# ARTIFICIAL INTELLIGENCE-BASED ANALYSIS APPROACH ON VISUAL PATTERNS OF USER GRAPHICAL INTERFACE (GUI) IN INDONESIAN VIDEO GAMES

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**Abstract:** The design of the GUI (Graphical User Interface) is one of the important aspects in the video game design process, because it also affects the experience and interaction experienced by players, or what we called as HCI (Human Computer Interaction) in a video game. Although GUIs are also used in other software, GUIs for video games use a fundamentally different approach. Video games have been intended from the beginning to provide an interesting and entertaining experience, so the visual design of video games must consider the various values and systems that are typical of the gaming experience. This process is different from the design approach applied to traditional visual media. In designing video games, designers are faced with various unique values and systems in video games, such as challenge, immersion, and social interaction, so the design of video games must go through a more thorough understanding of the relationship between players and the GUI in video games. Given its unique nature, the study of video games design requires a new approach and method to do GUI analysis. Through the use of artificial intelligence technology, video game researchers can explore the potential use of AI in analysing and optimizing video game GUIs. This paper seeks to offer a method of applying AI in the analysis of visual patterns that appear in video game GUIs. The data collected using AI can then be used to personalize the GUI and optimize the user experience, for example to identify common navigation patterns, the use of UI elements, and input from the player. As a result, the information obtained can be used to improve the GUI of video games and make them more intuitive and responsive.

**Keywords:** Video Games, GUI, HCI, AI, Visual Patterns.

**Introduction**

A Graphical User Interface, or GUI, is a crucial element in video game development. Serving as the bridge between player and game world, the GUI significantly influences the overall gameplay experience and interaction. A well-designed video game GUI seamlessly integrates players into the virtual world, fostering immersion and enjoyment. Conversely, a poorly designed GUI creates barriers, leading to frustration and disinterest. While GUIs are common in software applications, their implementation in video games presents unique challenges and opportunities. Unlike conventional software designed for specific tasks, video games prioritize engaging and entertaining experiences. This fundamental difference necessitates a distinct approach to both the design process and analysis of video game GUIs.

This study, presented as a proceeding, aims to be a preliminary step in exploring the complexities of visual pattern analysis within Indonesian-made video game GUIs. As with many studies requiring visual analysis, researching video game media using traditional methods often presents challenges due to the large and diverse nature of visual data. Traditional visual analysis methods frequently become time-consuming in both process and interpretation because of the sheer volume of visual information present in video game GUIs. The dynamic and interactive nature of these interfaces further complicates analysis, as video game GUIs adapt, and change based on player choices and game state. This inherent complexity necessitates the implementation of innovative analytical approaches capable of handling the scale and dynamism of video game GUI visual data.

To address these challenges, Artificial Intelligence is anticipated to be a powerful solution. AI is currently offered as a potential solution to revolutionize the analysis and optimization of various data, including data related to video game GUIs. AI-powered analysis systems are predicted to have the capacity to sift through large datasets, identify complex patterns, and generate insights that would be difficult to achieve through manual analysis. This research

explores the application of AI as a means to decipher the visual language of Indonesian video game GUIs, providing a proof of concept for a novel approach to GUI analysis.

While the potential of AI-assisted GUI analysis is substantial, it's important to acknowledge the potential challenges in applying this method, given the complex and dynamic nature of video games. The sheer volume of visual data in modern video games presents significant computational challenges. Furthermore, the subjective nature of video game aesthetics and user experience adds another layer of complexity, as what constitutes a "good" or "bad" GUI can vary greatly depending on individual preferences and the cultural context of both the game and its players. This research acknowledges these challenges and aims to address them through a critical and methodical approach to AI-assisted visual GUI analysis.

A specific focus on Indonesian-made video games as the object of research is another facet of this study. Indonesian-made video games are characterized by a unique blend of local cultural influences and evolving global gaming trends. One title that embodies this fusion is "Ghost Parade," developed by Lentera Studio. "Ghost Parade" is a horror-comedy platform adventure game inspired by Indonesian folklore ghost characters. The choice to analyse the GUI of "Ghost Parade" is intended to be part of a larger main research project and is expected to provide valuable insights into how cultural factors contribute to shaping GUI design to meet player expectations. This research contributes to a broader understanding of the influence and interplay of cultural nuances on video game GUI design, highlighting the importance of considering cultural context in developing globally appealing video games.

Fig 1. Ghost Parade Video Game

This research also serves as a preliminary exploration of the potential of AI in assisting visual analysis within visual research. It is certainly an initial study and can be considered a proof of concept demonstrating the feasibility and potential benefits of this approach. The findings from this research will lay the groundwork for future studies that delve deeper into specific aspects of GUI design, such as the impact of cultural factors, the relationship between GUI elements and player behaviour, and GUI design optimization for different game genres. Through leveraging AI assistance, future research is expected to unlock new possibilities for understanding and enhancing player experiences in the ever-evolving world of video games.



**Research Method**

The method employed in this research utilizes a mixed-methods approach, combining qualitative and quantitative analysis to investigate visual patterns present in Indonesian video game GUIs. This mixed-methods approach is carried out using AI tools and human interpretation for contextualization and meaning making. The theoretical framework guiding this research is based on principles within the User Interface design theory framework, applied to video game GUIs. The core principle is that an engaging and intuitive UI is a crucial aspect of game design. According to Nielsen (Nielsen, 1993), game developers must strike a balance between robust functionality and a simple, clear interface. Effective game UI design is guided by several key principles, including clarity, consistency, simplicity, functionality, aesthetics, feedback, customization, and accessibility.

Clarity, according to Pandian and Cai (Pandian & Suleri, 2020) (Cai, 2009), is paramount, as players must quickly grasp the purpose and behaviour of each UI element. Consistency across the entire UI is also essential, ensuring a seamless and predictable user experience, as highlighted by Nielsen (Nielsen, 1993). Simplicity should be a guiding principle, as overly complex UIs can overwhelm and frustrate players (Cai, 2009). Functionality is a core requirement; the UI must enable users to efficiently perform necessary actions and access relevant information (Ruiz et al., 2020). Aesthetic considerations are also vital, as a visually appealing and cohesive design enhances immersion and engagement (Ruiz et al., 2020). Meaningful feedback, such as clear indicators of player actions and system status, is crucial for a responsive and intuitive interface (Nielsen, 1993), (Gould, 1987). Customization options allow players to tailor the UI to their preferences, improving overall user satisfaction. Finally, accessibility features, such as adjustable text sizes, colour contrast, and alternative input methods, ensure inclusivity for users with diverse needs and abilities (Pandian & Suleri, 2020), (Cai, 2009), (Gould, 1987), (Nielsen, 1993). These GUI design

principles will be used to determine which aspects of the video game's visuals will be recorded for further analysis.

Visual pattern analysis conducted in this Indonesian video game GUI research also employs the following categorization of video game UI elements. First is Diegetic UI. This UI in video games becomes elements within the game world and is often justified by the game's narrative. Examples include health bars displayed as part of a character's armor, or interactive elements like in-game computer terminals. Diegetic UI enhances immersion by placing the interface within the game's reality. Discusses how augmented reality systems in games can be considered a form of diegetic UI, blurring the lines between the game world and the player interface. Second is Non-Diegetic UI. This UI becomes elements that are *external* to the game world and are displayed directly to the player. Common examples include health bars, minimaps, and menus. Non-diegetic UI prioritizes functionality and clear communication of information to the player. Mentions how players can modify their UI, which demonstrates the customizable nature of non-diegetic elements. Third is Spatial UI. This category refers to UI elements that are integrated into the 3D game space itself. Examples include holographic projections, world-space markers, and interactive objects within the environment. Spatial UI can enhance immersion and provide direct, contextual information within the player's view. (Interface, 2023) mentions UI design for VR games, which likely involves spatial UI elements due to the immersive nature of VR. Fourth is Meta UI. This UI becomes elements that provide information or feedback *about* the game or the player's performance, not about the game world itself. Examples include achievements, progress bars, and tutorial prompts. Meta UI elements can enhance player engagement and provide a sense of progression. Discusses game design elements that support learning objectives, which often involve Meta UI elements to provide feedback and track progress. This GUI classification based on these elements will later be used in the interpretation process of the descriptions generated by AI.

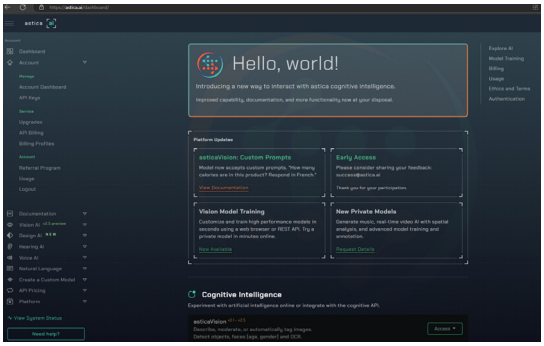

Fig 2. AsticaVision AI

The visual data within the video game will be recorded using screenshots. These screenshots will then be uploaded to an AI application called AsticaVision, which has automatic image recognition and moderation features based on GPT-5 for various visuals, including pictures, paintings, and photos. After analysis by the AI, the inputted video game GUI screenshots will generate text descriptions of the images. These descriptions will detail the objects present, their composition, colours, and various other visual elements contained within them. The generated descriptive text will then be interpreted by the researcher and linked to the video game GUI theoretical framework previously explained.

**Discussion and Results**

As explained in the introduction, this research primarily focuses on demonstrating the successful analysis of visual patterns in Indonesian video game GUIs using an AI-based analytical approach. The AI algorithm is trained using a dataset of screenshots from the Indonesian video game "Ghost Parade," a horror-comedy platform adventure game. The main objective is to identify recurring visual patterns that appear in the video game GUI and categorize them based on the existing game element classifications: diegetic, non-diegetic, spatial, and meta.

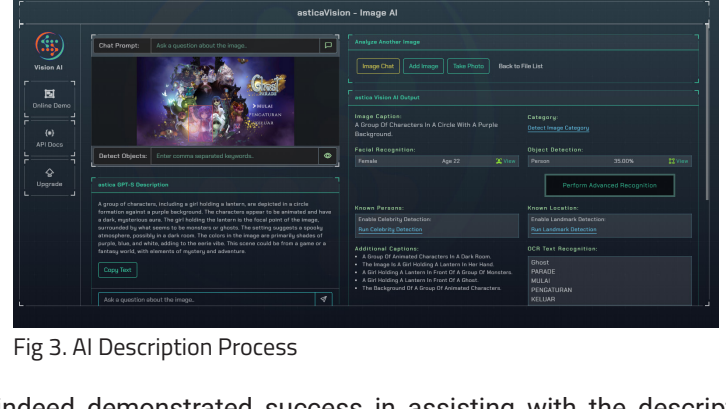

Fig 3. AI Description Process

AI has indeed demonstrated success in assisting with the description and identification process, thereby aiding researchers in categorizing GUI elements based on the predetermined classifications. After interpretation by the researchers, the AI consistently identified diegetic elements such as health bars, mini-maps, and other in-game prompts integrated within the game world. The algorithm effectively helped differentiate these elements from background visuals and other game assets, demonstrating a strong understanding of spatial relationships within the game's visual space. Similarly, the AI excelled at recognizing non-diegetic elements like menus, inventory screens, and HUD components. The algorithm accurately classified these elements within the game world, showcasing its ability to distinguish between diegetic and non-

diegetic information displays. Furthermore, the AI proved adept at analysing the spatial characteristics of GUI elements, such as size, placement, and proximity to other elements. This enabled the identification of common spatial patterns, such as the frequent placement of health bars in the top corner of the screen or the consistent use of central positioning for interactive menus. Finally, the AI successfully identified Meta elements, including loading screens, tutorial prompts, and settings menus. This highlights the AI's capacity and potential to assist researchers in recognizing elements related to the game system itself.

Despite its successes, the AI-based analysis also encountered some limitations. One key challenge was the AI's ability to recognize visually complex or cluttered GUI displays. In games with numerous overlapping or dynamically changing GUI elements, the AI sometimes struggled to accurately isolate and categorize individual components. This suggests that the AI's effectiveness is influenced by the visual complexity of the GUI itself. For instance, during the image recognition and description process, when the AI encountered video game screenshots with abstract textured backgrounds, it experienced what is called image delusion or recognition failure, which often occurs when the AI cannot provide an answer due to a lack of database information. In this case, the AI used described the abstract textured background as a specific figure or shape. Furthermore, the AI faced difficulties in interpreting the semantic meaning of GUI elements. While the AI could identify and categorize elements based on visual characteristics, it lacked the ability to understand the underlying function or purpose of those elements. For example, the AI could recognize a button but couldn't determine the button's function. This limitation underscores the importance of human interpretation in contextualizing the AI's findings. Finally, the AI analysis was limited by the quality and diversity of the training dataset. The accuracy and generalizability of the AI's findings depend on the representativeness of the training data. Biases or limitations within the dataset could potentially influence the AI analysis and lead to inaccurate or incomplete conclusions.

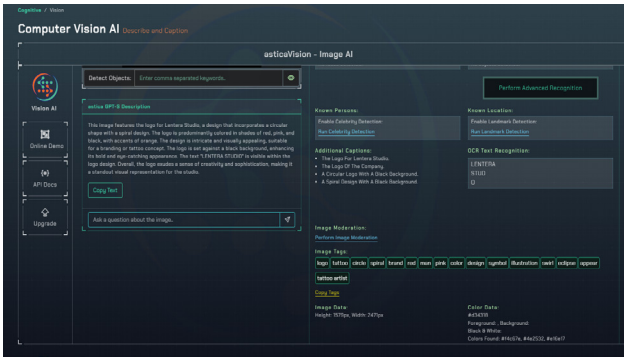

Fig 4. AI Misinterpretation

The AI-driven analysis approach offers a novel method for identifying and categorizing GUI patterns, complementing traditional human-centred analysis methods. However, it's crucial to acknowledge the limitations of AI-based analysis and the continued importance of human interpretation in contextualizing and validating the AI's findings. Future research could explore the use of more sophisticated AI techniques, such as deep learning, to address some of the limitations identified in this study. Additionally, future research could also utilize AI with larger databases than currently available, leveraging datasets from previous studies.

**Conclusion**

As a conclusion of the research, two important points were obtained, namely that: Visual GUI analysis through AI assistance proves its significant potential in accelerating video game GUI analysis. The enormous volume of visual data generated by modern video games, covering various UI elements, dynamic transitions, and their various states according to their interaction with players, does present a significant challenge if using manual analysis. AI algorithms, which have been adequately trained in image recognition and description, can process visual data more efficiently, AI is also able to identify and describe visual elements with a level of detail and speed that surpasses human capabilities. This automatic analysis allows researchers to manage extensive GUI image datasets, taken at various game states and player interactions, more easily and efficiently. The ability of AI to describe visual elements, such as shape, colour, position, and their relationship to other elements, provides a structured basis for further analysis. This descriptive data can be used to categorize GUI elements, identify recurring patterns, and track changes in the GUI over time, which facilitates a more comprehensive understanding of the visual design choices used in video games.

While AI-assisted analysis offers a valuable automated alternative for visual descriptions, human interpretation remains essential for contextualizing the AI's output and drawing meaningful conclusions. AI descriptions, although detailed, sometimes fail to accurately describe the analysed visuals. This can be seen in the discussion of the analysis results where the AI recognized abstract shapes as specific forms. AI still requires human assistance to recognize shapes that are not present or not yet included in their database. Researchers, therefore, must interpret the AI-generated descriptions, correctly categorize GUI elements based on their function and purpose within the game, and create contextualization between the GUI and its relevant meaning. This contextualization is crucial for understanding the significance of the visual patterns identified by the AI. Furthermore, researchers must analyse the

impact of these GUI elements on player experience, considering factors such as usability, accessibility, and aesthetic appeal. This analysis requires a deep understanding of human-computer interaction principles and specific design considerations relevant to video games. The AI output thus far serves as a tool that provides a rich dataset for analysis, but it is the human researcher who ultimately interprets this data and draws meaningful conclusions about the effectiveness of the GUI design.

As final conclusion, the combination of AI-driven analysis and human interpretation offers a powerful approach to understanding visual patterns in video game GUIs. AI streamlines the analysis process by efficiently processing large datasets and providing detailed descriptions of visual elements. Human researchers then leverage their expertise in game design and player experience to contextualize the AI's output, categorize GUI elements, and analyse their impact on usability and aesthetics. This synergistic approach allows for a more comprehensive and nuanced understanding of video game GUI design, paving the way for the development of more intuitive, engaging, and user-friendly interfaces. Further research could explore the application of more advanced AI techniques as research tools, such as machine learning and deep learning, to further enhance the analysis process and uncover deeper insights into the relationship between visual patterns and player experience in video games.

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