3D HORROR GAME FOR HUNGRY GHOST FESTIVAL

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Abstract — **3D technology has become a crucial component of modern high-tech applications, including printing, manufacturing, and video games. Implementing 3D technology in video games brings about qualitative differences, offering complex controls and enhanced graphics compared to 2D games. Recognizing the preference of the new generation for alternative platforms like video games, this project aims to develop a 3D horror game for the Hungry Ghost Festival, an important celebration in Chinese culture in Malaysia. Following the Game Development Life Cycle (GDLC) model, the project progresses through planning, pre-production, production, testing, pre-launch, launch, and post-launch phases. Using Unity and Autodesk Maya, the game is designed and implemented. Usability and black box testing validate that the game effectively enhances users' understanding of the festival and provides an immersive horror experience. Overall, the project successfully achieves its goals as a Hungry Ghost Festival-based horror game.**

Keywords-component; Hungry Ghost Festival; Chinese Culture; 3D Technology

I. INTRODUCTION

The Hungry Ghost Festival is traditionally falls on the 15th day of the seventh lunar month which is usually around the month of August of the Western calendar and it is celebrated by Buddhists and Taoists. People who celebrate this traditional festival believed that the spirits will roam among the living when the "Gates of Hell" is opened on the first day of the seventh lunar month [1]. Most of the Chinese in Malaysia will pray to "Da Shi Ye" which also known as "Guardian God of Ghost" to avoid themselves being attack from the hungry souls that roaming through the towns. During this period, the Malaysian Chinese will prepare food offerings for the lonely spirits, burning joss sticks and papers, and burn paper effigies to appease the spirits. They believe that they will get a good luck if the spirits are satisfied with the offering.

Basically, it is a normal phenomenon appear in Malaysia during August for the Malaysian. However, many people with different religious and culture does not know what is the purpose for celebrate the festival even though they always see the festival getting celebrated every year. Thus, it will be great

to develop a 3Dhorror video game which explain about the hungry ghost festival with an interesting storyline as it could act as a tool for cultural representation.

The purpose of developing a game is because it can help people to take a break from what is happening in their offline world for a while. For instance, gaming could help people especially young people to relief their stress from work, school and daily life. Nowadays, there are many company create a horror games with a storyline that based on an actual historical event such as Outlast, Silent Hill and Resident Evil where it could pique people interest in learning more about the culture in which they are immersed. A horror game that thrive on a suspense-filled atmosphere makes people want to continue and discover more in the game to see what will happen next. Moreover, 3D gaming provides user a batter experience in playing horror game due to its high precision graphics. Thus, it could make user becoming immersed into the horror game to discover the narrative history about the Hungry Ghost Festival.

II. LITERATURE REVIEW

A. Origin and Significant of Hungry Ghost Festival

The Hungry Ghost Festival holds different perspectives for Buddhists and Taoists. For Buddhists, it is known as the Yu Lan Pen Festival, where offerings are made to ancestors to ensure their well-being in the afterlife. Taoists view the festival as a means to soothe wandering spirits released from the underworld. Traditional Taoist beliefs revolve around three deities: Tian Guan Da Di, lord of heaven; Di Guan Da Di, lord of earth; and Shui Guan Da Di, lord of water, who govern human fate [2]. The Hungry Ghost Festival marks the birthday of the lord of earth, symbolizing his arrival on Earth to record human actions. During this month, Taoist priests perform ceremonies and followers visit temples to confess misdeeds and pray for happiness. Buddhists make offerings to prevent their ancestors from suffering in purgatory. The festival serves as a platform for both groups to burn paper offerings for ancestors and wandering spirits, aiming to ensure a prosperous afterlife and alleviate suffering.

B. First Day of Hungry Ghost Month

On the first day of the Hungry Ghost month, people burn paper hell money outside their homes, shops, and along highways or fields [3]. This practice is often accompanied by visits to temples. Throughout this period, one is likely to encounter individuals engaged in this activity or find remnants of burned hell money on the ground. The purpose is to provide the spirits with the money they require during their special month. Additionally, people worship wandering hungry ghosts by igniting incense and offering food, believing that such offerings will prevent harm or curses. The city is adorned with red-painted paper lanterns, seen across commercial and residential areas. Ceremonies, including street ceremonies, market ceremonies, and temple rituals, are held to appease the spirits and ward off spiritual attacks. Participants gather in the streets and markets for festive celebrations, while monks conduct ceremonial activities in temples.

C. Last Day of Hungry Ghost Month

The last day of the seventh lunar month marks a special celebration as the gates of hell reopen. On this day, various customs are observed. Many people burn hell money and paper clothing, allowing the spirits to use them upon their return to the netherworld. Ancestors' photos and tablets are returned to their original places such as shelves or walls. Taoist monks chant to drive the spirits away, as they are believed to dislike sound and respond with screams and laments. In the evening, some families float river lanterns in small boats, constructing lanterns of different colors using wood and paper, with their ancestors' names written on them. It is believed that the spirits will follow these floating lanterns bearing their names

D. Types of Horrior Game

The horror game genre has a long history in the gaming industry, with millions of copies released to scare and thrill players. To help differentiate between different types of horror games, the following sub-genres and their characteristics can be identified:

1) Survival Horror Game:

This is the most popular sub-genre and focuses on survival rather than combat. It includes limited resources, deadly opponents, exploration, and inventory management. Players must make strategic decisions to survive, often emphasizing puzzles over boss fights. An example is Resident Evil 4.

2) Action Horror Game

This sub-genre balances action and horror, compromising scary features for better gameplay. Combat is a central element, and players are equipped with powerful weapons to defend themselves against hordes of enemies. Examples include Dead Space and Dying Light.

3) Steatlth Horror Game

In this lesser-known sub-genre, players have no defense against enemies except running and hiding. These games can be frustrating due to frequent deaths and restarts but offer the thrill of outsmarting deadly foes. Examples include SCP, Amnesia, and Alien: Isolation.

4) Psychological Horror Game

Psychological horror games focus on players' mental and emotional states to terrify them. These games often incorporate untrustworthy narrators, fourth-wall breaks, and unsettling subject matter. Examples include Doki Doki Literature Club, Soma, and Observer.

5) Jump Scare Horror Game

This sub-genre relies on building tension and delivering jump scares to frighten players. It prioritizes immediate scares rather than character development or exploration. Five Nights at Freddy's (FNAF) is a popular example of a jump scare horror game.

E. Element for Building Good Horror Games

A high-quality horror game possesses several essential elements that contribute to its overall impact. These elements include isolation, which maximizes the player's feeling of discomfort by isolating them alone in the game world. Tension is crucial in creating a successful horror game and can be achieved through various means such as limiting resources and creating visual lighting effects to heighten the player's anxiety. Disempowerment plays a significant role in horror games by taking away the player's ability or power, either by removing combat opportunities or providing tools that leave them vulnerable. Uncertainty and the fear of the unknown are essential in creating a terrifying atmosphere, while lingering fear ensures that the player continues to feel scared even after finishing the game. Lastly, providing an unbalanced, imperfect, and relatable protagonist adds to the plausibility and tension of the game. By incorporating these elements effectively, a horror game can deliver a truly immersive and memorable experience for players.

F. Comparison Between Existing Horrort Game

The essential element to produce a high quality of horror game that explained earlier will be the key to compared between the Silent Hill: Shattered Memories and Amnesia: The dark Descent. The comparison is shown in table 1.

TABLE I. COMPARISON BETWEEN SILENT HILL: SHATTERED MEMORIES AND AMNESIA: THE DARK DESCENT

Elements	Silent Hill	Amnesia: The Dark Descent
Difficulty Level	Easy, Normal, Hard	Normal, Hard
Type of Horror Game	Survival Horror Game	Stealth Horror Game
Combat	YES	NO
Tension	YES	YES

Isolation	YES	YES
Disempowerment	YES	YES
Uncertainty	YES	YES
Lingering Fear	YES	YES
Provide an Unbalanced,	YES	YES
Imperfect, Relatable Protagonist	79	88

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The proposed project will utilize Unity as the game engine and Autodesk Maya for 3D modeling and animation. Unity is a versatile game engine that supports both 2D and 3D graphics, offers a hierarchical organization of game objects, and provides a large asset store for additional resources. Autodesk Maya is a powerful 3D computer graphics software widely used in film, gaming, and other industries for creating realistic 3D models and visual effects. Together, these tools will enable the development of a high-quality horror game with immersive visuals and interactive gameplay.

III. SYSTEM DEVELOPMENT METHODOLOGY

The chosen methodology for the project is the Game Development Life Cycle (GDLC), which consists of seven phases shown in figure 1. This methodology is specifically designed for game development projects and provides a structured approach to the entire development process. By following GDLC, the project can ensure better estimates, stable system development, effective communication with clients, early detection of issues, and overall customer satisfaction. Unlike the Software Development Life Cycle (SDLC), GDLC is more suitable for addressing specific challenges in game development, such as graphics, collisions, and user input:

Figure 1.   Phases of Game Development Life Cycle (GDLC)

Phase 1: Planning
During the game planning phase of GDLC, it is essential to define the concept and key details of the video game project. For the proposed project, it involves answering important questions such as the type of video game to be released (a 3D horror video game), the key features (an interesting storyline centered around the Hungry Ghost Festival), the main character (a Chinese young man returning to his hometown during Hungry Ghost Month), the setting (an old building), the time (nighttime), the target audience, and the platform to be used for development. These answers provide a clear direction and foundation for the project, ensuring a cohesive and focused development process.

Phase 2: Pre-production
During the pre-production phase of GDLC, the focus is on transforming the proposed concepts from the planning phase into tangible elements. This phase involves designing characters, locations, interfaces, and other features to understand their relationship and how they contribute to the overall game experience. For example, the UI interface should incorporate elements related to the Hungry Ghost Festival, such as Chinese traditional elements and a darker color palette. The storyline for the game should also be developed and finalized during this phase, as it serves as a foundation for the entire project. Additionally, background music and sound effects that evoke a fight-or-flight response and increase adrenaline should be defined.

Phase 3: Production
The production phase of GDLC is challenging and requires significant effort, time, and resources. It involves developing and iterating on character models to ensure they align with the plot. The audio, such as footsteps on different surfaces, is checked for compatibility and realism. Creating a dynamic and immersive environment to accommodate various playstyles is also a priority during this phase.

Phase 4: Testing
During the quality control phase, thorough testing of every function and component in the game is essential. Testers check for bugs, ensure proper display on the screen, test obstacle collisions, examine if any features provide an unfair advantage, and assess if characters get stuck in random spots. Additionally, testers evaluate the "fun factor" of the game to gauge its appeal and satisfaction for players.

Phase 5: Pre-Launch
After extensive testing and refinement, the game can be prepared for a late-Alpha or Beta release. This phase involves making the game available to the general public for the first time, which can be challenging for developers who may have doubts about how the public will perceive their product. To generate interest, it is important to showcase sample gameplay or high-quality videos with engaging content before releasing the formal Beta copy to the public.

Phase 6: Launch
In the months leading up to a game's release, developers focus on resolving a backlog of bugs uncovered during testing. A bug hierarchy is created to prioritize issues, with game-crashing bugs at the top. Developers aim to polish the game and make improvements, such as extending mountain ranges, enhancing tactile features like leather straps, and addressing visual details like waving trees. Even small changes can enhance the entertainment value of a video game.

Phase 7: Post-Production
The seventh phase of GDLC involves addressing any remaining flaws in the game after its release. Game studios rely on player feedback to identify and fix issues through bug reports and online forums. Post-launch support includes frequent software updates and the release of new downloadable content (DLC) to enhance the game's replay value.

Project design involves planning and organizing all aspects of a game project, including the vision, goals, and scope. It includes defining specific features, mechanics, and content. This subsection will explain the state diagram and game design for the project.
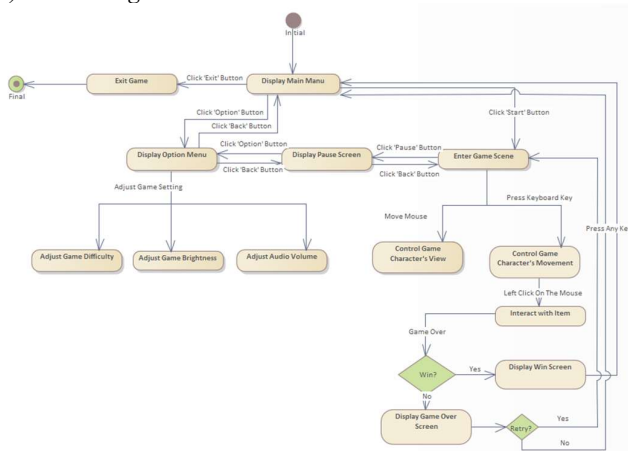
1) State Diagram

Figure 2. Project State Diagram

Figure 2 displays the state diagram for the game application. The main menu appears when the player launches the application, featuring buttons for "Start," "Option," and "Quit." Pressing "Start" leads to the game scene, while selecting "Option" displays the option menu for adjusting game settings. Choosing "Quit" terminates the application. In the game scene, the player controls the character's view with the mouse and movement with the keyboard. Left-clicking on an item interacts with it. After completing the game, a game over scene indicates the outcome, and pressing any key returns to the main menu. The game can be paused, and the pause screen offers options to resume or adjust settings.

2) Game Design

The game offers three difficulty levels: easy, medium, and hard. As the difficulty increases, the checklist items and the chance of being caught by the wandering ghost also increase. The objective is to survive for 2 days in the building. Players must explore and collect 8 randomly placed notes while avoiding the wandering ghost. They must also observe and interact with abnormalities in the building according to a checklist. If the player is caught by the ghost, the game ends. However, if all notes are collected and abnormalities are fixed, the game continues.

IV. IMPLEMENTATION

This chapter discusses the implementation process of the 3D horror game for Hungry Ghost Festival included the game user interfaces, game play, game mechanism and overall storyline for the 3D horror game for Hungry Ghost Festival.

A. Overall Game Play and Game Flow

Figure 3 displays the player control instructions, guiding the player on how to control the main character. Figure 4 shows the player interface during gameplay, with a central dot acting as a pointer for interactions. The progress of collected notes is shown at the bottom left corner, while the checklist icon is at the bottom right corner. Figure 5 demonstrates the checklist interface, accessible by pressing the 'C' key. Completed checklist items are struck through.

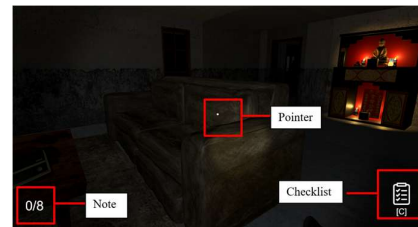
Figure 3. Player Control Instruction

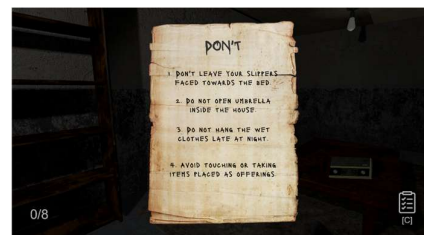Figure 4. Player Interface During Game Play

Figure 5. Checklist Interface

Figure 6.   Hiding Propt of Hiding System

Figure 6 depicts the hiding system, featuring a closet where players can hide from the wandering ghost. A prompt appears at the top of the screen, indicating the hiding option. By pressing the 'E' key, the player can hide in the closet while still observing the movements of the AI enemy from the inside.

B. Implementation of Game Settings

This section discusses the game setting feature, allowing players to customize audio volume, brightness, and game difficulty. It includes a serialized 'Sound' class storing audio information and uses 'Audio Source' components to control individual sound elements. The volume setting is saved and loaded using 'PlayerPrefs' for consistency across game sessions. For brightness setting, it uses the Unity Post-processing Stack components and a slider UI element for adjusting brightness. The brightness setting is saved and automatically applied upon loading the game scene using 'PlayerPrefs'. For game difficulty, a TMP_Dropdown UI element provides difficulty options, and selecting an option triggers the OnDifficultyChanged method. The selected index is mapped to the corresponding AI Enemy speed value, which is saved using 'PlayerPrefs' for persistence across scenes. The difficulty dropdown is disabled when not in the main game scene to prevent adjustments during gameplay.

C. Implementation of Player Interaction

Player interaction keys are essential in games, allowing players to interact with the game world and its objects, uncovering secrets and important clues. When the player interacts with an object within a certain distance, the PickUpNote function checks if the object is a note that can be picked up. A random number is generated to determine which note to pick up, ensuring unpicked notes are chosen. The code then updates the UI with the content and date of the selected note, destroys the note object, and marks the note as picked.

For object interaction, it uses raycasting to detect objects in front of the player and performs specific actions based on the object's tag, such as displaying a dialogue message for objects like "Vase," "Lamp," "Table," "Chair," and "ClothRack".

D. Implementation of Checklist

The input for opening and closing the checklist interface using GetKeyDown('C'). While the interaction mechanism is similar to object interaction, the checklist modifies game variables or triggers other game events for specific checklist objects.

For instance, if the player interacts with an object tagged as "Dryer" and has two wet clothes, a dialogue is triggered indicating that the clothes will be dried. The wet clothes counter is then reset. If the player successfully dries the wet clothes twice, the corresponding checklist item is marked as completed by applying a strikethrough effect on the UI text.

E. Implementation of Hiding System

The hiding system in the game is implemented through the "Hide" script and "Door" script. The "Hide" script manages the hiding functionality, while the "Door" script detects player interactions with closets using raycasting. In "Hide" script, a coroutine named "Animation" is responsible for handling animations and movements when entering or exiting the closet. The "CoroutineEnter" and "CoroutineExit" functions call this coroutine when the player presses the interaction key ('E') while facing the closet. The "Pressed" function retrieves the "Hide" component attached to the closet object and invokes the appropriate coroutine based on the current hide state. Furthermore, trigger-based events are employed to display text prompts. The OnTriggerEnter and OnTriggerExit methods check the current hiding state and show or hide the text prompt when the player enters or exits the collider, as illustrated in Figure 7.
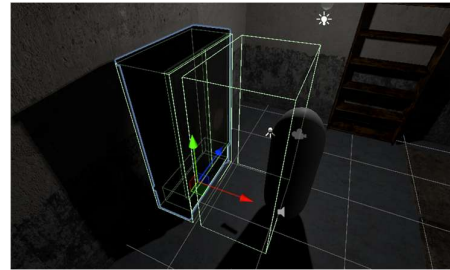

Figure 7.   Collider of Closet

F. Implementation of Enemy AI

There are various variables are declared including references to the NavMeshAgent component, wait times, speeds, view parameters, masks for player and obstacle detection, and waypoint positions in Enemy AI script. The script also includes variables to track player positions and the states of the enemy, such as patrolling, chasing and attacking. The "EnvironmentView" function is used to check whether the player is in the enemy's field of vision. It uses an overlap sphere to find the player and checks if there are obstacles between them using raycasts. If the player is within the view angle and not obstructed, the enemy enters the chasing state and moves towards the player's position. In the "Update" method, the script checks the current state of enemy and calls the appropriate method accordingly. The "Chasing" method makes the enemy move towards the player's position and checks if it has caught the player or should return to patrolling. Meanwhile, the "Patrolling" method makes the enemy move between waypoints and detects if the player is nearby. The script also includes a coroutine called "waitForAttack" that handles the enemy's attack behavior. It waits for a specified time and then reduces the player's health. There are also helper methods like "Stop"

and "Move" to control the enemy's movement and animation states.

V. Testing and evaluation

This chapter will analyse the developed project in different aspect based on the evaluation that had been carried out. The target testers are all above 12 years old and have a different culture background. A pre-test and post-test questionnaire was distributed to the testers before and after they tested.

A. Usability Testing

During the usability testing, 30 testers from diverse backgrounds, ages, cultures, and genders participated in evaluating the 3D horror game related to the Hungry Ghost Festival. The testing took place through online and offline sessions, with a pre-test questionnaire gathering personal information, gaming experience, and understanding of the festival. A post-test questionnaire collected feedback on the game experience.

Most respondents were between 21 to 25 years old, with an equal distribution of males and females. The majority identified as Chinese, followed by Malay, Indian, and other ethnicities. In terms of gaming habits, 11 respondents played games daily, while others played 3-6 days per week or not at all. Approximately 73% had prior experience with horror games, and opinions on whether they helped release stress varied. About half of the respondents claimed familiarity with the Hungry Ghost Festival, while others were unfamiliar or unsure, demonstrating varying levels of knowledge.

The post-test questionnaire indicated positive ratings for the overall experience, with 76.7% and 20% of respondents rating it as good. The clarity in delivering objectives and tasks garnered strong agreement from 63.3% of respondents. The game's atmosphere and immersion received high praise, with most finding it very immersive and effectively capturing the festival's essence. Around 66.7% strongly agreed that the game represented the festival's traditions and beliefs, with a significant proportion gaining knowledge through playing. Satisfaction levels were high, with 69% being very satisfied. Feedback included requests to change the ghost model, lower game difficulty, add more Chinese traditional elements, and improve dialogue and subtitle speed.

Overall, the usability testing yielded positive feedback and satisfaction with the 3D horror game, its immersive experience, and its ability to convey the traditions and beliefs of the Hungry Ghost Festival. The feedback provided valuable insights for enhancing cultural elements and addressing specific gameplay aspects.

B. User Acceptance Testing (Black Box Testing)

The black box testing phase involved 15 target users who were given a 15-minute session to explore the application independently. The goal was to evaluate their ability to navigate and interact with the prototype. The testing included 17 predefined actions, and the results were recorded for analysis.

Overall, the users were successful in selecting different options in the main menu, adjusting game settings, controlling player movement, and exploring the game environment. They were also able to hide in the closet, pick up and use the torchlight, and interact with notes and checklist items. However, there were some instances of failure, such as difficulty in unhide from the closet and triggering dialogue with objects. Some users did not interact with checklist items or press the retry button after game over. Additionally, not all users proceeded to the next level as they were unable to find all the notes or complete all checklist items. Despite these issues, the majority of the predefined actions were completed successfully by the users.

VI. Conclusion

The proposed project is a 3D horror game centered around the Hungry Ghost Festival. It successfully achieved its objectives, which included analyzing the requirements for developing the game, designing an immersive experience that promotes cross-cultural understanding of Chinese culture, and evaluating the game's impact on individuals from different cultures. Through user testing and feedback, the game proved to be well-received, entertaining players while also serving as an educational tool to deepen their understanding of Chinese traditions and foster cultural appreciation.

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