

Feature List

Function Type	Function Completed	Function Description
UI Function	Start Page Selection	The player is enabled to select whether to start a game in single/multiplayer mode or exit in the start page.
	Loading Screen	The loading screen would be shown at the start of the game.
	Pause Screen	During the game, the player is enabled to pause the game by pressing the ESC button.
	Score Board	The score would be shown at the end of the game, and a score board would be stored for the player to check.
	Sound Effect	Added in-game sound effects and overall background sounds.
In-Game Stage Function	Level Generation	There are five levels in total, and each type of object in the level scene has a corresponding sequence number, the levels would be generated according to the sequence number in the textGrid.
	Camera	The camera would follow the movement of the train.
	Countdown	<p>The countdown system for the water carriage was set. When water has not been added for a specific period of time, the carriage would be on fire and the colour of the carriage would be changed, particles would also show on the carriage. After the player added water to the carriage, the countdown would be reset.</p> <p>The countdown bar would be shown at the right of the in-game scene.</p>

	Game End Detection	When the train reaches the end of the railway without reaching the station or the water carriage continues on fire, the game would end with failure. When the train reaches the station, the game would continue to the next level or show the final score.
	Position Projection	Press P for projection mode. A point would be shown for the position of placement, the point would turn to red if the item could not be placed.
	Terrain Detection	When wood was placed on the water, it would automatically become a bridge which allows the character to stand on.
	End-Stage Detection	When the railway reaches the station, the train would speed up to end the game.
Character Function	Character Movement	Use WASD to move, SHIFT to dash.
	Object Collection	Objects would automatically be collected and shown on the left side of the screen when collided with the character. A character is able to collect up to three objects at the same time.
	Object Placement	Press R to place the collected object.
Lighting	Character Lighting	A point light is applied to the character for better view in the night mode.
	Environment Lighting	Different environment lighting modes and skyboxes for day mode and night mode are applied to the scene.
	Train Lighting	A point light is applied to the head of the train and station for better view in the night mode.

AI Function	Assistant Automatic Pathfinding	The assistant would automatically find the nearest destructible object when holding the tool, and find the character when not holding the tool.
	Assistant State Change	There are four stages of the assistant: idle, finding the nearest destructible object, destroying destructible objects based on the tool and moving towards the character. When the player gives the assistant a tool, the assistant AI would change from idle state to finding state. The in-game UI would show the current status of the assistant.
	Enemy Automatic Pathfinding	The enemy uses pathfinding to navigate through the level, either randomly or to the nearest collectable object it detects to try and steal it.
	Enemy Behaviour Tree	The enemy drone is controlled by a behaviour tree, which is composed of three main branches. The first branch contains actions which detect nearby players and move away from them. The second branch contains actions which detect nearby collectables, navigate to them and steal them from the players. The third branch uses pathfinding to patrol through the level to search for collectables.
	Animal Random Pathfinding	The animal uses grid-based pathfinding to generate a random path to follow through the level when in 'wander' state, and roughly follows this path while maintaining smooth movement.
	Animal State Machine	The animal is controlled by a state machine. When the character, train or enemy is near, it would change from the wander state to the scared state and move away

		from the 'threat' at a faster speed.
Physics Function	Collision Detection	The player character would be rebounded when collided with indestructible rocks.
	Trigger colliders	Trigger colliders were implemented for the use of the AI agents to detect nearby players and objects. These colliders register collisions still and call the appropriate functions, but the collisions are not resolved and so the trigger colliders do not have any impact on physics objects.
Multi-Player Function	Icon display	The player's avatar would be displayed in the upper left corner in multiplayer mode
	Player Detection	The server would be notified when a new client is connected to the game. When the client leaves the game, the corresponding character would be removed from the game.
	Object State Transmission	Different packets are applied for different kinds of objects and information transmission.
Multi-Platform	PS5 Platform	Most of the game's features and content have been ported to the PS5 platform.
	Key Adjustment	The key positions and detection system have been adjusted to better suit the PS5 platform's joystick operation, and key jitter has been eliminated.
Debug	Debug Mode	Press B button for debug mode. The debug mode would hide the UI and show the current frame rate, current collision object of the character and position of the train. The path of the AI and type detect for the nearest destructible object would also be shown.

Platform	Keys	Features
PC	WASD	Character Movement
	R	Put down Objects
	Space	Interaction Functions(Cut tree, Dig rock...)
	P	Projection
	B	Debug Mode
	F9/F10	Lock/Unlock Camera
	F	Give tool to AI
	T/Y	AI chase/not chase character
	ESC	Pause
PS5	Left Stick	Character Movement
	R1	More information
	L1	Lock/Unlock Camera
	Right Stick	Move Camera
	Circle	Interaction Functions(Cut tree, Dig rock...)
	Cross	Put down objects
	Triangle	Projection
	Square	Put down railroad/Give Tool To AI
	L3/R3	AI chase/not chase character
	Options	Pause

Risk Assessment

Risk Type	Risk Description
Railway Texture	When a rail is put, the texture would change based on the direction of the nearest railways. However, if the railway is turned 180°, though the train would still move with the placement order, the

	railway texture would have errors in display.
Automatic pathfinding	Since the automatic pathfinding for AI is real time based on the current terrain, the frame rate would be lower than expected when the AI is calculating the expected path to the nearest object.
	When the player traps the animal and enemy in the corner, the player might be attached by the enemy due to the collision volume overlapping.
UI	When the networked game is running in client mode, the UI tool window will not be able to display correctly sometimes because of the network transmission.

Contribution Matrix

Group	Task	Member
Graphics	Model, Texture Loading and Rendering	Mo Han, Rui Zhang, Yupeng Mao
	Lighting System	Mo Han, Rui Zhang, Yupeng Mao
	Post Effects	Rui Zhang
	Animation	Hongxi Zhu
	Day and Night System	Yupeng Mao, Hongxi Zhu
	UI & Sound Effects	Rui Zhang, Mo Han
Engine	Character Features	Tianfeng Ma, Mingyu Wang, Mo Han, Hongxi Zhu
	Map Build	Mingyu Wang, Yanzhi Yang, Hongxi Zhu
	AI	Josh Frost, Mo Han
	Network System	Mo Han
	Physics System	Tianfeng Ma, Josh Frost, Hongxi Zhu
	PS5 Platform	Mo Han, Rui Zhang

Document	Document Editing	Yupeng Mao
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Demonstration Video

<https://youtu.be/cUqIk4fCExl>