

ELEC 1005 Project 2

Group Members

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1. Planning

1.1 Client Brief

As a kindergarten teacher, our client wants to teach children to use the computer by playing a child-friendly computer game. She already has a game template. However, the game does not meet her architecture and design requirements. Additionally, she noticed some defects in the software that should be fixed for the children. She proposed that the game be designed to accommodate the target audience of kids aged 4-5. She also wanted to make the game a learning experience for the children. She wanted to include the alphabet, where the children are able to learn about the alphabet in order from the game.

1.3 Requirement Analysis

Negotiation:

After a discussion with the development team, it was decided that implementing the alphabet would be difficult within the given time period. However, since there were only 14 days to complete the game, it was not enough time for the development team to integrate the client's idea. We had to prioritize client requirements. Therefore a discussion with the client was held to inform her about this challenge. The client was very understanding and agreed to have the alphabet removed from the game. Instead, we proposed the idea of a train that picks up people, and as it does so, the number of carts on the train increases. The client approved this suggestion, and the development team confirmed that the proposed idea could be completed in 14 days.

Requirement Specification:

Our client wanted to use the template and requested to improve architecture and design. Furthermore, she wanted to fix any existing and additional defects in the software. The architecture and design requirements were required to entertain and engage children, even if they could not complete the game.

Architecture and Design requirements:

The original template lacked the functionality of engaging and entertaining the target audience. It also does not provide a user experience that the children would enjoy. After a discussion with the client, it was decided that the game would be themed and reference the cartoon Thomas & Friends. The design requirements included a cover page and game background to accommodate the theme. Additionally, considering the target audience, the game should consist of bright colors and engaging sound effects.

Bug Fixes:

Our client noticed some defects and software vulnerabilities while reviewing the template, such as the screen size, the flickering of the start screen, and consistent game crashing. The small screen size can be seen as a challenge for user experience in the current software and hence needs to be increased. The screen size and flickering of the start page were something the client wanted fixed, keeping in mind health concerns for young kids. The Client also noticed constant crashing on the game whenever the snake hit the left wall and requested the bug to be fixed. Another requirement added to improve the game's user experience was changing the spawning method for the strawberries. The original template had hard-coded values, which were altered to appear randomly across the map.

1.3 User Story

ID	User Story	Proposed Idea
1	Children aged 4-5 might find it hard to see on a small-sized screen. Considering health concerns for young kids, the game screen should be of reasonable size.	Increase screen size by increasing width and height
2	As the client mentioned, children like themed and relatable games.	Add a cover image of the cartoon Thomas & Friends
3.	The game should relate to the theme and be child-friendly for a younger age group.	Change background Change snake to train Change strawberries to people
4	Children at a young age are attracted to bright colors, and interacting with different colors can be a great learning experience.	Add colorful features to the player based on the theme. Make exciting colors core part of gameplay

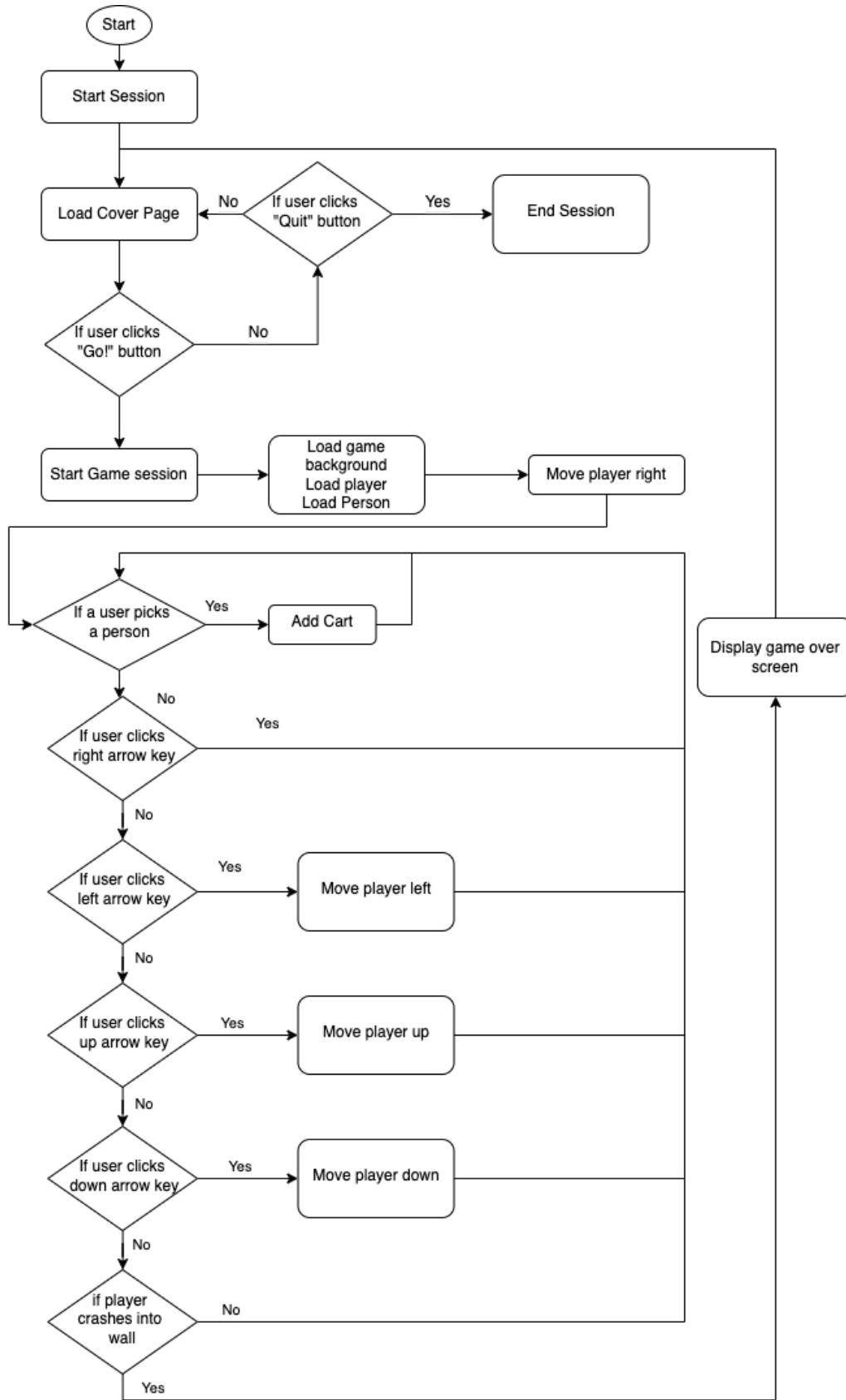
5	Our client stated that children aged 4-5 react to sounds well. The current template has a crashing sound, which our client thought would be too violent for young children.	Add child-friendly sound effects such as the train horn and train moving sound effects. Background music for the cover page and in-game.
6	The start screen flickering in the original template can raise children's health concerns.	Fix the flickering text and buttons, and simply position it on the screen
7	The current name of the game does not relate to the themes discussed with the client, hence needs to be changed.	Change the game name and change the font of the game name
8	Kids will be taught to use the replay button to replay and the quit button to stop playing. The bug in the template where the game crashes when pressing the replay needs to be fixed.	Prevent players from crashing when the replay button is clicked, and the game session begins.
9	To prevent children from focusing their eyes too much on the screen, each object should be increased in size. This will avoid raising health issues for children.	Increase the train's size from the snake's size, Increase the person's size from strawberry's size
10	While small children wouldn't be able to make a judgment on the movement of the player. Our client requested that the train has coherent movement.	Make the player be able to move in all four directions smoothly across the map.
11	The children need to be able to open the game themselves. They will not be able to run the code on the laptops	Create the python game into an executable file.

1.2 Acceptance Criteria

ID	Acceptance Criteria
1	The screen size should be larger than 1000px by 550px.
2	The game should revolve around a central theme that appeals to the target audience.
3	The game should have a background image and a cover page. The player and objects that interact with the player should be related to the theme.
4	The player display should consist of multiple bright colors that are a core part of the gameplay.
5	The game should have background music when the session starts and when the cover page is loaded. The game should also implement sound effects related to the theme

	when needed.
6	The cover page should not flicker, and the go and quit button should not glitch.
7	The game should have a name and font related to the theme.
8	When the replay button is clicked, the game session should start, and the player should move without spawning in a place where it constantly crashes into a wall.
9	The size of each object on the map of the game should be greater than 30px by 30px
10	The player should be able to move through the map in all four directions corresponding to the correct arrow keys. Once the player crosses the border of the map, the game ends.
11	The game is an executable file. The cover page is displayed when the executable file is opened, and the ten criteria listed above run correctly.

1.3 UML (Activity Diagram)



1.4 Sprint Planning

The product owner had discussions with the client to understand the requirements and acceptance criteria. Based on the acceptance criteria, the scrum master and team members decided on changes and bug fixes that should be made to meet client requirements. Each task was allocated to one of three sprints based on feasibility and efficiency in terms of game development.

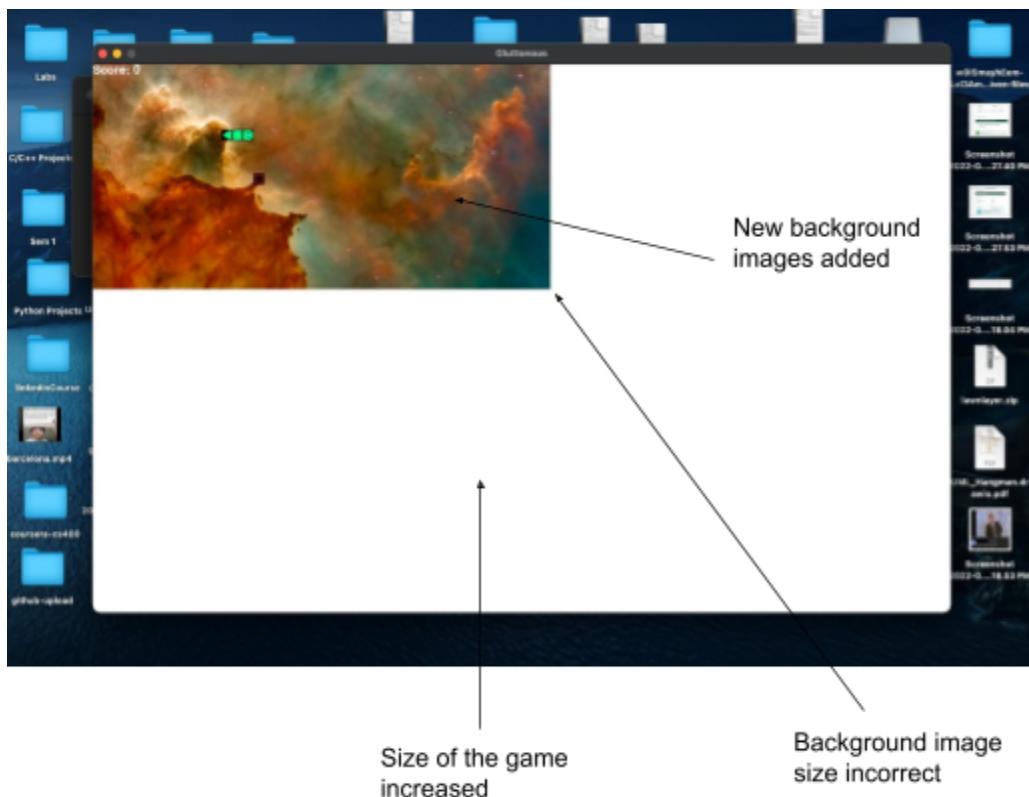
1.4.1 Sprint 1: May 7 - May 11

Meeting Notes	Task Notes
<p>Meeting 1 (May 7) - Planning</p> <ul style="list-style-type: none">• Make changes to background-size first to map out the rest of the game.• Changing background image follows with changing the background-size <p>Meeting 2 (May 11) - Retrospective meeting</p> <ul style="list-style-type: none">• Developers reviewed the code during the sprint and recognized the true difficulty of editing the code to fit the acceptance criteria	<ol style="list-style-type: none">1. Increase the size of the game2. Change the background image<ul style="list-style-type: none">a. Need to continue in Sprint 23. Establish a Github Repository for the new project

Standup:

Date	Overview	Progress
May 8th: 9:13pm to 9:31pm (18 mins)	Dev team began work on increasing the size of the game Scrum masters updated jira and updated reports improving team velocity	Initial dimensions of the game were tested by the developer
May 9th: 5:30pm to 5:44pm (14 mins)	Decided on making the game 1200x750 pixels Scrum masters updated jira and updated reports improving team velocity	Successful in increasing the size of the game
May 10th: 7:00pm to 7:11pm (11 mins)	Added a new background image to the game but was not able to change the background image to fit Scrum masters updated jira and updated reports improving team velocity	Able to add a new image to the background, but was not successful in increasing the size of the background image in this sprint Need to continue in Sprint 2 Jira updated with burnup and burndown reports created

Showcase 1:



We held a meeting to showcase to the team the development progress; as shown in the picture above, we showed the changes between the current and old versions of the game and took notes on the errors and potential future of the game.

Retrospective 1:

May 11th: 8:04 - 8:30 pm (26mins)

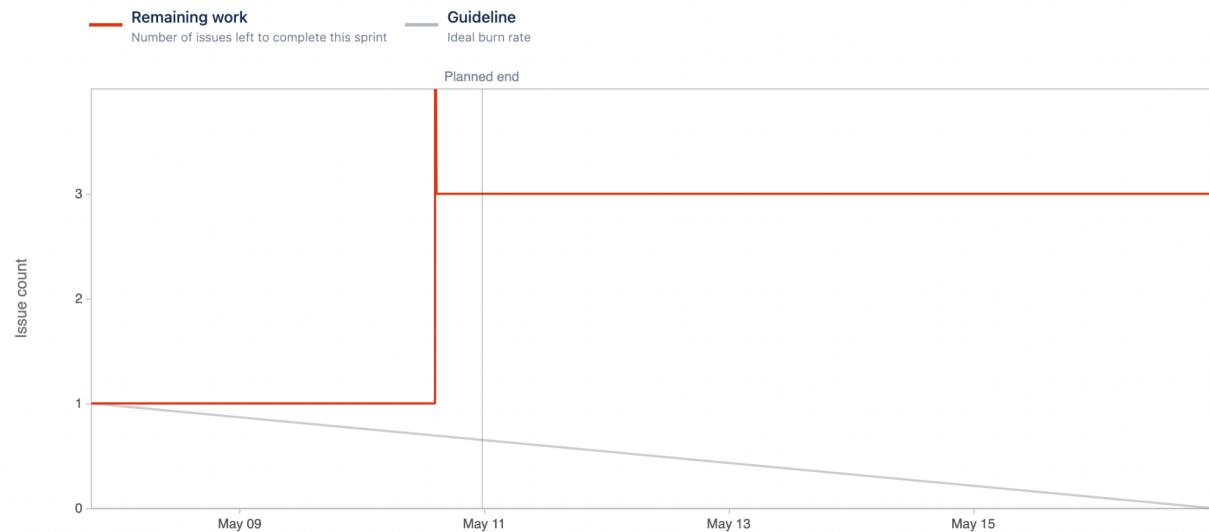
- For this sprint, we successfully increased the size of the game and attempted to add a new background image. The devs made themselves comfortable with the code and functions.
- However, the dev team needed more time than initially planned to fix the dimensions of the background image to fit into the larger game window size.
- Therefore, we decided that this part of the project needs to be continued in sprint 2

Burndown and Burnup Reports 1:



As evidenced by the Burnup report, the team's velocity was relatively low because this sprint was more of an investigatory sprint. While we may not have accomplished the full acceptance criteria, we did manage to develop a professional understanding of the code and its functions.

Sprint goal - Aesthetic changes to make the game look more child friendly to our clients



Assessed team velocity to prevent further issues of technical debt.

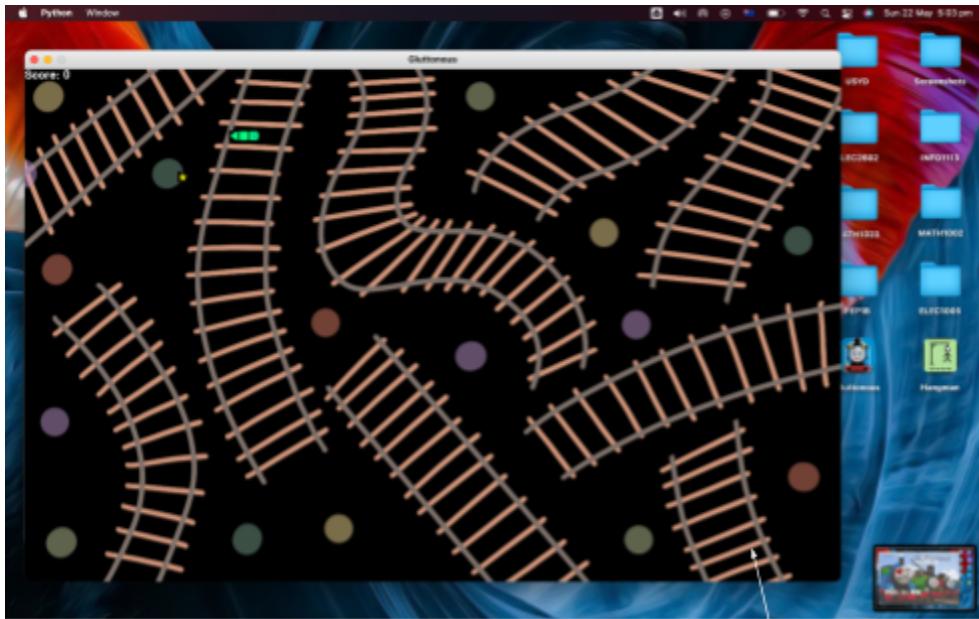
1.4.2 Sprint 2: May 17 - May 20

Meeting Notes	Task Notes
<p>Meeting 1 (May 17) - Planning</p> <ul style="list-style-type: none"> ● Finish sprint 1 <ul style="list-style-type: none"> ○ Add image with correct dimensions ● Improve user experience by adding features and fixing issues to make it more enjoyable <ul style="list-style-type: none"> ○ Change main menu background image ○ Add sound effects ○ Character improvement <ul style="list-style-type: none"> ■ Change character images and fix character orientation ○ Remove glitches 	<ol style="list-style-type: none"> 1. Fix the incorrect dimension of the background image 2. Add a new background image to the main menu page 3. Add sound to the game <ul style="list-style-type: none"> a. Add sound effects and background music 4. Improve the character <ul style="list-style-type: none"> a. Fix character orientation b. Change character image 5. Remove the flickering issue at the start of the game

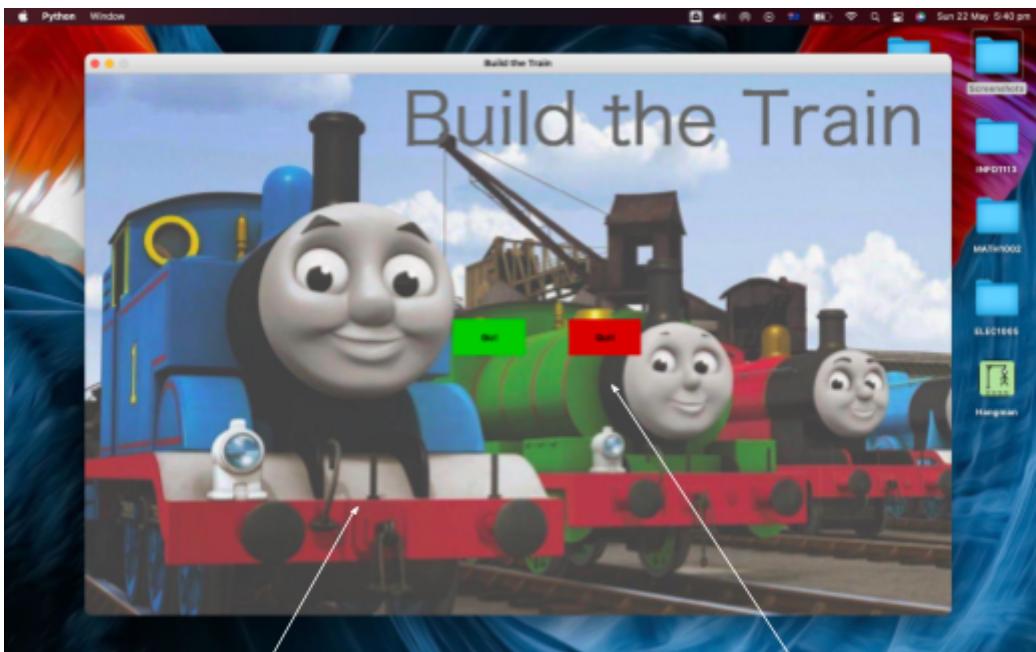
Standup 2:

Date	Overview	Progress
May 18th: 1:20pm to 1:32pm (12mins)	<p>Dev team added a new background image to fit the larger background-size</p> <p>Dev team also fixed issues in the game - > Removed the flickering</p> <p>Scrum masters updated Jira and updated reports.</p>	<p>New background image successfully added, which fits the new game size</p> <p>Flickering issue removed</p> <ul style="list-style-type: none"> ● Game runs smoother and less jittery
May 19th: 4:10pm to 4:23pm (13mins)	<p>Dev team changed the character image from a snake to a train and attempted to fix the characters orientation</p> <p>Dev team added sounds to the game</p> <p>Scrum masters updated Jira and updated reports</p>	<p>Character improved</p> <ul style="list-style-type: none"> ● Successfully changed the character of the snake to a train ● Attempted to fix the character orientation but was not able to complete it in the time frame <p>Need to continue in Sprint 3</p> <p>Added sound effects and background music to enhance the user experience</p> <ul style="list-style-type: none"> ● New sound effects and background music <p>Jira updated and burnup and burndown reports created</p>

Showcase 2:

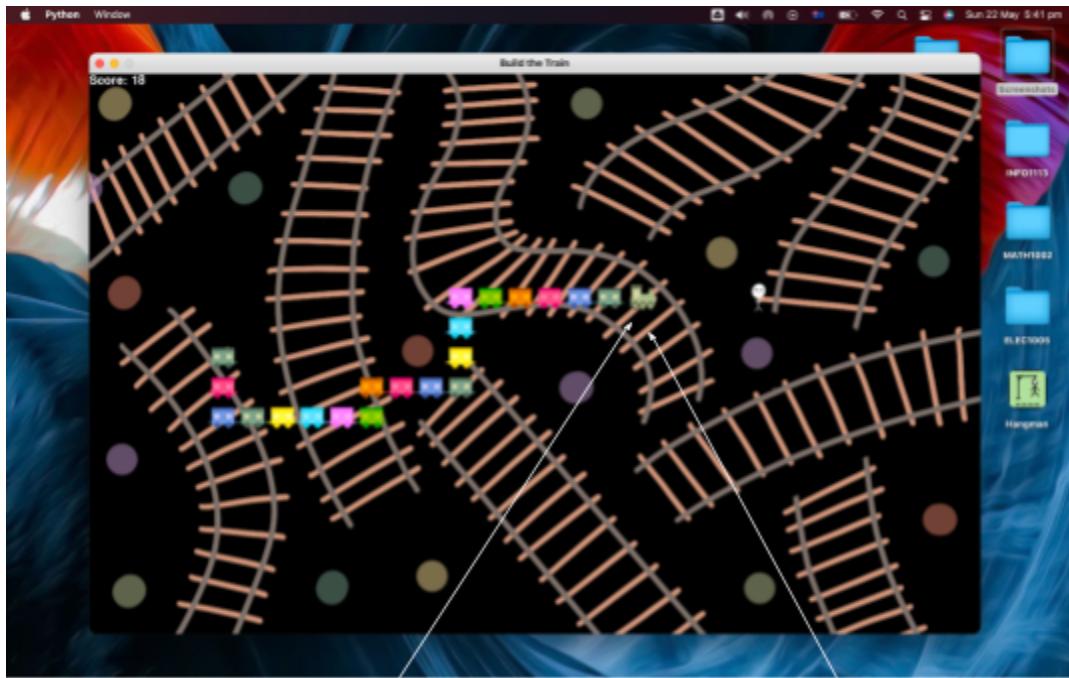


New background image added
with correct dimensions



New background image for the
main menu added

Flickering of main menu fixed,
no long flickers



Attempted to fix orientation of the game, but not able to finish in this sprint

Character changed from snake to train

Note: The game's sound was played to the team but can't be shown here.

We held a meeting with our team to show the game's progress, as shown in the pictures above. We looked at the new background image, allowed each team member to hear the sound effects and background music, and took more notes on the errors and potential future of the game.

Retrospective 2:

May 20: 7:12pm-7:35pm (23mins)

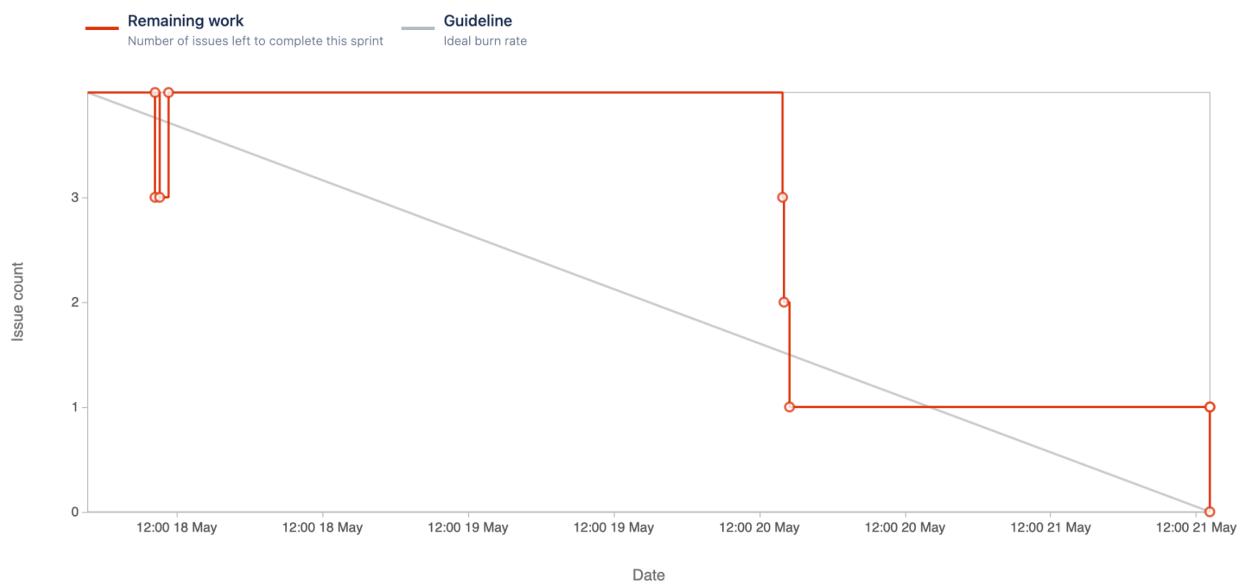
- For this sprint, we were successful in almost completing everything that we planned for
- We were able to catch up on the technical debt incurred from the previous sprint and work on all the user stories slotted for this sprint
- We successfully updated the character of the game by changing its image from a snake to a train. However, the dev team was not entirely successful in fixing the character orientation of the new character.
 - Need to continue to work on it in Sprint 3
- We were successful in adding a new background image for the main menu too
- Able to further enhance the user experience by adding sound effects and background music
- While working on this sprint, we modified specific acceptance criteria and were able to make changes based on the feasibility of making the game of higher quality.

- At this point, the majority of the functional coding had finished. The team felt that to truly make a fulfilling user experience, we would need to conduct **User Testing** before sprint 3 [Refer to section 3.4].

Burndown and Burnup Reports 2:



We could maintain a much more steady velocity. The team was very productive and could keep up a high level of motivation. This sprint followed the ideal burnup line the most and was our most efficient sprint.



1.4.3 Sprint 3: May 21 - May 22

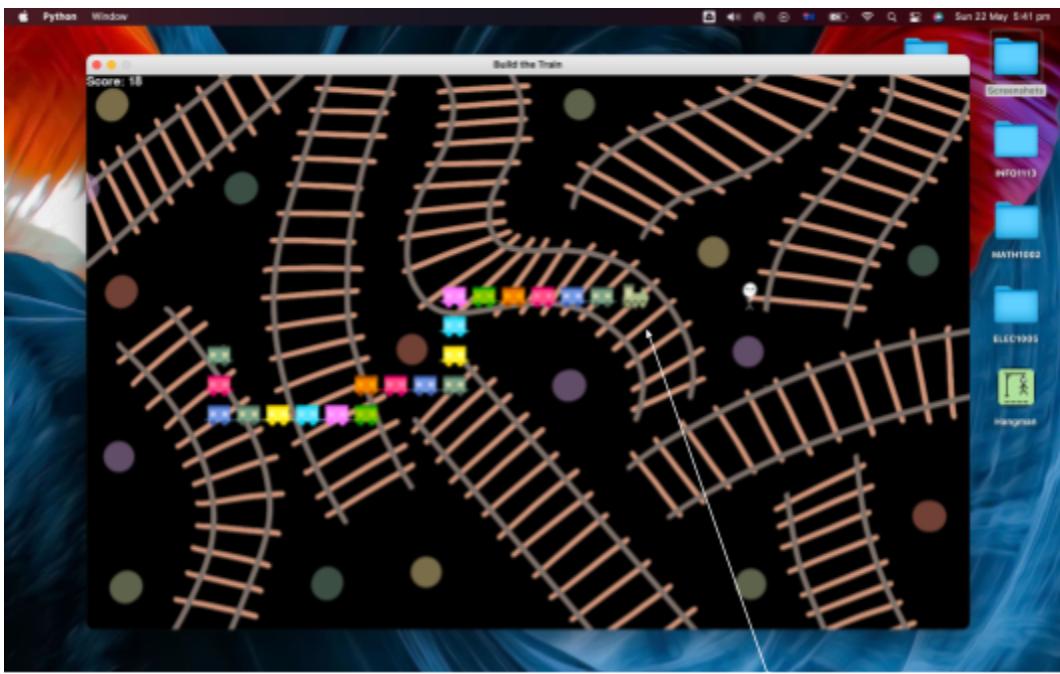
Meeting Notes	Task Notes
<p>Meeting 1 -</p> <ul style="list-style-type: none"> ● Consider the research noted from the user beta testing ● Finish Character improvement <ul style="list-style-type: none"> ○ Finish character orientation issue <ul style="list-style-type: none"> ■ Heading left train faces left and vice versa ● Aesthetics <ul style="list-style-type: none"> ○ Font ○ Color ○ Main menu music (to keep the audience engaged from the moment the game starts) ○ Game over Screen ● Executable file 	<ol style="list-style-type: none"> 1. Character improvement <ul style="list-style-type: none"> a. Need to make sure when the train heads left, the front of the train faces left and vice versa 2. Aesthetics <ul style="list-style-type: none"> a. Add a more appealing font to the game b. Add more appealing colours to the game c. Add more music to the game to enhance user experience <ul style="list-style-type: none"> ■ Add main menu music d. Game over screen with score 3. Have an executable file

Standup 3:

Date	Overview	Progress
May 21st: 5:21pm - 5:33pm (12 min)	<p>Dev team fixed the character orientation issue</p> <ul style="list-style-type: none"> ● Ex. When the train faces left the front of the train faces left <p>Discussed on what minor modifications to the game aesthetics to make to better fit the target audience based on the results from the beta testing.</p>	Successfully fixed the issue and now train moves and looks at the right direction
May 22nd: 1:20pm to 2:32pm (12min)	<p>Aesthetics of the game need to be improved:</p> <ul style="list-style-type: none"> ● New font and More colors added to the game ● Add music to the main menu page too ● Add a game over screen with final score counter <p>Create executable file Scrum masters updated jira and</p>	<p>Aesthetics improved</p> <ul style="list-style-type: none"> ● New fonts added ● Game became more colorful ● Music added to the main menu page ● Game over screen with functional final score counter <p>Executable file successfully made Jira updated and burnup and burndown</p>

	updated reports	reports created
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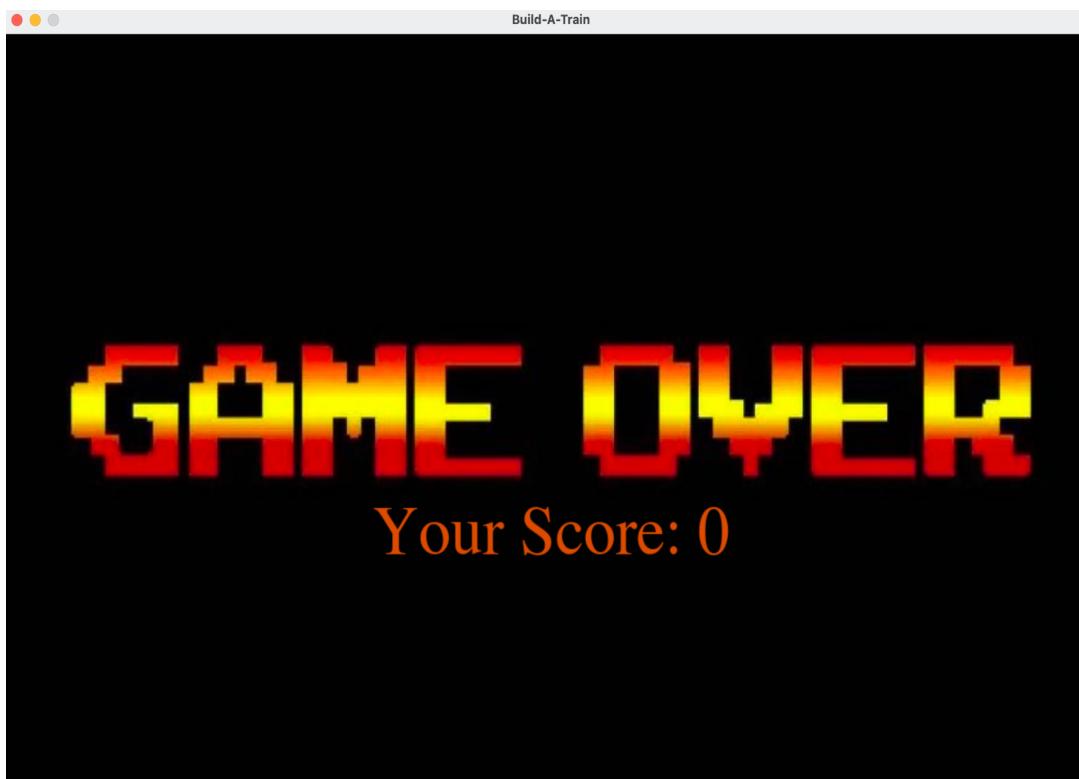
Showcase 3:



Character orientation fixed, when the train faces right the front of train faces right, the same for when it moves to other directions



New fonts and colour added to the main menu



Note: Sound of the game was played to the stakeholders, but can't be shown here.

Following the user testing, we had an easier time making certain aesthetic design decisions to make the game more engaging for the target audience of young children.

In our last showcase, we held a meeting with our team to show the final product of the game; as shown in the pictures above. We showed how the character orientation of this train correctly moves and looked through the improved aesthetics of the game. We also showed the team the game over screen with a score counter function at the end of the game. The whole team was happy with the final product and agreed that the game would definitely meet the clients expectations.

Retrospective 3:

May 22: 6:34pm-6:55pm (21mins)

- In our last sprint, we were able to complete everything we had planned for and more
- We were able to successfully fix the character orientation of the train
- To even further enhance the user experience of the game we implemented new fonts and colours throughout the game
- We also added background music to the main menu page so throughout the whole game some sort of music would be playing
- Since this was our last sprint, we also held a reflection period at the end of this meeting and discussed what was done well and what could have been done better.
 - However, overall as a team we believed that we were pretty successful and are all proud and satisfied about the final outcome of this game

Burndown and Burnup Reports 3:

Date - May 21, 2022 - May 22, 2022



The teams' velocity started to follow the Ideal burnup line better as the sprints progressed, a key indication of the teams' motivation.

Date - May 21, 2022 - May 22, 2022



2. Development

2.1 Development Comments

From the planning team, we initially got the requirements to create an alphabet-themed game. After careful consideration from the development team, we deemed that this game idea requires significant code changes, and we cannot complete this long task within the given time frame. This was not feasible.

We used pair programming for this development; we decided to divide the task by file and pull the changes committed to git so that each developer will be working with the latest version of the game. This results in a low margin of error incompatibility requirements.

<https://github.com/Noe-Jacob/Build-A-Train>

(The repository will be made public after the submission has been made).

According to the PEP-8 standard, each variable and function has been updated and commented upon. The following image is an example of how the code has been commented on and organized.

```
  main.py > ...  main.py  game.py  def text_objects(text, font, color=black):  
    """  
    Param text: The String to be displayed  
    Param Font: The Font to be used  
    Param Color: The colour to be used  
    Returns the source of the image and the destination of the image to be drawn in the game window.  
    """  
    text_surface = font.render(text, True, color)  
    return text_surface, text_surface.get_rect()  
  
def message_display(text, x, y, color=black):  
    """  
    Param text: The string to be written in the screen  
    Param x,y: The coordinates where the message should be displayed  
    Param color: The color of the message  
    The function displays the message with the given parameters in the game window.  
    """  
    large_text = pygame.font.SysFont('ヒラギノ角ゴシックW3', 100)  
    text_surf, text_rect = text_objects(text, large_text, color)  
    text_rect.center = (x, y)  
    screen.blit(text_surf, text_rect)  
    pygame.display.update()  
  
def button(msg, x, y, w, h, inactive_color, active_color, action=None, parameter=None):  
    """  
    Param msg: The string to be displayed in the button  
    Param x,y: Coordinates of where to display the button  
    Param w,h: The dimensions of the button box  
    Param inactive_color: The colour when when the position of the mouse is outside the box  
    Param active_color: The colour when when the position of the mouse is inside the box  
    Param action: The function to run if the player clicks the button  
    Param parameter: the parameter to be passed into the action function if the player clicks the button  
    Returns True if the function runs successfully  
    """  
    The function displays the buttons and checks if the player pressed the button.  
    If the player pressed the button runs the function to start the game.  
    """  
    mouse = pygame.mouse.get_pos()  
    click = pygame.mouse.get_pressed()  
    if click == (1, 0, 0):  
        if x + w > mouse[0] > x and y + h > mouse[1] > y:  
            if active_color != None:  
                screen.fill(active_color, [x, y, w, h])  
            if action != None:  
                action(parameter)
```

Ln 138, Col 1 Spaces: 4 UTF-8 CRLF Python 3.9.6 64-bit

2.2 Modifications

Game Window Size:

- The game window was too small to be used in a laptop so after changing and testing it from various ranges such as 40 - 100, we decided that the appropriate dimensions are 80 x 50 (Width x Height).
- After testing, a new bug arose that the food items only spawned in a specific small area. Which we fixed by deleting a conflicting line of code.

Background Image:

- Instead of the Black background, we changed the background to a newly designed kids-themed background. To test this with the new window size, we put a placeholder background image which created a new bug. The background is enclosed in a small area of the screen.
- We changed the dimensions of the background image to account for the game window size.
- Made the title integrated with the background of the cover page.
- Changed the name of the game.

Sprite:

- Instead of the snake, we changed the sprite to a train which changes color. Initially, we used only one color for the head, body, and tail, and tested the dimensions of the train, to make sure it looked correct and the game ran smoothly.
- The image is one from a set of 8 different colored images for each cart, and the images are cycled through.
- The head of the train stays either left or right. Its orientation remains in the direction it was previously moving in when moving up or down.
- The crash conditions were also changed, based on tested values, due to our initial changes in the code to accommodate the new size of the sprite.

Collectible:

- The collectible was altered from a strawberry to a person to represent the train picking up people in new carriages. The images were resized to account for the edge cases.

Sound effects:

- First, we implemented the in-game background music, which repeats in a loop. After testing this, a timer was constructed and, according to the fps, was adjusted so that the music would continue to play. The music only starts after the player has begun the game and stops when the game ends.
- We also changed the crash sound for a better user experience.
- For an immersive experience, we implemented turn sounds to indicate that the player (sprite) has changed its direction.

- We have implemented the lobby background music, which also plays endlessly. After a bug is found when the player tries to play again, the music stops and will restart for a set amount of time. Fixed the bug by adding a flag that changes to true when the game restarts and tells the program to start the music. However, we can see that the background music echoes. So we changed the button function to return true if it calls the action function. Accordingly, the background music plays.

Game Over display:

- Added a new game over the page, which shows the player's score.
- The screen gets cleared after this and displays the cover image.

Bug Fixes:

- The player (sprite), after the game ends, does not change its direction to the initial value; instead remembers the previous value. Thus, when the player crashes into the left wall, the game cannot be played as the player crashes into itself. So we initialized the player to face right.
- When testing, we saw that after the game ends, the in-game background image stays, which interrupts the game's homepage. We then decided to clear the screen after the player had crashed.
- Changing the fps to 6, as the game runs best at this fps when compared with other values
- Increase the time for which the game shows the crash image so that the user has enough time to see their score.

3. Verification

3.1 Test Cases for Sprint 1

In the first sprint, the main objectives were to increase the game's window size as each feature of the game is subjected to screen size and mapping. The goal was also to prevent any potential damage to the vision caused by playing the game. Also, the other feature is to add a background image so that it could be more appealing to kids. The test cases are listed as follows:

Related ID	Test Cases	Outputs / Results
1	Window size is larger than 1000px by 550px.	The game window is 1200 x 750 pixels and is increased by a substantial amount compared to the original
2	Background image can be loaded	The background image successfully loads into the game
3	Background image size fills the entire window	The background image doesn't fill the entire window and shows white spaces for the areas that don't get covered

Test Case Revision and Reflection to Developer

The window size is satisfactory and pleasing to look at compared to the original given code. This could be retained as the standard viewing window size in future game developments. However, despite the background image containing an appealing theme to kids, it doesn't fill the increased window size as expected. Therefore adjustments must be made to overcome this issue of excessive white spaces.

3.2 Test Cases for Sprint 2

In the second sprint, the main objectives are to resolve the background image issue from the previous sprint, add sound effects to the game, and remove the flickering issues of the button at the beginning of the game. The test cases are listed as follows:

Related ID	Test Cases	Outputs / Results
3	The background image fills the entire window without any excessive white spaces	The background image fills the updated window size without any issues
5	There is a sound effect whenever the direction of the train changes, and the sound effect is smooth	A sound effect is played whenever a direction change is made, and the sound is played smoothly without issues
5	There is a background music that is played that is played throughout the gameplay and without issue	The background music was able to be played smoothly, and increases player engagement
6	The flickering buttons at the start of the game are removed and displays their consistent colors	The buttons no longer flicker, and maintains a stable color throughout the main screen
6	The buttons are still functional after the flickering issues have been fixed	The buttons maintain their original functionality

Test Case Revision and Reflection to Developer

The background image has successfully filled the window size without any issues, and the sound effects exceeded expectations. Furthermore, the original flickering issues have now been fixed, and the user interface and experience have been significantly improved due to that. Overall, great progress forward.

3.3 Test Cases for Sprint 3

From the third sprint, the main objectives are to update the game's aesthetics, including changing the font, adding a feature story, and making the game objects larger and more colorful. Furthermore, the final objective of this sprint is to change the orientation of the object based on the direction it's going. The test cases are listed as follows:

Related ID	Test Cases	Outputs / Results
4	There should be at least five vibrant colors for the new train objects	The train displays a total of eight colours
6	The new train object replaces the original game object	The train perfectly replaces

	and retains the functionality of the original game object	the original game object and maintains the supposed functionalities
7	The new font can be displayed without issue and is clear to read	The fonts are clearly displayed without issue
9	The size of the objects are increased	The objects are at least 30 x 30 pixels
10	The orientation of the train turns left when going left, and turns right when going right	The train faces left when the train is going left, and faces right when the train is going right
10	The game ends when the object surpasses the borders of the screen	The game successfully ends when the object impedes the borders of the game screen
11	An executable file is created successfully and all ten criterias throughout all sprints are successfully completed	The game is in the form of an executable file, and the game music and background are all loaded correctly, with all criterias fulfilled from the previous sprints as well.

Test Case Revision and Reflection to Developer

The goals for the object sizes and colors have all been met, and all the functionalities and mechanics of the game surpassed expectations. The game is extremely engaging and is ready to be released.

3.4 Beta Testing

The beta testing was an essential step in finalizing our program as it gave us insights into the game's user experience. Since the game was made for kids aged 4-5, the product owner connected with the client, and we were able to test the game with her four-year-old son and make important design decisions to suit our target audience better.



The child didn't know how to use a computer, hence was tapping the screen at most points but eventually learned to use the arrow keys. The client agreed that it was a good learning experience for the child



interacting with technology. The child seemed to be engaged with the music and the flashing colors on the train. When he started playing the game, he also noticed that he should avoid the walls. Overall, the aspects added to the game to improve child engagement were a success.

While we were limited in being able to beta test with our target audience, we did the beta test with other older users, who were able to give more constructive feedback. They stated that the orientation of the train while going up and down was incorrect as it was oriented to go horizontally even while moving vertically. Unfortunately, this issue still occurred when the game was presented to the client due to time constraints.



4. Validation

4.1 Meeting Acceptance Criteria

ID	Acceptance Criteria	Not/Achieved	Client Feedback
1	The screen size should be larger than 1000px by 550px.	Achieved	Client was happy with the screen size.
2	The game should revolve around a central theme that appeals to the target audience.	Achieved	The theme revolving around trains appealed to the target audience that took part in beta testing. The client also approved of the theme and the elements relating to the same.
3	The game should have a background image and a cover page. The player and objects that interact with the player should be related to the theme.	Achieved	The game has a background image, a cover page, and a player who interacts with the object, all of which are related to the theme. Additionally, the client also with the game over screen
4	The player display should consist of multiple bright colors that are a core part of the gameplay.	Achieved	Instead of the train simply composed of numerous and bright colors, the colors of the trains change while the player moves. The client especially liked this feature.
5	The game should have background music when the session starts and when the cover page is loaded. The game	Achieved	The client requested that the cover page music be changed from electrical beats to a more calming classic piece. At the end of sprint

	should also implement sound effects related to the theme when needed.		three, this change was made, and the client approved it.
6	The cover page should not flicker, and the go and quit button should not glitch.	Achieved	The bug was fixed, and the screen no longer flickers.
7	The game should have a name and font related to the theme.	Achieved	The client was happy with the result of this criteria.
8	When the replay button is clicked, the game session should start, and the player should move without spawning in a place where it constantly crashes into a wall.	Achieved	When the client tested, this bug was fixed, and the client, therefore, had no complaints about software crashing.
9	The size of each object on the map of the game should be greater than 30px by 30px	Achieved	The client was satisfied with this criteria.
10	The player should be able to move through the map in all four directions corresponding to the correct arrow keys. Once the player crosses the border of the map, the game ends.	Achieved	Based on beta testing feedback, there was an issue with the train's orientation when moving vertically. However, the client did not see this as an issue. Moreover, the game-ending criteria are met.
11	The game is an executable file. The cover page is displayed when the executable file is opened, and the ten criteria listed above run correctly.	Achieved	The client was happy with the executable file and even liked the app's color image

4.2 Ideas for Further Improvements

Our client liked the game, but she had a suggestion of being able to make this game into a learning experience that was fun and engaging. Based on what our client suggested for further improvements, the following are some ideas that could potentially make the game better.

Minor Improvements:

- Change train orientation when moving vertically. The train should face the direction it's moving, such as if the train is moving up, it shouldn't be oriented in a horizontal direction.
- Increase frame rate without increasing the train's speed to make the game smoother.

Major Improvements:

- Make a .exe file that can run on windows and all mac operating systems. The current game is only able to run on Mac Monterey.

- The game can implement the alphabet as a learning experience for kids. Each cart can collect an alphabet and grow the train in order. This can help kids learn the alphabet in order.

5. User Manual

5.1 Description

A game where you control a train and try picking up people from the ground, and as you pick up more people, the size of the train increases. The game ends if you crash into a wall or crash into yourself.

5.2 Objective

The game's objective is to survive as long as possible and keep collecting more people without crashing.

5.3 How to Play

1. Select the 'Play' button on the loading screen to start the game or the 'Quit' button to exit the game.
2. The game map loads, and the train spawns facing towards the right with the head, tail, and a carriage.
3. Control the train with your arrow keys/WASD.
4. If you are moving in a particular direction, then you can only change to a direction perpendicular to the current direction you're going in.
5. The train is in perpetual motion and cannot be stopped midway
6. While moving, you must pick up the people icons to increase your score while simultaneously increasing the length by increasing the number of carriages
7. The game will end if you hit a wall or crash into yourself. After the game end, your score will be displayed for a few seconds before re-entering the loading screen.