

The VR Trip Simulator with Multi Networking of Rule-based Model

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Abstract

Unity 3D tools ('Unity') can be used to develop VR applications that can simulate various environments. In this paper, we develop VR Trip Simulator ('Simulator') for the purpose of travel. The simulator to be introduced in this paper was developed based on Rule Based Model. Rule Based Engine is added to form a State - Rule - Action structure for various models. The NPC AI, which is developed by using it, takes various actions appropriate to the situation. Simulation is carried out, the information related to the destination is automatically provided to the user, and the practicality of the simulator is enhanced. In addition, by establishing networking in the TCP / IP communication environment, it communicates with various users in real time. This increases the expertise of network programming and makes up the funniest element in the simulator, not just information.

Keywords: Unity 3D, Rule Based Model, TCP/IP, networking

INTRODUCTION

We want to develop Android VR application in 3D environment using 'Unity', a game engine that provides application development environment for 2D or 3D. The VR device is intended to provide a more convenient operating environment by using a 'VR Box'. Various objects needed for application development are modeled using 'Blender' and 'Zbrush' tools. We also think about ways to satisfy users' needs by considering UI elements. In the VR Simulator, AI NPC using Rule Based Model is added to take appropriate action according to various conditions. We will also add a variety of factors, such as adding a route-finding algorithm and a player-tracking algorithm to the NPC. Finally, by adding the networking, it provides an environment where players can play games together with other players. TCP-based socket programming allows you to play games in the form of servers and clients.

RELATED WORKS

A. Rule Based AI

Artificial intelligence is that allows computers to do thinking, learning, and self-development with human intellectual skills. In other words, it allows computers to imitate human intelligence.

The Rule Based Algorithm is a system that allows the machine to make a judgment by applying the part of the human intelligence judgment to the machine. Therefore, it is a rule-

based system that makes rules according to various situations and takes action.

For example, you can make a choice by comparing several conditions. In this case, it is called a conditional branch that compares the presented conditions and allows the work to be processed. When applied to a computer, IF - THEN - ELSE is used to express the conditional branch. Therefore, a system in which a conditional branch program operates using a rule (condition setting) is referred to as a rule-based system. We can efficiently process IF - THEN - ELSE repeatability of this system using Rule Base algorithm. The operation process first outputs the rule according to the selected condition by passing the input value from the game engine (Unity). The output is then passed back to the game engine to handle graphics, scoring, character movement, etc.

B. Network programming

Networking is a communication for connecting two or more users. In this paper, Socket Programming is applied to implement a multiplayer environment. We used socket for communication. It serves as a connection window for transferring data in the network and operates between the Application layer and the Transport layer in the TCP/IP protocol. As a component of the socket, it needs five pieces of information such as Internet protocol(TCP, UDP, raw IP), local IP address, local port, remote IP address, and remote port. The application of the user who opened the first simulator space becomes the server, and the user who requests connection to the server becomes the client. In this project, TCP is used for the protocol. TCP is a reliable connection-oriented communication method that provides flow control and error control functions.

IMPLEMENTATION PROGRESS

A. 3D Modeling

The total process of creating 3D objects consists of three steps. First, model objects in Zbrush. 'Modeling' is to create the appearance of the object. If you select the appropriate brush and use the tablet to refine the mesh, the poly paint will work on the texture. When working with textures, turn off the Z add button, activate only the RGB button, and paint the finished mesh freely. After completing the above process, the basic appearance of the object is completed. However, this mesh is only available in Zbrush. Therefore, to work with Blender, you need to extract it as a compatible file format. Unlike other file formats, FBX files reduce the file size of an object, and can

extract UV maps and animations at the same time. In order to extract into FBX file, the texture map is expanded into image file in Zbrush, and exported to fbx, all preparation for passing to Blender is finished.

Second, import the object that has passed the above process into the blender. Zbrush uses the Decimate modifier provided by Blender because of the huge number of polygons. Decimate The modifier has the ability to reduce the number of polygons in an object. By using this to reduce the number of polygons by 80%, the base object of the rigging for animation work is completed in earnest. Rigging refers to the task of creating the skeleton of 3d objects as the basis for animation. In Blender, there is a modifier called 'Rigify' for this task. Use Rigify to create an object's skeleton and apply it to 3D objects.

Third, an animation is made on the object that has been rigged. Animations work in key frame units. After changing to the animation window supported by the blender, adjust the position, rotation, and size of each skeleton. After creating the desired posture and inserting the keyframe, Blender calculates the change of the character's posture and automatically creates the animation. Once you have created all the different animations for each character, you can extract the finished objects in FBX format for use in Unity.



Figure 1: Character Modeling work

B. Guide and NPC

a. check the distance between objects

It receives two game objects, converts each object's position into Vector3 type, and measures x, y, z coordinates. And we use the Vector3 class's Distance function to calculate and return the distance between the points. Rule and state are used to write this in C # script and apply it to NPC to take actions according to distance from other objects.

a. Player tracking function of Guide NPC

As the distance between the player and the guide AI decreases, the action AI of the guide AI is activated, so that the guide AI automatically follows the player. It measures the current position of the player and guide AI and applies the algorithm to move to the player's coordinates over time. The Lerp function used in the algorithm implementation is provided in the Vector3 class, and Lerp (startMarker.position, endMarker.position, fracJourney) Parameters startMarker.position to endMa-rker.positi fracJourney on to move on time. If the

position of each parameter is the same in the implementation, the object collides, so we added a difference of 7 to the y coordinate.

b. A description of the guide AI for each object

When the distance to the object described above becomes smaller than the set reference value, the guide AI executes Action to explain the nearby building object. Place the Canvas object on the guide AI and print the description as a text object under Canvas. The text component is implemented by outputting an appropriate description depending on each building object.

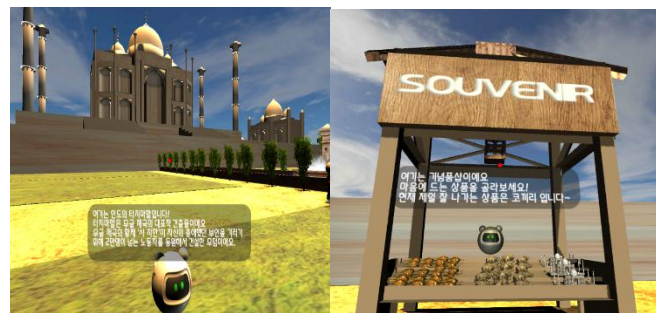


Figure 2: Example of building AI description balloon

c. Role according to player's action path

We implemented different situations according to the actions taken by the players. Therefore, you can choose the food you want to go to the main restaurant and enter the house of the ghost to experience a real house of ghosts. In addition, in the pangs experience, the player tells the reason for the pangs according to the activities that he had experienced before and implemented the pangs experience.



Figure 3: Various events on a map of a Korean village implemented using a rule-based algorithm

d. Navigate the path of passersby

In this paper, we implemented the path object in the project to set the path to the whole map and repeat the movement. Set the waypoint object that is movable, and rotate each point in turn. After passing the last point, the starting point is randomly set by the rand function, and it is incremented by 1 again.

C. Networking

Since we have decided the protocol, we have to set the IP address to connect. By configuring the UI to dynamically enter the IP address without hard coding, more flexible connection is possible. The local IP address does not need to be entered because the connected address is automatically entered, and the port number is a fixed number so that the connection can be continued with one number.

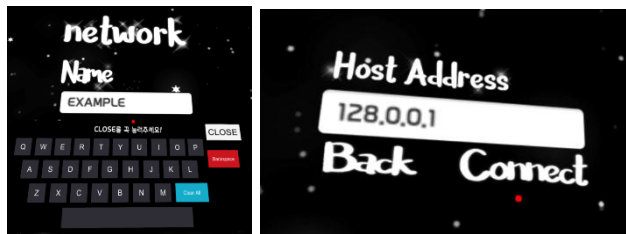


Figure 4: Scenes to enter the player's name and host IP address

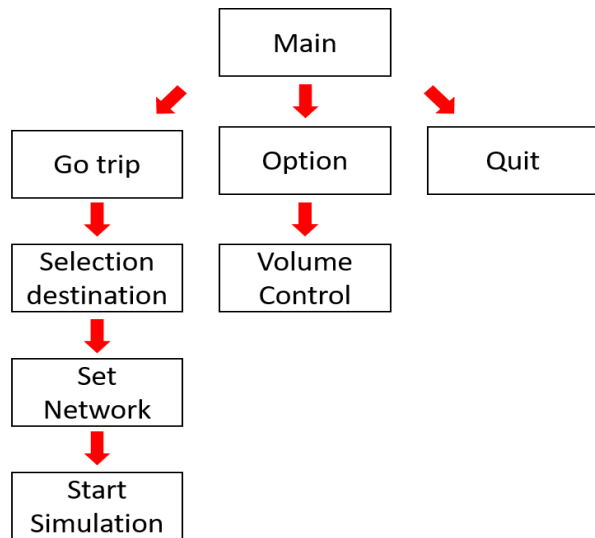


Figure 5: Progress scheme

CONCLUSIONS

The scenes of the developed application consist of Main, Travel Area Selection, multi-network setting, and travel scene. In the main scene, we first configured the UI with game start, options, and game exit buttons. When the player clicks the Trip button, it switches to the travel area selection scene. Also, when the option button is clicked, the option setting window appears.

The option setting allows you to control the BGM volume and sound volume of the game. In the travel selection scene, we configured the UI that the user can select the travel area through the globe. By adding the function of rotating the globe with the controller, it provides more interesting feeling. If you select the desired region, you will proceed to the network setup scene. The network with other players is activated by opening the server through this scene or connecting the client to the opened server.

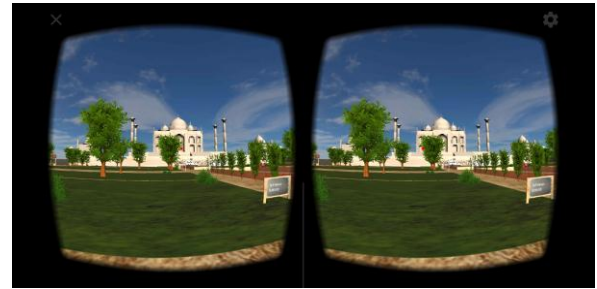


Figure6: Mobile phone screen running simulation



Figure7: Photo of the player experiencing the simulator

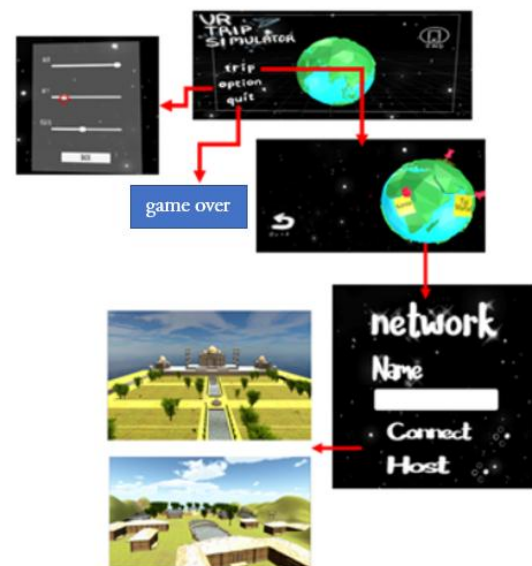


Figure 8: Overall Scene Configuration

In this paper, we developed VR trip simulator that can play multiplayer by network programming and have rule based NPC. By connecting the controller with the mobile phone with the VR box, the user can easily experience the VR even without a professional device. Based on the rule-based AI NPC that can take appropriate actions according to various situation conditions, it enables various information transmission for the purpose of the simulator. We also did network programming using sockets to build an environment that could enjoy with many players. This allowed us to gain knowledge of network programming and Rule Base AI, and to develop the ability to actually implement it. The Rule Based Model used in this paper has a disadvantage that it can not respond to situations other than the rules specified by the manufacturer. If we study how to expand into a knowledge-based model, we will be able to implement more diverse situations through learning.

ACKNOWLEDGMENT

This research was supported by the MSIT (Ministry of Science and ICT), Korea, under the ITRC (Information Technology Research Center) support program (IITP-2018-2016-0-00288) supervised by the IITP (Institute for Information & communications Technology Promotion).

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