Club experience and application booth

Software Requirement Specification

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Introduction to Software Engineering 41

Team 6(EEA-VRChat)

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. Introduction

1.1 Purpose

The purpose of the statement is to describe the requirements for the Club Experience and Application Boot project described in the document. Before starting system design, this document defines the functional and non-functional needs to be implemented in the project to clarify what needs to be implemented. You can build a specific service that needs to be provided and use it for testing to see if you have met the initial requirements at the validation stage of the project. This document also defines the constraints to be considered when proceeding with project design. Based on this document, you can design a system to provide services that meet your needs in consideration of constraints. Potential readers of this document are not limited to team members who design, develop, and test the project but include students, assistants, and professors who want to understand the initial development background of the project.

1.2 Scope

The requirement specification includes constraints that should be considered for system design and development from the needs desired by customers of the project. It includes the External Interface that customers directly experience and the financial requirements that customers require. It also deals with performance requirements and logical database requirements that must be achieved internally. It describes not only Design constraints and Standards compliance that must be observed in the design stage, but also system evolution that takes place after development is completed.

1.3 Definitions, Acronyms, Abbreviation

1. VRChat

   VRChat is an online virtual world platform. Created by Graham Gaylor and Jesse Joudrey and operated by VRChat, Inc, the platform allows users to interact with others with user-created 3D avatars and worlds.

2. Unity

   Unity is a cross-platform game engine developed by Unity Technologies, first

announced and released in June 2005 at Apple Inc.'s Worldwide Developers Conference as a Mac OS X-exclusive game engine.

3. SDK

   A software development kit (SDK) is a collection of software development tools in one installable package.

4. EEA-VRChat

   The developing team’s name is EEA-VRCHat which comes from ‘Explore, Experience and Apply to club activity with VRChat’.

1.4 References

[1] iDecide, "Recommend Laptop for Tech Newbies(Software Requirement Specification)," SungKyunKwan University, Suwon, 2020.

[2] SK telecom, "코로나 19 시대, 대학생들의 생각이 궁금하다! 1탄," SK telecom, 16 7 2020. [Online]. Available: https://news.sktelecom.com/123940. [Accessed 30 10 2021].

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1.5 Overview

Due to COVID-19, most universities, including Sungkyunkwan University, are conducting online classes. As a result, visits to schools have naturally decreased and exchanges between students are disappearing. According to SKT Insight's survey [2] of college students, most of them were regrettable that they could not participate in group activities due to COVID-19. The project provides students with opportunities for club activities that have been suspended due to COVID-19 through VRChat. To design

and develop a project, it is necessary to clarify what the actual user's needs are. In addition to detailed descriptions in writing, the document describes requirements and constraints using tables and diagrams.

2. Overall Description

2.1 Product perspective

This product implements a VRChat map using unity. The result of the project is a campus map implemented using SDK provided by the existing VRChat. Users can experience clubs by using various club booths.

2.2 Product Functions

1. Build SKKU Campus map for Club Promotion and Application booth.
2. Meet people who are interested in the Club through VRChat.
3. Take pictures at a photo booth of each club for those who are interested in the club.
4. Look at the gallery including photos and videos of previous activities of the club.
5. Move into a new map and experience the representative activity of the club.
6. Apply to the interested club immediately in the interview room through VRChat.

2.3 User Classes and Characteristics

1. Users of the project can be classified into CLUB, the management of the club, and the applicant who wants to join the club.
2. Users who correspond to CLUB can participate as an applicant while looking at other club booths, not fixed.

2.3.1 CLUB

1. Club's activity history or actual activities can be shown without space constraints.
2. Interviews are available as soon as applicants apply without having to rent a separate interview place and go through procedures.

2.3.2 Applicant

1. Applicants can make a decision to join after experiencing club activities indirectly.
2. Anonymity allows applicants to browse the various clubs with a lighter mind.

2.4 Operating Environment

The operating environment is available on both PCs and VR Devices. Users can simply install a VRChat application to access the map they want, including the project.

2.4.1 PC

1. You can download it from Steam and run VRChat. Users can interact with objects and talk to other users, but cannot move their hands or perform detailed actions that move their bodies.

2.4.2 VR Devices

1. You can download and use the VRChat application from the device platform. Depending on the type of VR device, you can express detailed movements from moving your hands to moving your body.

2.5 Design and Implementation Constraints

2.5.1 Design Constraints

1. The project follows the constraints of the assignment.
2. Therefore, it is prohibited to reuse public data without modification or re-

creation.

3. Users can access the system through VRChat.Managers of each club can access the system through VRChat.
4. The manager of each club should be able to check the application submitted through the web browser.
5. It should not be complicated to operate smoothly even in graphic specifications of NVIDIA GeForce GTX 970 or less.

2.5.2 Implementation Constraints

1. Programs are written according to the C# standard using VR Chat Udon Sharp.
2. For the names of functions and variables, use Carmel notation.
3. Development should be carried out using the SDK provided by VRChat.
4. Several links connected to VRChat must be reliable.
5. It is developed in consideration of the possibility of integration with other projects.

2.6 Assumptions and Dependencies

1. Assume that the situation in which non-face-to-face college life is impossible due to COVID-19 continues.
2. Assume that there are many students who want to promote the club through the project.
3. Assume that the VRChat map can be produced using Unity and SDK.
4. Assume that the VRChat map implemented as Unity is available in a PC environment including Windows.

3. Specific Requirements

3.1 External Interface Requirements

3.1.1 User Interfaces

Table 1 User interface using buttons for gallary

name	User interface using buttons for gallery
Purpose/Description	Users push buttons for next or previous photos and videos. Users push a button to play or pause videos.
Input source/Output destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, etc. [1], personal computer (PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/Accuracy/ Margin of error	Range: according to the buttons on the screen Accuracy: according to the user's device accuracy and user's touch Margin of error: device tracking error (case of VR device), mouse error(case of PC)
Unit	A click
Time/Velocity	Time: Asynchronous user click Velocity: execute right after the button is clicked.
Relationship with other input/outputs	When a button is clicked the input is sent VRChat system and give appropriate output to users. Display previous or next photos or videos. Play or pause videos.
Format and configuration of the screen	Buttons are made of cubes. Previous and next buttons are located next to screen for showing photos and videos. Play/ pause button is located under the previous and next buttons.
Format and configuration of window	Controlled by Udon or Udon Sharp, VRChat button
Data type	Boolean [2]
Instruction type	Instruction allocated to the button
Exit message	N/A

Table 2 interview room

name	Interview room: Interview through VRChat
Purpose/Description	When a user enters the interview room, do an interview with the club members to register to the club.
Input source/Output destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, etc. [1], personal computer(PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/Accuracy/ Margin of error	Range: in the same room Accuracy: N/A Margin of error: N/A
Unit	N/A
Time/Velocity	N/A
Relationship with other input/outputs	N/A
Format and configuration of screen	1. There is a chair to seat for interviewees. 2. There is a desk for interviewers.
Format and configuration of window	VRChat world
Data type	N/A
Instruction type	N/A
Exit message	‘want to quit interview?’

Table 3 Campus as background

name	Campus: background world
Purpose/Description	Background of the world. Several club booths are set in the world. Walls and ground of the world are designed to represent SKKU campus. The library or lawn can be used to express SKKU campus.

Input source/Output destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, etc. [1], personal computer(PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/Accuracy/ Margin of error	Range: in the defined world size Accuracy: N/A Margin of error: N/A
Unit	N/A
Time/Velocity	N/A
Relationship with other input/outputs	N/A
Format and configuration of screen	1. When a user enters the world, he/she will appear in the center of the world. 2. There are walls at east west south and north. 3. Three walls are designed with trees and grass. 4. A wall is designed with the library of SKKU. 5. The ground of the world is designed as lawn.
Format and configuration of window	VRChat world
Data type	N/A
Instruction type	N/A
Exit message	‘want to exit SKKU club booth world?’

Table 4 Club booth

name	Club booth
Purpose/Description	Club booths show the club’s purpose, representative activities, and gallery that includes photos and videos of previous activities in the club. Also, a way to apply to the club can be posted on the wall of the club booth.

Input source/Output destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, etc. [1], personal computer(PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/Accuracy/ Margin of error	Range: in a club booth Accuracy: N/A Margin of error: N/A
Unit	A club booth
Time/Velocity	N/A
Relationship with other input/outputs	1. If a user wants to see the gallery, the user can push buttons next to the screen and the proper action mentioned in Table 1 should be done. 2. If the user wants to experience representative activities of the club, let the user move to another map to experience the activities.
Format and configuration of screen	1. Club booths are located on the lawn in the world. 2. There are three walls. 3. On a wall, there is a purpose and description of the club. 4. On another wall, there is a way to apply to the club or club's rule to follow. 5. On the last wall, there is a screen that shows pictures and videos of previous activities of the club. 6. There is a space for club members to advertise their clubs in each club booth. 7. There is a portal to a new map for representative activities.
Format and configuration of window	VRChat world Udon or Udon sharp
Data type	N/A
Instruction type	N/A
Exit message	When using portal: 'want to move to (name of map)?' Else: N/A

Table 5 Portal

name	Portal: Move to another map
Purpose/Description	When users want to experience the representative activities of clubs, the users have to move to another map for the activities. Therefore, portals are located each club booth to move users to another map.
Input source/Output destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, at, etc. [1], personal computer(PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/Accuracy/ Margin of error	Range: N/A Accuracy: N/A Margin of error: N/A
Unit	N/A
Time/Velocity	Time: asynchronous user input Velocity: right after the user chooses to move or not.
Relationship with other input/outputs	1. If users move in the direction of the portal, move the users to the linked map.
Format and configuration of screen	1. The portals are located in club booths.
Format and configuration of window	VRChat world Udon or Udon sharp
Data type	N/A
Instruction type	N/A
Exit message	When using portal: ‘want to move to (name of map)?’ Else: N/A

Table 6 User Interface of Experience World [5]

Name	Experience World
Purpose/ Description	Users get into a different world to experience application activities.
Input source/ Output Destination	Source: User VR devices such as Windows Mixed Reality, Oculus Rift S, HTC Vive Cosmos, at, etc. [1], personal

Destination	computer(PC) with Windows 7, 8.1, 10 Destination: VRChat systemcomputer(PC) with Windows 7, 8.1, 10 Destination: VRChat system
Range/ Accuracy/ Margin of Error	N/A
Unit	VR Chat World
Time/ Velocity	Asynchronous user input/ Communication time between the server and user devices.
Relationship with other input/outputs	N/A
Format and Configuration of Screen	1. Users can watch some youtube movies about selected application activity work. 2. User can use some objects related to application activity. 3. User can hear some introduction specifically by the manager. 4. Users can go back to the application booth world by entering the portal.
Format and Configuration of Window	N/A
Data type	Packet
Instruction type	N/A
Exit Message	When using portal: “Go back to application booth world?” Else: N/A

4.1.2 Hardware Interfaces

Table 7 Applicable Devices for System

Name	Applicable Device for the System
Purpose/Description	To utilize software, users need VR Devices, Remote Controllers such as oculus quest2. However, users can also execute software with only a computer with minor constraints.

3.1.3 Software Interfaces

Table 8 Software Interface for VR Chat

Name	VR Chat
Purpose/ Description	Base platform to execute VR World
Input Source/ Output Destination	VR Chat Server/User, User/VR Chat Server
Range/ Accuracy/ Margin of Error	Depends on the performance of the VR Chat server
Unit	Packet
Time/ Velocity	At least 100Mbps
Relationship with other input/outputs	Related to all inputs/outputs from the server
Format and Configuration of Screen	N/A
Format and Configuration of Window	N/A
Data type	Packet
Instruction type	Packet statement

Exit Message	N/A

Table 9 Software Interface for Youtube

Name	Youtube server
Purpose/ Description	Showing youtube movies on VR chat world
Input Source/ Output Destination	Youtube Server/User, User/ Youtube Server
Range/ Accuracy/ Margin of Error	Depends on the performance of the Youtube server
Unit	Query, Packet
Time/ Velocity	At least 100Mbps
Relationship with other input/outputs	Related to all inputs/outputs from the server
Format and Configuration of Screen	N/A
Format and Configuration of Window	N/A
Data type	Query, Packet
Instruction type	Query, Packet statement
Exit Message	N/A

3.1.4 Communication Interfaces

Table 10 Communication Interface

Name	Client and Host
Purpose/ Description	Each client requests the connection to the host, requesting a list of results of user IDs for the system when the user is trying to connect on VR chat world. The host provides world information and user lists to the client. Clients send their action, chat audio, text to the server. Clients receive other client's actions, chat audio, or text from the server
Input Source/ Output Destination	Client/Host Server
Unit	Packet
Time/ Velocity	Instant Reaction
Relationship with other input/outputs	Related to all inputs/outputs from the server
Format and Configuration of Screen	N/A
Format and Configuration of Window	N/A
Data type	Query, audio, text
Instruction type	Query Statement
Exit Message	N/A

3.2 Functional Requirement

3.2.1 Use Case

Table 11 Use case of booth world

Use case name	Register
Actor	World user
Description	Booth world is the background world of club experience that imitates the real Sungkyunkwan Univ's Club promotion event
Normal Course	1. All users enter this world at first. 2. First room is a small cube space, for check-in. 3. Check-in room has an object which gets the user's school data and opens the door to the next background room. 4. Background room imitates the structure of the natural science campus of Sungkyunkwan univ's small part. 5. Imitating area of SKKU is in a cube, the center point of the bottom surface in the middle of welfare center and digital library, length of the side is same as the distance between welfare center and digital library. 6. Club promotion booths are at between digital library and welfare center. 7. World boundary consists of 4 plates for cube walls. 8. room boundary walls have the texture of SKKU pictures, taken at the point specified in normal course 3.
Precondition	World is opened for only invited users.
Post Condition	Users can interact and enter to booth rooms inside the background world
Assumptions	There is a VRchat SDK3 object where can show user typing interface and get values from entered data.

Table 12 Use case of Othello club experience world

Use case name	Log-in/out
Actor	Othello club experience world entered user
Description	Othello club experience world. This world is entered from the Othello club booth, in the background world. Users can experience Othello itself.
Normal Course	1. Othello world has two rooms, also for check-in and experience. Two rooms are separated with a door and corresponding interactive object, which also shows an interface to enter user info and open the door. 2. There are 2~3 Othello boards to play Othello in the world. 3. When two users interact with the Othello board, the game starts. 4. You can see competitor's information from the whiteboard behind, updated when the user interacts with the Othello board and gets data from the user database object in the check-in room of Othello world. 5. While playing, at the Othello board users can see the available place to put the stone on. 6. When Othello stone is placed, there would be effects for indicative sound and stone update motions. 7. At the end of each game, data of players and game result is updated to the game history database object and show total game results on the result board on one side of the walls.
Precondition	User database object in the Othello world check-in room should be updated for the user before entering Othello playing room.
Post Condition	Game result data should be also updated at the Othello world database object
Assumptions	N/A

Table 13 Use case of Astronomical club experience world

Use case name	Profile
Actor	Users who entered the astronomical club experience world

Description	This world is an astronomical club experience world where can be entered from the astronomical club booth portal. Users can observe the starry sky at various times and locations.
Normal Course	1. This world is in spherical space, and the standing plate is the bottom of the upper hemisphere. 2. World celestial texture is based on the Republic of Korea at first. 3. Based on time flow, the celestial texture rotates, and there is no sunlight even though it's daytime. 4. Background sound is a night-feeling sound, such as a crickets chatter sound. 5. At the center of the world, there is an object which can change time and country value, where users can change the texture of celestials corresponding to time and country entered. 6. There is a board on the plate which indicates the current time and country.
Precondition	N/A
Post Condition	When the country is updated, the time board should be updated along.
Assumptions	N/A

Table 14 Use case of Band club experience world

Use case name	Search
Actor	Users who entered band club experience world
Description	Band club experience world can be entered from the band club booth portal. Users can see the band's concert and get some memories.
Normal Course	1. This world imitates a concert hall at the natural science campus of SKKU, between the digital library and N center. 2. World is in a cube structure; the bottom plate is the grass ground. 4 side surfaces textures are photos taken at the center point of the bottom plate specified at 2 and corresponding directions. 3. Each band player uses a media object, which makes a corresponding sound effect. 4. There are some photo zones to take pictures in the world.
Precondition	Band members playing objects should be organized.
Post Condition	N/A
Assumptions	N/A

Table 15 Use case of Booth room

Use case name	Item details
Actor	User who entered the booth room
Description	Users can fill out the application form after listening to a simple club introduction. Interview in the booth. The experience world is also supported.
Normal Course	1. Each booth has 2 cuboid rooms, left and right room. 2. First entered room is the left room, where the user can chat with the club staff for club introduction. 3. When a user enters the first room with an interactive object to open the door, the interactive object records the entered user info into the booth database. 4. First room has some photos, videos available for a brief introduction to the club. 5. First room has an interactive object which can automatically fill out the application form with info based on the booth visitor database object. After interacting with the application form entering the object, the auto-filled application form is also saved at the club database object. 6. Second room can be entered through another interactive object which can open the door between the first and second room. When opened with this object, the club database is also updated to record experience-world entered people, getting data from the club booth visitor database. 7. Second room has a portal to enter each booth's experience world.
Precondition	User database in the check-in room of the background world should be updated.
Post Condition	N/A
Assumptions	N/A

Table 16 Use case of Booth Management Space

Use case name	Item details
Actor	Club managers
Description	Club managers can access the game objects that contain the applicant and booth information.
Normal Course	1. Each booth has a secret space which contains the game objects serving as a database. 2. The space has a door and a button that is only accessible to the authorized user (i.e. club managers). 3. If the authorized user interacts with the button, the door is opened. 4. There are some database objects which contain the information of the applicants and the booth. 5. Club managers can manipulate the objects to change the booth information or check the applicant information.
Precondition	The database should be filled with any data.
Post Condition	N/A
Assumptions	N/A

3.2.2 Use Case Diagram

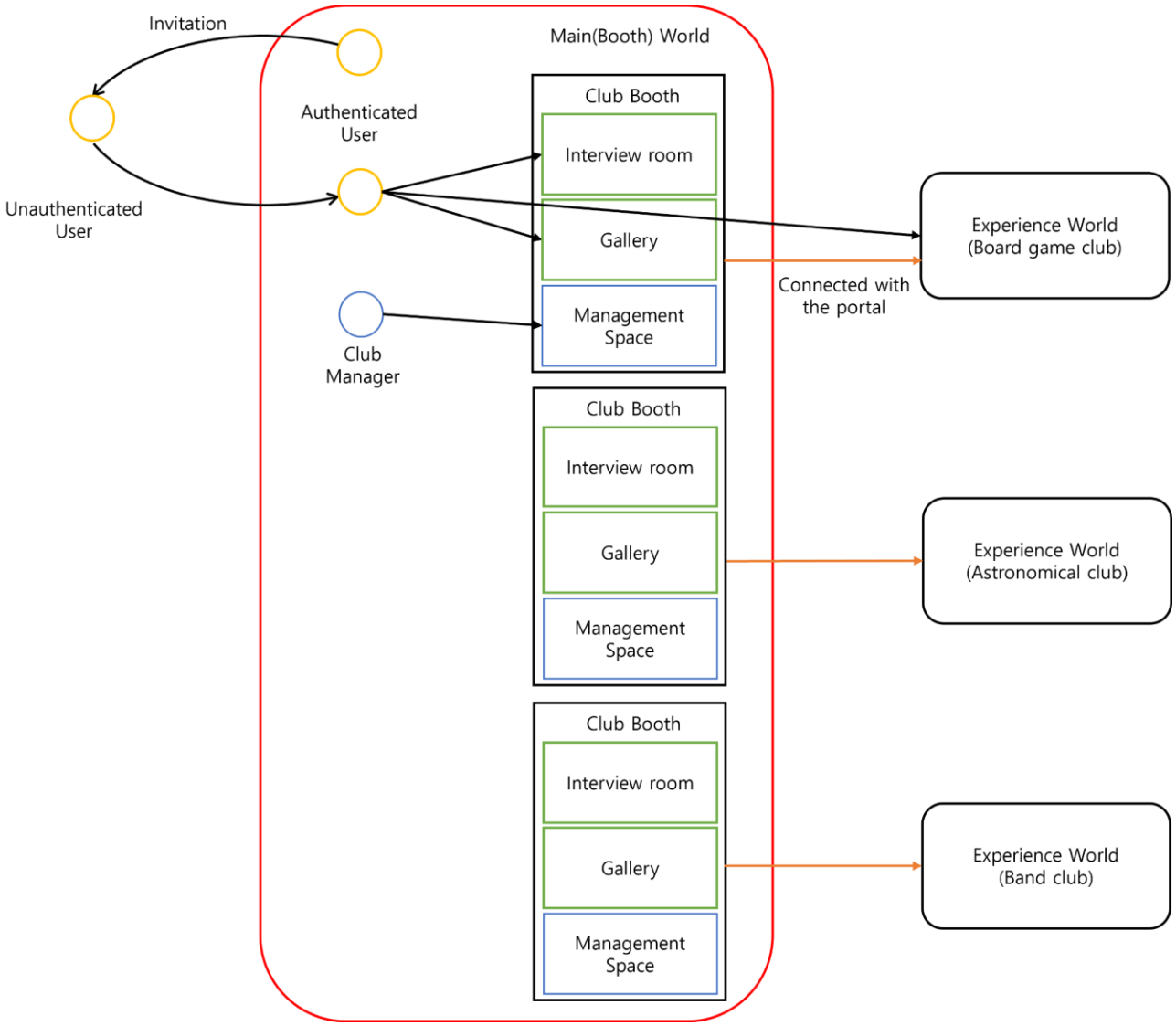

Figure 1 Use case diagram

3.2.3 Data Dictionary

Table 17 Users

Field	Key	Constraint	Description
Id	PK	Not Null	User id
Name		Not Null	User name
Student_id		Not Null	Student id
Department		Not Null	User department
Email		Not Null	User email

Table 18 Clubs

Field	Key	Constraint	Description
Id	PK	Not Null	Club id
Club_name		Not Null	Club name
Club_admin_id	Foreign Key	Not Null	Club admin id
View_count			Club view count

Table 19 Club Applications

Field	Key	Constraint	Description
Club Id	PK / Foreign Key	Not Null	Club id
User Id	PK / Foreign Key	Not Null	User id

Table 20 Game Scores

Field	Key	Constraint	Description
User Id	PK / Foreign Key	Not Null	User id
Game Score		Not Null	Game Score

3.2.4 Data Diagram

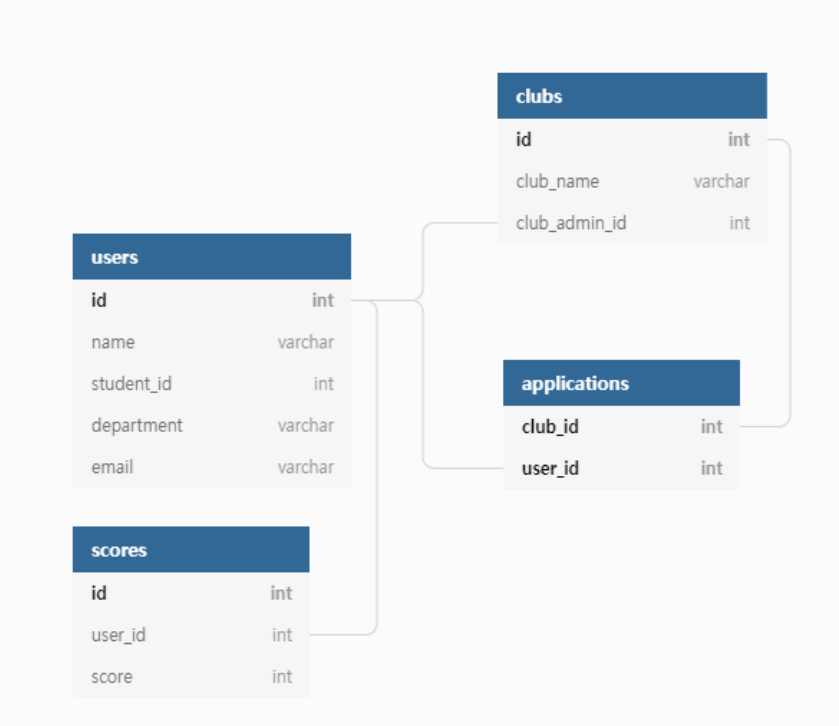

Figure 2 Entity Relationship Diagram

3.3. Performance Requirements

The followings are prepared based on estimates, so specific values may be changed in the final system.

3.3.1. Static numerical requirement

1. 1 manager of each club should be able to manage the allocated booth.
2. The System supports one simultaneous user per PC.

3. If it is a PC environment above the specifications below, the system should run smoothly. (based on the minimum specification of VRChat)
    a) Operating system: Windows 10
    b) CPU : Intel i5-4590 / AMD FX 8350
    c) RAM: 4GB
    d) GPU : NVIDIA GeForce GTX 970 / AMD Radeon R9 290 / Intel UHD Graphics 610
    e) DirectX: Version 11

3.3.2. Dynamic numerical requirement

1. The system should be operated smoothly for at least 20 simultaneous users. (Based on the maximum number of people per VRChat world, 40)

2. Data for more than 4,000 users must be able to be processed. (Based on the average number of university freshmen per year)

3. Movement from one club booth to another neighbor booth should be possible within 5 seconds.

4. The portal movement for experience must be completed within 5 seconds.

5. Users should be able to move to the interview room within 5 seconds at any point in the club booth.

3.4. Logical Database Requirements

1. Managers of each club should be able to upload the desired images and videos to the database and bring them into the system in the desired way.

2. Unauthorized users other than the club’s manager should not have access to data other than information displayed by the club’s manager.

3.5. Design Constraints

1. Users can access the system through VRChat.

2. Managers of each club can access the system through VRChat.

3.6. Standards compliance

1. Programs are written according to the C# standard using VR Chat Udon Sharp. [6]

2. For the names of functions and variables, use Carmel notation.

3.7. Software System Characteristics

Non-functional requirements of the system are classified into product requirements, organizational requirements, and external requirements.

3.7.1. Product Requirements

The requirements for the product are as follows.

3.7.1.1. Usability Requirements

1. Booths should be arranged in consideration of the movement line so that users can naturally tour various booths.

3.7.1.2. Performance Requirements

1. Resistance in the process of responding to interviews should be minimized.

2. Therefore, users must be able to move to the interview room within 5 seconds at any point in the booth.

3.7.1.3. Security Requirements

1. All club managers and users must obtain student certification. Only users certified as enrolled students should be able to access the system.
2. The space allocated to the club shall not be arbitrarily adjusted except for certified club managers.

3.7.2. Organizational Requirements

The requirements of the customer and developer organization are as follows.

3.7.2.1 Environmental Requirements

1. Each university provides an email address of the university domain only for enrolled students, so the system relies on university mail as identity information for student authentication.

3.7.2.2 Operational Requirement

1. The system operates on the VRChat in a PC environment and can be accessed for a predetermined time by an administrator.
2. Club managers and users must be certified as enrolled students through steam accounts first and university mail accounts second.
3. The inside of the booth is arranged in the form desired by the club manager.
4. Through the portal in the booth, users can move to the world where they can experience club activities indirectly. The portal movement is completed within 5 seconds.

3.7.3. External Requirements

Requirements external the system are as follows.

3.7.3.1. Safety / Security Requirement

1. All data, including user information for authentication, data uploaded by the club, and personal information submitted, shall not be accessible from external systems and shall ensure safety not to be damaged by external natural disasters.

3.7.3.2. Regulatory Requirement

1. Since the system operates based on VRChat, it must comply with VRChat's terms and conditions of service.
2. The system should be developed in accordance with national privacy standards.

3.8. Organizing the Specific Requirements

3.8.1. Context Model

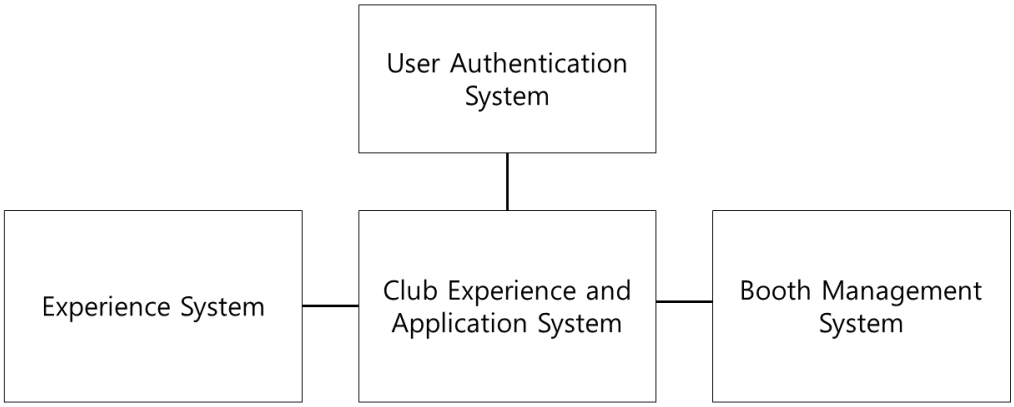

Figure 3 Context Model

3.8.2. Process Model

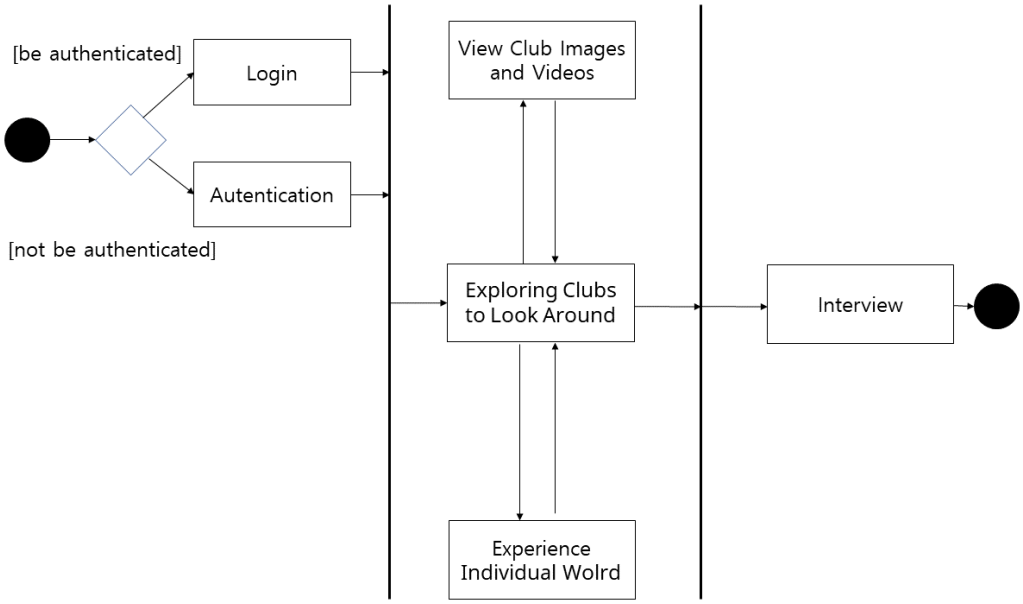

Figure 4 Overall process model

3.8.3. Interaction Model

See 3.2.2. Use caseDiagram.

3.8.4. Behavior Model

3.8.4.1. Data Flow Diagram

See 3.2.4. Data Flow Diagram.

3.8.4.2. Sequence Diagram

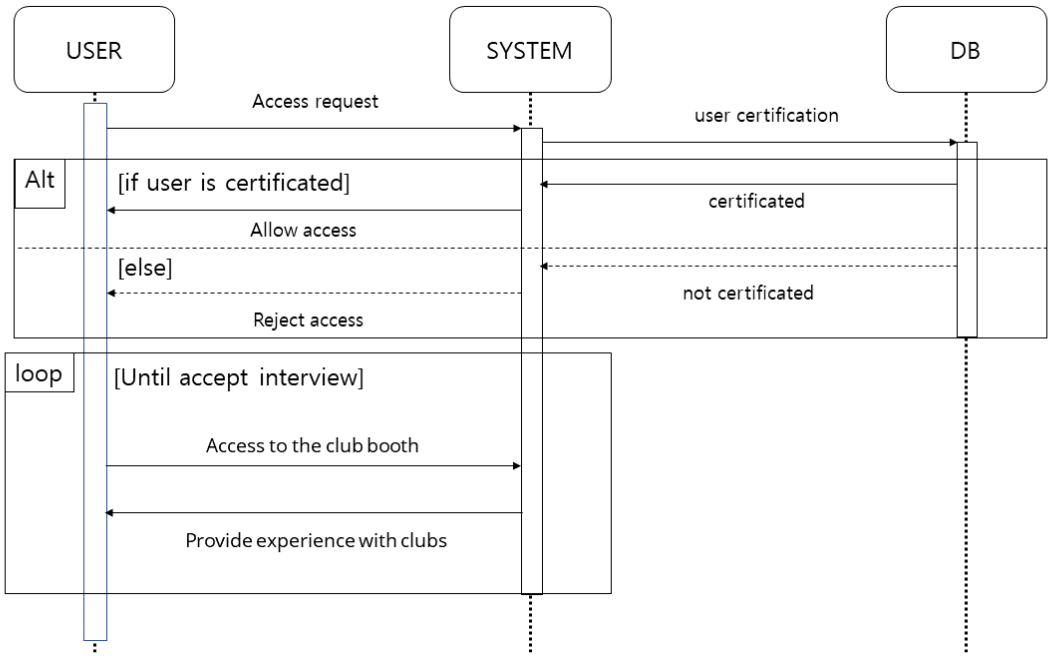

Figure 5 Sequence diagram

3.9. System Architecture

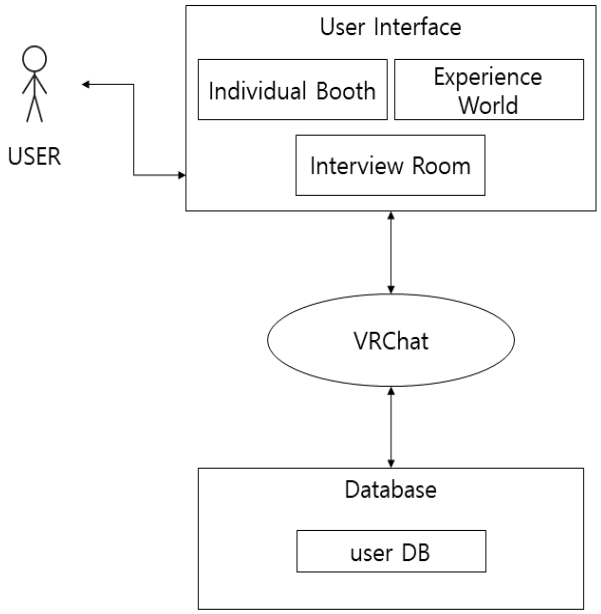

Figure 6 System architecture of the system

3.10. System Evolution

Limitation and assumption on the system, and the expected changes in user requirements due to the evolution of hardware are as follows.

3.10.1. Limitation and Assumption

1. The system does not determine whether the information provided by each club to the user and submitted by the user in the application form is true or false. All information submitted is assumed to be true, so organizations using the system must have a separate verification process.

3.10.2. Evolutions of Hardware and Change of User Requirements

1. As hardware advances, it will be possible to accommodate more users at the same time without deteriorating quality. Considering the ratio of the number of freshmen and maximum simultaneous users, and the offline club promotion booth operation process, increasing the number of simultaneous users is important in our service. Our service should gradually increase the number of simultaneous users as hardware performance improves.
2. With the development of VR devices, each club will want to give users a more vivid experience of their activities. When a club manager adjusts a booth, it should be possible to apply functions available on the latest VR devices.

4. Supporting Information

4.1 Software Requirement Specification

This software requirements specification was written in accordance with the IEEE Recommendation (IEEE Recommended Practice for Software Requirements Specifications, IEEE-Std-830).

4.2 Document History

Table 21 Document History

Date	Description	Writer
10/18	write 3.1.1 part	Dongwon Kim
10/25	write 3.2 part	Doyeol Kim, Junyoung Lee
10/15	write 1 ~ 2 part	Chung Juwon
10/25	write 3.1.2 ~ 3.1.4 part	Minje Kim
10/25	write 3.3 ~ 3.10 part	Myeongmin Kim

10/29	modify Figure 3,4,5,6	Myeongmin Kim
10/29	modify 3.1.2 ~ 3.1.4	Minje Kim
10/29	modify 3.3 ~ 3.9 part	Myeongmin Kim
10/30	modify 1.4	Chung Juwon
10/31	modify 1.4	Doyeol Kim, Junyoung Lee
10/30	modify whole	Dongwon Kim
10/31	modify whole	Minje Kim