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3D Tactical Floor Game Application for Visualization of Battle Operation Plan by Utilizing Three Act-Structure

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A B S T R A C T

Tactical Floor Game (TFG) is an activity to simulate tactics and test the concept of battle operation plans. The main focus in TFG activity is aligning planning logic with field execution estimates using storytelling, mainly through role-playing in a replica of the combat situation. TFG activity is usually done manually by laying out a paper map on the floor and pairing miniatures representing units in operation. In the digital version, TFG activity is typically presented in the form of short film segments representing a stage of combat preparation or by utilizing simple PowerPoint-based animations. The use of such multimedia is considered less representative and may not provide a realistic visualization in the context of battle simulations. This research aims to address the issue of creating realistic visualization and dynamic simulation in combat planning by developing an interactive multimedia application. The contribution to the field of knowledge in this research is focused on the application of the Three-Act Structure, a storytelling framework commonly used in films, into the process of developing multimedia applications. The test results indicate that an interactive multimedia application developed specifically for TFG activities can serve as a comprehensive visualization tool for testing the concept of battle operation plans.

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1. Introduction

Tactical Floor Game (TFG) is an activity to simulate tactics and test the plan of battle operation [1]. This activity is an essential aspect of the training process at the Command and Staff School (Sesko) for the Army (AD), Navy (AL), Air Force (AU), and the Indonesian National Army (Sesko TNI). TFG exercises are occasionally undertaken using a combined scheme between the TNI and the Republic of Indonesia Police to replicate operational plans in the civilian domain as part of their development [2].

TFG aims to test operation plans, including planning simulations, movement simulations, coordination simulations between units, and accommodation and supplies simulations to ensure that operations can go according to technique [3]. The implementation of TFG activities is divided into several stages, including coordinating with commanders, conducting movement and logistics planning, performing battle planning, and post-operation consolidation. All stages of these activities are conducted in response to a specific storytelling-based scenario and documented in a working document that will later be presented to the highest-ranking commander and simulated by the senior-ranking officer.

Storytelling holds essential importance in TFG activities [4][5]. It is fundamental as players engage with various scenarios or case studies of battles that must be addressed. Participants must develop and implement well-thought-out tactical and strategic plans to navigate these challenges. These plans are not only documented in comprehensive working documents but also brought to life through the visualization of the battlefield using paper maps and miniature models to represent the actual unit. The manual mechanism is depicted in Figure 1.

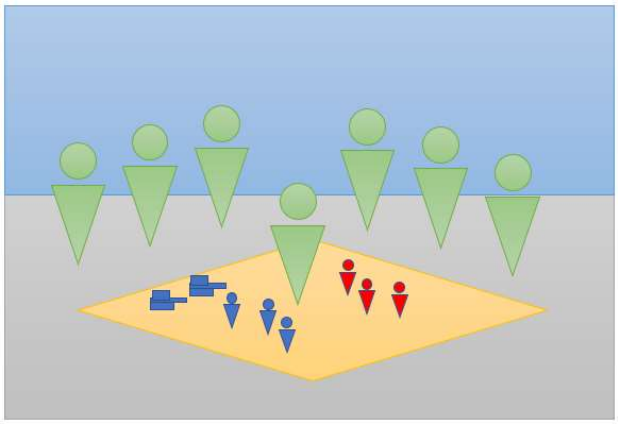

Figure 1 Conventional TFG Illustration

TFG activities offer a cost-effective training solution compared to live exercises or field maneuvers [6][7]. It reduces the need for extensive resources, equipment, and logistics associated with large-scale training exercises [8][9][10]. However, setting up a manual map for TFG can be time-consuming and labor-intensive. It involves arranging miniature models and physical elements on the map, which can be tedious, especially when multiple iterations or modifications are required.

There are limited research studies specifically focused on the development of digitized TFG. One of the reasons is the secretive nature of TFG within the military domain due to the differing doctrines of friendly and enemy force movements in different countries [11]. The specific strategies and tactics employed by military forces are often classified information, making it challenging to conduct extensive research on the digitization of TFG [12][13].

TFG is a highly valuable tool for visualizing combat planning. However, the current tools used are predominantly manual, relying on paper maps and miniature models. For digital processes, PowerPoint presentations are often used. This creates a gap between the need for more advanced visualization and the existing tools available. To address this problem, the research aims to develop a TFG prototype that combines planning plotting, and battle visualization in a digital format.

The application to be developed will be using Unity Game Engine which combines game-like visualizations with a higher level of interaction and flexibility to facilitate the process of creating battle planning operations. The TFG application to be developed will also adopt the use of the Three-Act Structure framework commonly employed in films [14][15][16]. This is intended to effectively break down and visually organize the simulated case studies or scenarios within the application. The goal is to provide users with an intuitive and user-friendly experience, facilitating the understanding and planning process.

2. Development Method

The TFG prototype application was developed using the Multimedia Development Life Cycle (MDLC) method combined with the Three Act Structure framework. The MDLC original method consists of Initialization, Blueprint Design, Assets Preparation, Product Development, Testing & Validation [17]. MDLC has a purpose for making applications. Meanwhile, the Three Act Structure, which consists of three main phases namely Setup, Confrontation, and Resolution, will be the foundation of storytelling in preparing various feature scenarios. These two models have their respective goals that support each other. We refer to it as MDLC-TAS as described in Figure 2, which is also part of our contribution to knowledge.

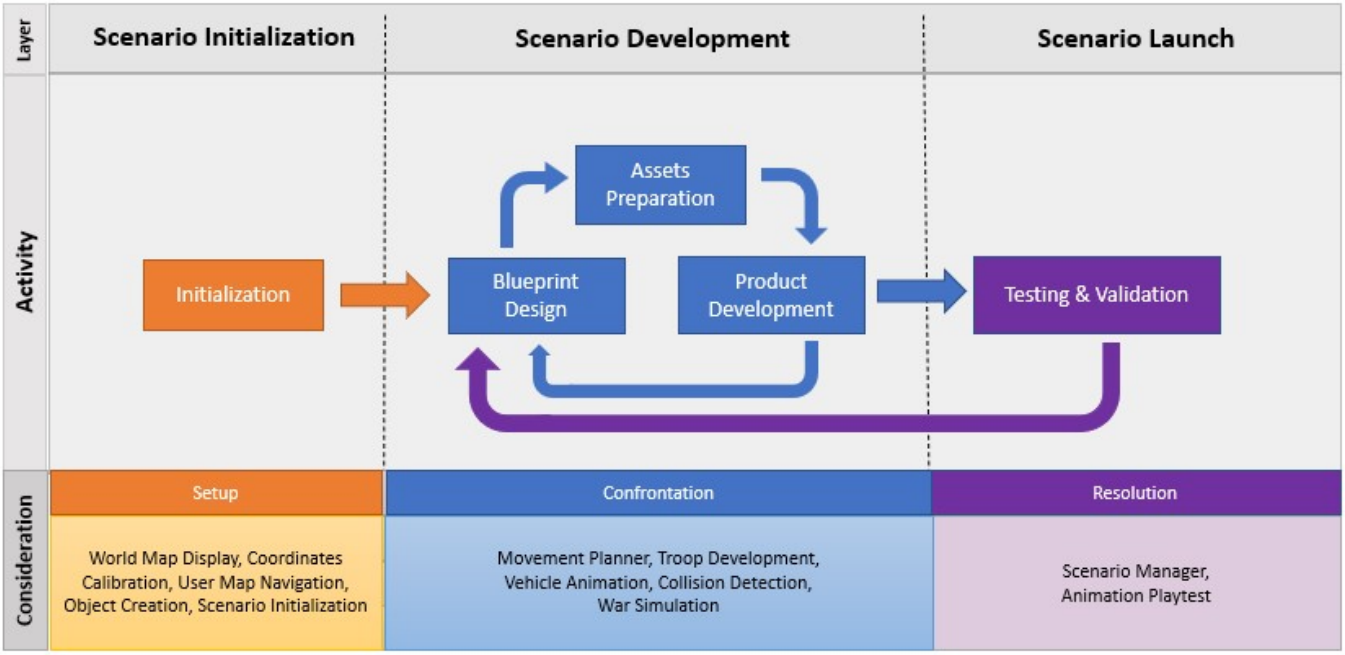

Figure 2 Multimedia Development Life Cycle – Three-Act Structure (MDLC-TAS)

In general, MDLC-TAS consists of three main layers, namely Scenario Initialization, Scenario Development, and Scenario Launch. Each layer encompasses activities derived from MDLC and considerations drawn from the

specific Three-Act Structure for a particular case, in this instance, related to TFG Activity development.

The scenario Initialization layer, within the context of TFG activities, is essential to present the story's setting. It is manifested in the form of a world map, interactive coordinates, map navigation mechanics, and scenario data storage. The world map provides a visual representation of the TFG environment, allowing users to have a clear understanding of the geographic landscape and locations. The interactive coordinates enable users to pinpoint specific positions and navigate through the map seamlessly. The map navigation mechanics ensure smooth movement and exploration within the virtual world. Additionally, the capability to store scenario data allows users to save and retrieve their progress, enabling continuity and the ability to revisit previous scenarios.

The scenario Development layer, within the context of TFG activities, is achieved through various elements such as the movement planner, troop development, vehicle animation, and war simulation. The movement planner allows users to strategize and plan the movement of their troops. Troop development enables users to customize unit composition, equipment, and formations. The vehicle animation component brings the battlefield to life by depicting realistic movements and actions. Lastly, the war simulation aspect creates realistic war simulation to enhance the engagement of the TFG activity.

The scenario Launch layer focuses on showcasing the results in the previous layers. Users will be able to witness the execution of their planned movements and observe the visualization of battle scenarios. It is essential to understand that the purpose of the visual representation in the TFG application is to aid in the planning process and provide a visual understanding of battlefield dynamics. TFG application is not a serious game, so the focus of the war simulation is to visually represent the form of warfare rather than calculating the outcome of who wins or loses [18][19][20]. TFG activity results will serve as initial data that followed into the Wargame Simulator engine, which is beyond the scope of this discussion.

3. Implementation Result

The TFG application was developed using the Unity game engine and has implemented several features in accordance with the MDLC-TAS method. Some of the developed features include displaying a world map, map coordinates, navigation mechanics, troop and vehicle movement animation, battle animation, and scenario data storage.

The world map feature allows users to have a global perspective of the TFG environment. The navigation mechanics ensure smooth movement and exploration within the virtual world. Troop and vehicle movement animation brings realism and immersion to the TFG activity, enhancing the user experience. The battle animation showcases the dynamics and intensity of combat, adding depth to the overall simulation.

Lastly, scenario data storage allows users to save and retrieve their progress, enabling continuity and the ability to revisit previous scenarios. These features collectively contribute to the engaging and realistic nature of the TFG application.

3.1 Setup

Figure 3 shows the implementation of the World Map Display, Coordinates Calibration, and User Map Navigation feature. Some standard mouse features such as pan, scroll, and zoom have been implemented as modern GIS applications [21][22]. The map used in this application is an offline map with a resolution of

2K. In addition, this feature also applies the cursor position detection needed to obtain world map coordinates using the interpolation formula [23][24].

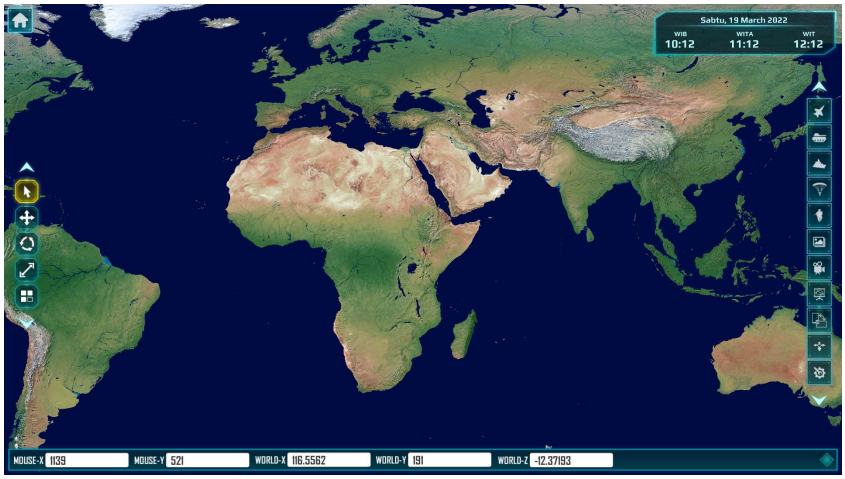

Figure 3 Map 2D Feature

The map viewer feature has two modes, namely 2D and 3D. By default, the VGA setting used is that Display 1 will display a 2D map, and Display 2 will display a 3D map, as shown in Figure 4. However, this configuration can be reversed or not used at all. In a sense, TFG activities can be carried out using only floor media or only wall media.

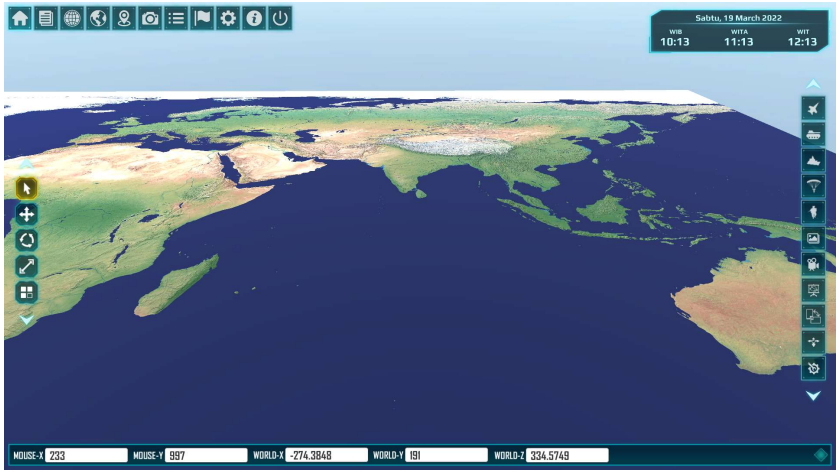

Figure 4 Map 3D Feature

3.2 Confrontation

Figure 5 illustrates the implementation of the Movement Planner, Troop Deployment, and Vehicle Animation. The mechanics applied to this feature use user-generated content techniques and the use of gizmo arrows, which are commonly found in 3D graphics software [25][26][27]. The user can move, rotate, or scale objects using the three-color gizmo arrows, namely Red, Green, and Blue, associated with the X, Y, and Z axes.

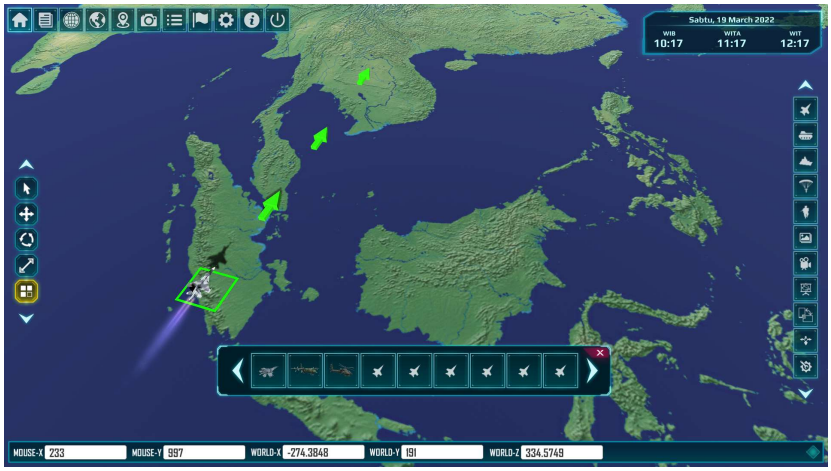

Figure 5 Movement Planner Feature

3.3 Resolution

Figure 6 illustrates the results of the Scenario Manager and Animation Playtest implementation. The mechanics used in creating the battle simulation are very similar to animated filmmaking [28]. Each movement route and action of each object is stored in a specially organized XML file and executed at a specific coordinate point [29][30]. The Scenario Manager feature serves to record the results of each scenario prepared. The user can use the saved XML file to playback the created operation plan.

Figure 6 Animation Playtest Feature

3.4 User Testing

A user satisfaction survey was conducted on 30 respondents using the User Experience Questionnaire (UEQ), which consists of a 26-item questionnaire with a minimum scale of -3.00 and a maximum scale of 3.00 [31][32]. Figure 7 shows the results of the UEQ survey. The UEQ evaluation resulted in positive scores across key indicators, indicating a favorable user experience with the application.

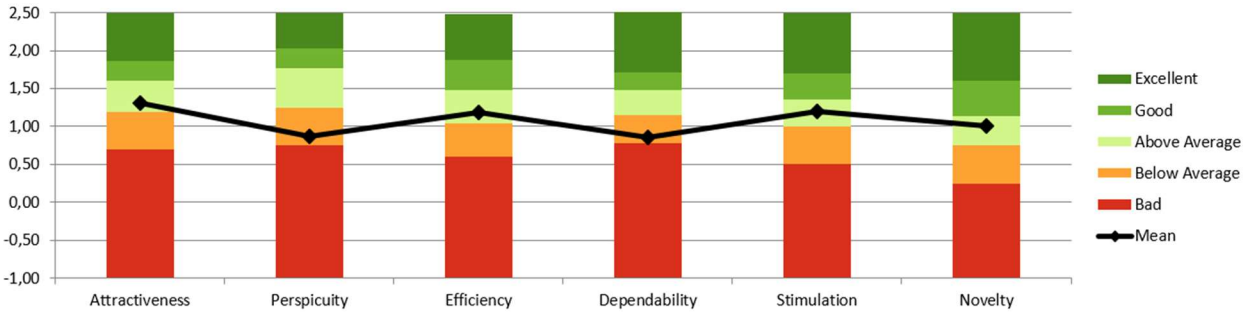

Figure 7 UEQ Survey Result

The application received a score of 0.88 for Perspicuity, indicating high clarity and comprehensibility. Efficiency scored 1.19, reflecting effective and efficient performance. Dependability scored 0.86, highlighting users' perception of reliability. The application successfully stimulated users, as shown by a score of 1.20 for Stimulation. Users also found the application to be attractive, with a score of 1.30 for Attractiveness. Lastly, the application was perceived as novel and innovative, with a score of 1.00 for Novelty. These scores collectively indicate a successful and engaging user experience with the TFG application.

3.5 Research Overview

Creating an interactive multimedia application that can fulfill all the needs of TFG activities is highly challenging. The outcomes of this research are limited to an initial prototype aimed at visualizing TFG activities, such as displaying a digital map, representing combat units with digital objects, and features to build a simple animation that can simulate battles. The prototype results strongly support the argument that this research has been successful. Furthermore, the test results of the UEQ evaluation show that the Attractiveness score reached 1.30 or above average. This indicates that visually, the TFG prototype appears highly appealing to users.

4. Conclusions

This research has successfully transformed manual TFG activities into a digital format through the development of an interactive multimedia application. By combining the MDLC and Three-Act Structure methods, this research not only accomplished the digitalization of TFG activities but also demonstrated the effectiveness of employing storytelling techniques in enhancing user engagement. The Attractiveness score obtained through the UEQ further validates the success of the research. With a score of 1.30, falling within the range of -3.00 to 3.00, the application received an Above Average rating in terms of its appeal to users. The application serves as a valuable tool for TFG activities, allowing it to plan, strategize, and visualize combat scenarios with an interactive and immersive experience.

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