Development of adventure games and puzzle solving in mysterious museums

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***Abstract*— This research explores the development of an adventure and puzzle game set in a mysterious museum filled with artifacts and challenging gameplay. The game uses 3D and AI technologies to augment reality and engage players with cultural content. Players interact with artifacts to learn about their history, solve puzzles, and stimulate critical thinking. The game's atmosphere is enhanced with lighting, sound, and storytelling, while AI is used for 3D models and environment manipulation. However, high-resolution graphics impact performance, and balanced puzzle design remains a challenge. Future enhancements include a VR version of AI-driven NPCs for deeper immersion, and procedural puzzles for greater replicability.**

Keywords*— *adventure game, puzzle-solving, cultural heritage, AI.

I. Introduction

Cultural centers are places to preserve and disseminate a country's artistic and cultural heritage, which are essential for building pride in its history and culture. In an era where technology has become an integral part of daily life [1], cultural centers are facing the challenge of appealing to a new generation who consumes media and entertainment differently from previous generations [2]. Today's youth tend to seek out convenient and easily accessible information through digital media, such as online games or applications, and are less interested in visiting museums or cultural centers that require time or travel [3]. As a result, many cultural centers experience a decline in audience engagement, which could affect the sustainable preservation and dissemination of culture in the future. Accessible and fun cultural performances have emerged as an interesting alternative to attract young people, especially digital games, which are one way to connect players with culture, creating fun and challenging experiences [5].

Adventure and puzzle games are genres that can present history and cultural heritage in an engaging way. Players must explore a game world, such as a mysterious museum filled with artifacts and hidden stories, by solving puzzles and searching for clues [6]. For example, a game may require players to use their analytical and creative skills to solve puzzles about the history of an object, or simulate a real-world museum or cultural site, allowing players to learn about the culture through a virtual experience [7].

Developing these games requires sophisticated design to present culture in a valuable and accessible way. The use of modern tools allows the creation of 3D virtual worlds and realistic graphics, which provide players with a high-quality gaming experience, allowing them to explore and understand cultural heritage and history more deeply [9].

While developing these games is challenging due to the need to design puzzles that fit into realistic environments, the most important thing is to use technology to connect young people with cultural heritage. Digital games can create a bridge between the digital and real worlds, allowing young people to understand and appreciate cultural values in a modern and accessible way [10]. Game development not only enhances cultural knowledge and education, but also provides a fun and valuable experience, motivating young people to learn and participate in the conservation of cultural heritage in a way that is appropriate for the digital age [11].

This article is structured as follows: Section 1 Introduction Section 2 Literature Review Section 3 Describes the Research Design Section 4 Results and Discussion and Section 5 Conclusion.

II. Literature review

The study and development of digital games to promote learning about cultural and historical heritage has become a field of continuous interest in the past decade, especially in an era where digital technology plays a major role in our daily lives. Digital games can enhance the fun of playing games and can also create interesting and immersive learning experiences. They allow players to explore and understand cultural heritage through interaction with the virtual world, solving puzzles, and exploring places that reflect history, art, and culture in an easily accessible and modern format [1].

Several studies have provided important information in support of the use of games as a tool for studying and preserving culture. It has been found that games can stimulate interest and increase learning better than traditional methods of education, especially when the game includes elements of puzzle-solving and exploration of a virtual world offering cultural content. Participating in the problem-solving process through games not only helps players practice their critical thinking skills, but also allows them to experience and understand culture in a more concrete and interesting context.

The incorporation of digital games into the learning process has been recognized as an effective approach to increase understanding and interest in history, arts, and culture. Research studies have shown that games are an effective medium for promoting cultural learning by offering engaging and intellectually stimulating experiences [7]. By providing information through interactive gameplay, players are able to actively engage with historical and artistic content, thus gaining valuable cultural knowledge.

Studies have also found that incorporating digital media in museums and cultural centers makes it easier for visitors to access information and experience culture. The use of games and digital applications has made museums more engaging

and has attracted young people to cultural heritage [10]. Furthermore, research exploring the use of AI in 3D modeling of objects in digital games allows players to experience cultural and historical heritage in detail through object creation and in-game interactions.

Based on these studies, it can be concluded that digital games are a potential tool to promote learning and preserve cultural heritage by combining elements of exploration, puzzle-solving, and presenting cultural information in a realistic and interesting way. This can attract players to understand and appreciate culture in a modern and easily accessible way.

III. Methodology

A. Game Design

In developing the digital game for this cultural center, we used a design process that took into account both entertainment and learning, starting with the study of the cultural content we wanted to present, such as the history of the artifacts in the museum. The player must press the object in order for the object to display the information for the player to read. By collecting data in the database in order to display images and information in the game so that players can understand the history of the object or the design of the object. Creating a virtual environment with the ability to create graphics. Realistic and compatible 3D AI for 3 D modeling of various objects.

B. Content Development

In the process of creating game content, developers collect data from cultural centers and other sources to ensure that the game content is engaging and educational, in order to create an immersive experience that reflects authentic cultural elements. Once the data is collected, developers refine and adapt it into a format suitable for gameplay, including designing puzzles that require players to analyze clues, decipher symbols, or solve logical challenges inspired by real-world history. These puzzles are strategically integrated into the game's progress, requiring players to engage deeply with the content to unlock new areas, discover hidden stories, and pass levels. In addition to solving puzzles, there are also exploration mechanics that encourage players to discover and interpret historical artifacts or cultural relics. Engaging with these elements not only helps players develop problem-solving skills, but also helps them better understand different cultures and histories.

C. Use of AI Technology

AI technology plays a crucial role in automatically generating and customizing 3D models within a game environment, improving the realism and detail of a scene without much manual work. By leveraging AI-driven techniques, developers can efficiently add diverse and dynamic objects to a game scene, resulting in a rich and immersive experience.
By integrating AI into scene modeling and decoration, game developers can significantly reduce the manual workload while creating more dynamic, realistic, and immersive environments, which not only enhances the visual storytelling, but also makes each scene come alive and responsive to player interactions.

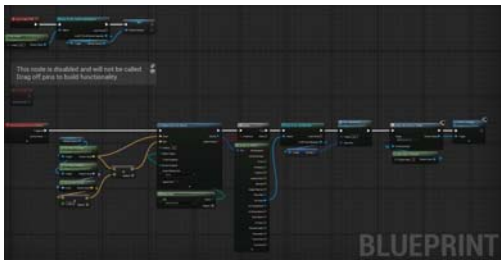


Fig. 1. A set of instructions for object display its history to the player.

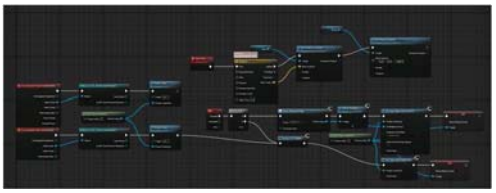


Fig. 2. A set of instructions for object move when the player enters the code.

Fig 3. The command set for setting the button.

Fig. 4. A set of instructions to check if the code is correct.

(A)

(B)

Fig. 5. AI Tool (A) Tripo Tool (B) Spaces Tool

D. Game Testing

To ensure that players get a good experience with their game, developers continuously test their game throughout the development process. Testing includes functional testing, performance testing, and usability testing to ensure that the game works according to standards and is suitable for the target audience.

E. Evaluation and Improvement

After testing the game at different stages, the developers collect the test results from the players to evaluate the game's performance in terms of attracting attention. Then, the game will be improved and improved in all aspects, especially in terms of content and player experience.

IV. Result and Discussion

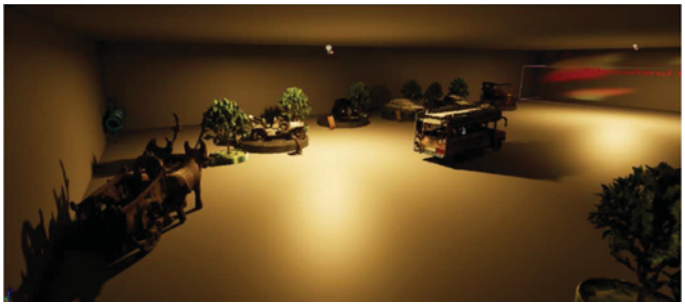
The research findings show that the adventure and puzzle game set in a mysterious museum effectively meets players' needs across multiple aspects. In particular, the game scored an average of 4.40 for graphics, environment design, puzzle complexity, and gameplay mechanics, reflecting the game's ability to create an exciting and challenging experience. Players appreciated the realism of the graphics and the detailed environment design that enhanced immersion. Additionally, the puzzles were well-designed, challenging but not frustrating, allowing the game to strike a balance between fun and difficulty.

In terms of sound design and atmosphere, the game received a score of 4.30, indicating that players found the sound and the mysterious atmosphere effectively engaged them in the game world. The use of AI to create lighting and shadows, along with 3D model design, enhanced the game's visuals, although the use of high-resolution technology could impact performance, particularly on devices with limited resources.

In the area of educational value, the game achieved the highest score of 4.67, showing that players gained knowledge about history and culture while playing. This is a standout feature of the game, as it combines interactive learning with entertainment. Players could interact with objects in the museum and access related information and stories, turning learning into an enjoyable and beneficial experience.

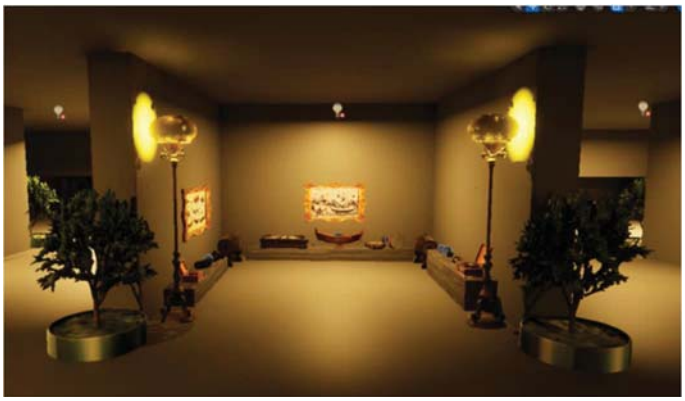
However, game developers face challenges in designing puzzles with moderate difficulty to avoid player frustration or boredom, while ensuring the game performs well on a variety of devices. Furthermore, adding NPC that assist or hinder players could increase the challenge and intrigue of the game. Future development of a VR (Virtual Reality) version could enhance realism and further boost player engagement. Introducing a procedural puzzle generation system would add variety, preventing the gameplay from becoming repetitive and keeping players challenged with each round. Overall, the research demonstrates that this game successfully combines entertainment and education, providing players with a fun and valuable learning experience.

Fig 6 Menu start.



(A)

(B)



(C)

Fig 7. (A) Shows a model car used for decoration. (B) Arranges a model that provides knowledge about the items on display related to sailing. (C) Displays Thai musical instruments.

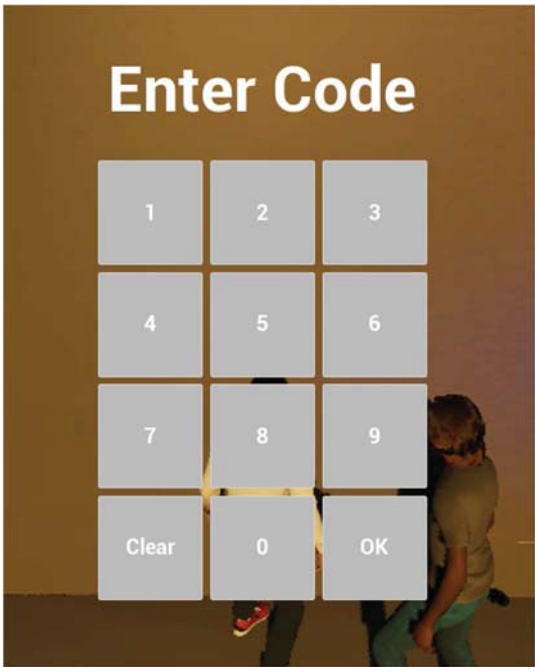


Fig. 8. Puzzle inside the scene.

Fig. 9. Game pause menu

V. Conclusion

From the study and development of adventure and puzzle games in a mysterious museum full of antiques and challenging gameplay mechanics, it was found that the use of 3D and AI technologies in games can effectively increase realism and attract players. Designing games that focus on exploration and solving puzzles in a virtual world promotes learning about cultural heritage and history through interacting with objects in the game, such as studying information about antiques, allowing players to learn in an accessible and fun way. The evaluation results found that players were highly satisfied in many aspects, such as graphic and environmental design, puzzle complexity, and gameplay mechanics, especially in learning about history and culture, which received the highest score of 4.67, indicating that this game can perfectly combine learning and entertainment. The design of this game can provide players with an experience that is both fun and valuable in learning. the development of this game also encountered challenges in designing puzzles with an appropriate level of difficulty so that players do not get bored or discouraged, as well as customizing the game to support operations on a variety of devices, especially the use of high-resolution technology that may reduce game performance on low-spec devices. For future development, consideration should be given to adding NPC that play important roles in the game to increase challenge and make the game more interesting. The development of VR (Virtual Reality) games can enhance the challenging experience for players through deeper and more immersive engagement. However, future VR developments may face several limitations, such as hardware and accessibility limitations. Using VR for a long time may cause dizziness, fatigue, or vision problems. In addition, the addition of an automatic puzzle generation system will make the game less boring and create new challenges every time you play. Overall, the development of this game is a good example of using digital technology to promote learning about cultural and historical heritage by combining education and entertainment to allow players to learn in a modern and fun way. This game is a potential tool to effectively connect players with cultural heritage in the digital age.

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