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Best Practices on Improving the Virtual Reality (VR) Content Development Process with EPIC's Unreal Engine

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Abstract

Recently, in the Game industries, they are increasing to use of game engines to reduce the development cost of 3D content and software. In particular, Unreal Engine provides a blueprint visual scripting function that enables software production without programming (coding). Although High-end video content can be produced, the problem is that content development is complicated and requires advanced manpower. To solve this problem, we propose an optimized VR game context process. This is because 1) a Blueprint visual script is used, 2) VR games with various interactions can be produced, 3) Non-majors in the software field (or groups) can develop advanced content. In various related industries such as defense, medical care, manufacturing, and construction, we may easily develop any game content without programming with our refined VR rhythm action game development process. We expect to reduce the development cost with the process advantages in the game industries.

Keywords: *Game, Virtual Reality, Process, Unreal Engine, Blueprint visual script*

1. INTRODUCTION

Recently, for sustainable growth, the world is paying attention to the VR/AR industry as a keyword for overcoming the industrial crisis in the face of the slowing growth of the global ICT industry.

In various related industries such as defense, medical care, manufacturing, and construction, the game industries have been made to improve immersion and realism. Convergence services for each field are also in progress.

Virtual Reality (VR) / Augmented Reality (AR) technology is a key technology field in the era of the 4th industrial revolution that can innovate the ICT market in the future. It can significantly change the existing ICT market and create new markets. In 2018, KISTEP mentioned the Virtual Reality (VR) / Augmented Reality (AR) technology as one of the destructive technologies [1].

In addition, various companies are participating in VR/AR-related industries, and related products and services are presented with 360 cameras and Head Mounted Display (HMD) hardware at international conferences such as Consumer Technology Association (CES) and Mobile World Congress (MWC). In 2018,

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the NIPA issue report also mentioned that the technology is actively spreading [2].

2. RELATED WORKS

2.1 Virtual Reality(VR)

The VR is a simulation graphic that creates an environment that realistically resembles reality. This environment is not static but responds according to the user's actions or verbal commands. It is defined as being able to change the environment immediately [3]. In such an environment, virtual reality uses one or more human senses to act as a factor that makes virtual data feel real to participants and users.

In the technical part, the VR content is produced by adding storytelling and interaction elements as content to virtual reality elements. Additionally, visual elements are not necessarily based on reality but are provided in the style of cartoons and movies. Through this, the participant can feel a more realistic immersion according to the story he/she feels. Because new results are derived from the above interactions, virtual reality acts as a completely dynamic environment rather than a static one. The Participants (User) feel real things for the provided content in the virtually created world. It is probably VR games that the public generally uses VR devices in various fields. When users experience the First-Person Shooting VR game, they can feel as if they are actually participating in the VR game and enjoy the exciting 6 game [4].

2.2 Unreal Engine

Unreal Engine [5] is a 3D game engine developed by EpicGames in the United States. Since 1994, the middleware solution has been developed through continuous improvement and is used in dozens of video games. Versions of Unreal Engine are classified by generation, and up to the 4th generation has been released so far [6]. This engine is preferred for high-cost, high-spec project development based on powerful high-spec 3D rendering technology. In Unreal Engine 4, global illumination is dynamically performed using Sparse Voxel Octree Global Illumination (SVOGI) technology that processes light reflection calculations in real-time.

2.3 Blueprint Visual Script

Unreal Engine's visual scripting system is a visual scripting system for creating gameplay elements within the Unreal Editor using a node-based interface [7]. As with general scripting languages, it is commonly called “Blueprint” for defining object-oriented (OO) classes or objects within the engine. Blueprints are tools that allow designers to implement difficult concepts or develop game tools without a programmer. It uses graphs and nodes to control events, variables, functions, and classes. Blueprints work by using node graphs for different purposes, unique to each Blueprint instance, such as object creation, individual functions, and general gameplay events. Blueprint Visual Script is a higher-level tree structure with textures, transformations, detail levels, rendering states, light sources, and many more. It is expressed in the form of a tree, and when rendering, the tree is refined in depth first order. For example, you can put a light source into an internal node, which only affects the contents of its subtree. As another example, when a texture is encountered within a tree, it is applied only to all geometries in the subtree of that node[8].

2.4 Game Development Process

According to the study on the improvement of the game production process by the Korea Game Industry Development Institute, the game production process is classified as follows [9].

Step1. Game Work Area’s Analysis phase
Form an organization for game production work and define the roles of each department

Step 2. Requirements gathering phase
Review ideas and conduct market analysis and research to identify trends and cultural flows. Establish a game concept by identifying requirements based on research and predicting the cost and period required for production.

Step 3. Game element analysis and design phase
Design detailed plans for each work task in art, programming departments, and sound departments and establish specific plans.

Step 4. The game element implementation phase
Implement the game elements and systems designed according to the work schedule, and produce the necessary art resources in the art part. This is the stage where all elements are completed and the system is integrated by merging and checking intermediate products by designating milestones in the middle phases.

Step 5. Test Phase
Conduct balance and QA tests, and continue from the prototype to the beta version of the game.

Step 6. Deployment phase
Review the elements and deliverables necessary to complete the production, establish a game help and update plan, and perform appropriate activities according to the platform and game type.

The above steps are defined when various development infrastructures such as Unreal Engine are relatively insufficient, so the complexity of the steps is high. A concise development process is needed to improve this.

The structure of this paper is as follows. Chapter 2 refers to related research and existing development processes. Chapter 3 proposes Epic's engine-based refined development process. Chapter 4 mentions the development case. Finally, we describe the conclusion and future research.

3. REFINED DEVELOPMENT PROCESS

In this study, we suggest VR game development of Blueprint Visual Scripting of Unreal Engine on our refined VR rhythm action game development process. That is, we develop a rhythm action game playing during a set time (music playback) based on space (background), character, and User Interface (UI) among the basic requirements of 3D games time) that can be played.

Through this process improvement, we shorten and omit tasks of game concept setting document, design document, system structure model, function model, and class model among the contents included in the game element analysis and design stage, and the game element implementation stage among the existing 6 stages of the process. We can do it possible for the refined VR rhythm action game development process in Table 1.

Table 1 shows the development items of the process.

Table 1. Development items of the process

Development Items	Simplification	elimination	Not applicable
Version plan establishment document			o
Game concept setting document			o
Game concept setting document	o		
Game element design document	o		
System structure model		o	
Functional Model		o	
Class model		o	
Database Model		o	
detailed list document	o		

4. APPLIED PRACTICE FOR GAME DEVELOPMENT

Based on the improved process for the game progress, interface, note processing of rhythm action game, characters, and stage space, we use one example of VR game to describe how to develop the game by applying the improved process using blueprint as follows.

Step 1: Define Game Play & Event

In the existing development method, when the planner plans the flow of the game, the programmer (developer) implements the part. Direct implementation. It controls the main screen and play screen from the start of the game, and controls the object of each screen and event. After creating the above elements as individual objects, and visually creating the necessary classes and stars, connect the nodes as shown in the figure to enable game execution and progress. Figure 1 Shows the game player blueprint script.

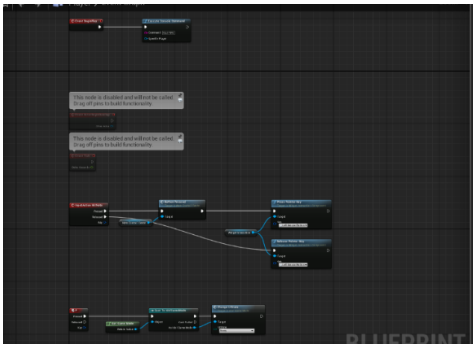

Figure 1. Game player blueprint script

Step 2: Define User Interface

Parts that require interworking with visual elements (Figure 2), such as interface control, were also implemented through reference to each node and resource (Figure 3), and the test result confirmed that it works normally. This confirmed that development using blueprints for game interface and HUD implementation is possible through this. Figure 2 shows resources for UI output. Figure 3 is the Blueprint Script that makes the UI work. By linking the UI resource and operation event created in this step, it is possible to control game score evaluation, result output, and input. Create game events and UI classes as Blueprints and connect nodes for each. The interface was designed with an emphasis on contributing as a positive factor rather than a hindrance to the immersion of the game. It helps players to immerse themselves in the game by using graphic technology using 3D space, various characters, and sound effects like those of reality [10].

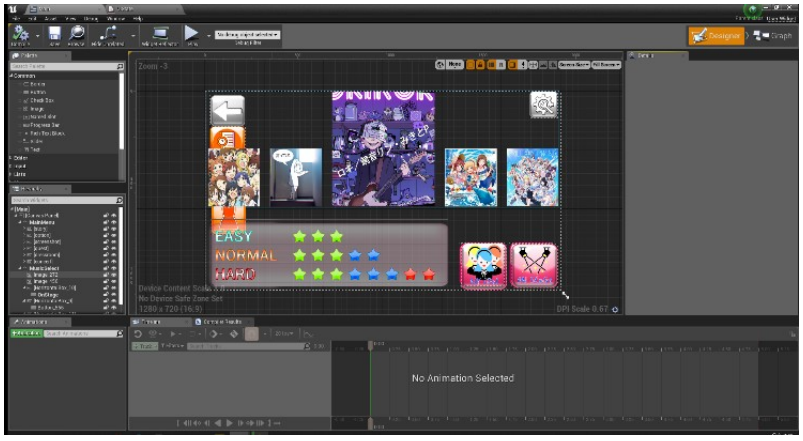

Figure 2. Resources for user interface output

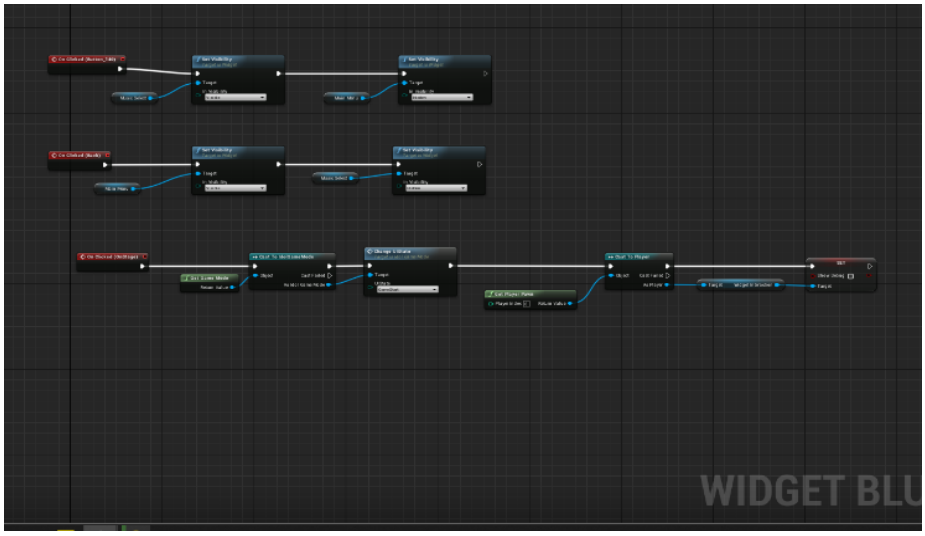

Figure 3. UI blueprint script

Step 3: Define Game Note

Visual scripting was performed using Blueprints to control the saving and output of game notes, progress of game notes, success and failure judgment of input values for notes, and output effect and speed control by music output in case of success or failure. Figure 4 shows a blueprint script that activates the game notes that the user must input according to the timing in the rhythm action game.

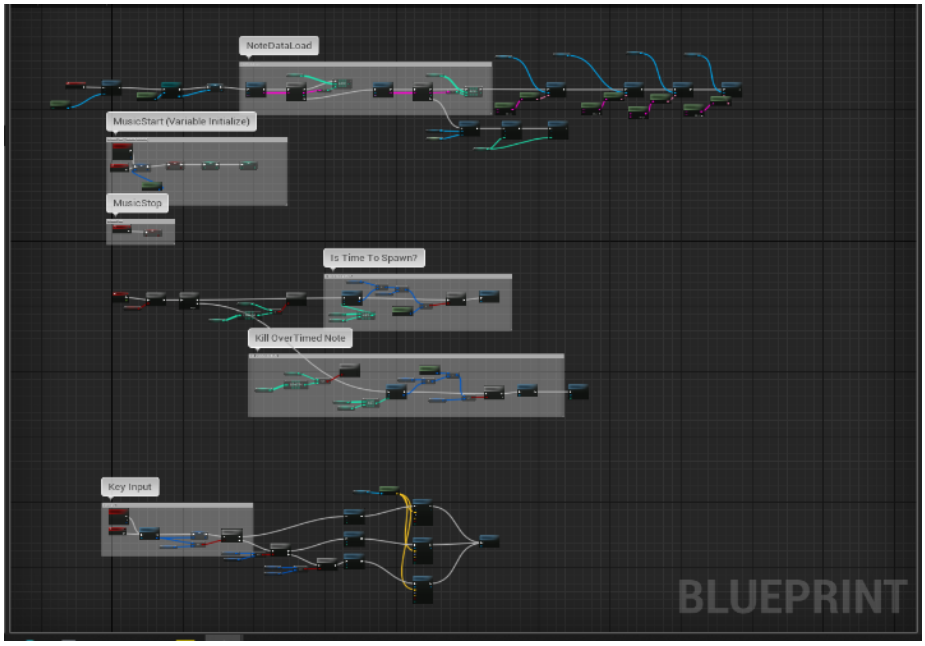

Figure 4. Game note Blueprint Script

Step 4: Defined Virtual Space (3D Stage)

Using blueprints for the effects included in the game background and background, and the action of the audience behind the background, the event is produced as shown in Figures 5a, 5b, 5c, and a necessary 3D virtual background is produced as shown in Figure 6.

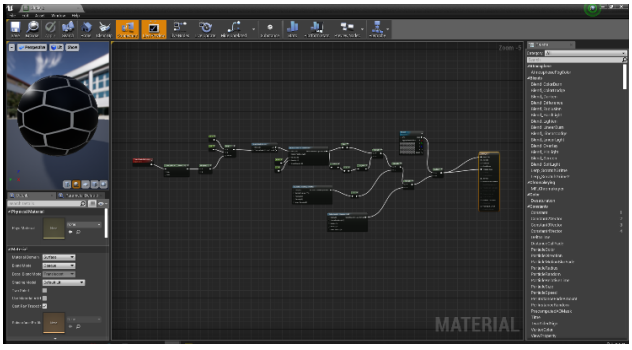

Figure 5a. Stage Implement material handling

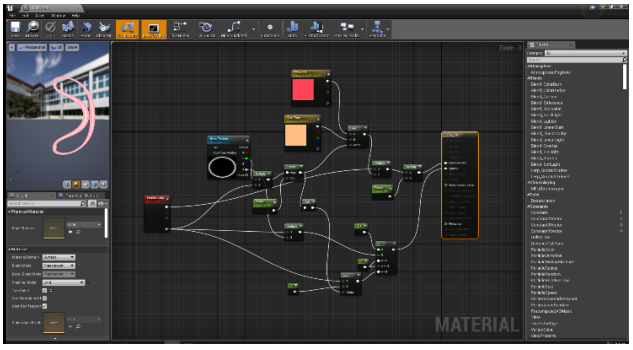

Figure 5b. Stage control and lighting

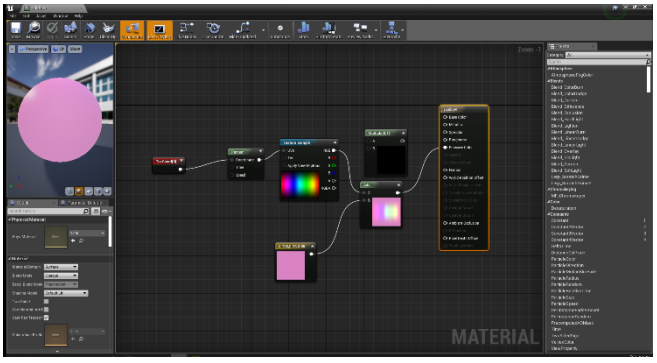

Figure 5c. Stage control and lighting & Implement material handling

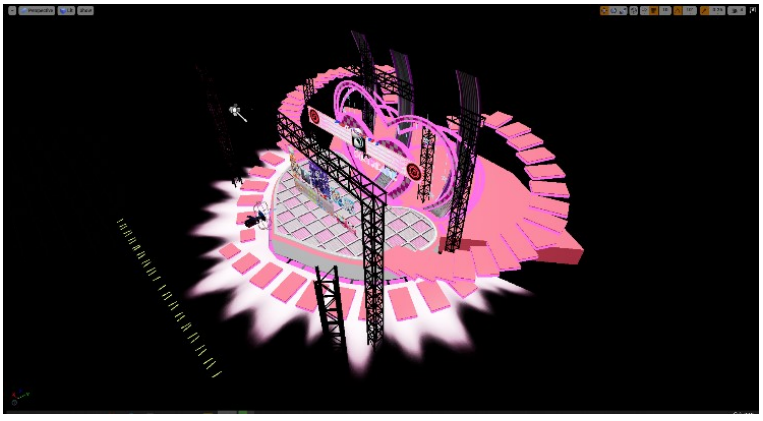

Figure 6. 3D Virtual Stage Graphic Resource Creation

Step 5: Development result screen

By synthesizing the above factors, we complete the implementation of rhythm action gameplay and confirm that it works normally. Figure 7 shows a screenshot of the production result screen.

Through this process, efficient content production is possible. However, we do not conduct additional research related to game planning because we do not focus on the fun elements or design of the game. In addition, content production in terms of quantity to secure a long playtime has a clear cost limit. We exclude RPGs and strategy simulations as genres for making large-scale games because they are too difficult to produce due to the time period.

Figure 7. Screenshot of the production result screen

5. CONCLUSION

Recently, in the Game industries, they are increasing to use of game engines to reduce the development cost of 3D content and software. In particular, Unreal Engine provides a blueprint visual scripting function that enables software production without programming (coding). In this paper, it is possible to complete the game without programming by using the Blue Script function. We reduce the development stage in the system structure model, function model, and class model based on the proposed game development process. In addition, some improvements are made in the game concept setting, game element design, and database model design stage. We may easily develop any game content without programming with our refined VR rhythm action game development process in various related industries such as defense, medical care, manufacturing, and construction. As a result, we may quickly create content for VR game production using Unreal Engine's Blueprint. In the future, additional research is needed to apply content that requires high-spec hardware and network transmission speed.

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