkscreen Font, Dafont, 2005, www.dafont.com/silkscreen.font.

Note about game assets: All game assets were created by Kristina unless otherwise noted

7 Point of Contact

For further information regarding this document and project, please contact **Prof. Daly** at University of Massachusetts Lowell (james_daly at uml.edu). All materials in this document have been sanitized for proprietary data. The students and the instructor gratefully acknowledge the participation of our industrial collaborators.