## Developing a Building Recognition Application for University Facilities Using Augmented Reality

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#### Summary

Recently, as the interest in the augmented reality increases, a variety of apps utilizing the augmented reality technology are emerging. In this paper, we develop the Android app for Sookmyung Women's University using Augmented Reality technology. The app developed in this paper uses the Vuforia SDK to recognize the exterior of the school buildings and guides the facilities of the building. In addition, Sookmyung Women's University's representative character, Snowflake, is implemented as an augmented reality to provide fun to decorate and animate snowflakes. Therefore, this app suggests a new direction of the school guidance app, and it is expected that it will be very helpful for the guidance of the freshmen and the promotion of the school character.

#### 1. Introduction

Augmented reality became widely known and popularized through 'Pokemon Go', a mobile game that hit the first half of 2017. Augmented reality is a technology that enables interaction with users by synthesizing digital contents in reality [1]. It has a high level of immersion due to its ability to interact with reality, and it can be said to be a major factor in gaining popularity in a short period of time.

In addition to 'Pokemon Go', augmented reality technology can be applied to information transfer applications ranging from maps to educational materials. For example, the Google Play Store app "Sky View" uses augmented reality to illuminate the camera in the sky, showing constellations and stars by location. It is no longer difficult to experience augmented reality using a smartphone, and interest in augmented reality is increasing accordingly.

In this paper, we develop an Android app for university facilities using Augmented Reality. In this paper, we use Vuforia, an augmented reality software development kit (SDK), to realize augmented reality and recognition function [2]. The app developed in this paper is aimed at Sookmyung Women's University, and it provides the function of modeling the 'snowflake', which is the character of Sookmyung Women's University, in 3D, and providing entertainment that can direct the character as well as school guidance.

The composition of this paper is as follows. Chapter 2 introduces apps similar to this app. Chapter 3 explains the main functions of the app developed in this paper, and Chapter 4 describes the implementation techniques used to develop each function. Finally, Section 5 concludes.

#### 2. Similar App Status

Similar apps developed in this paper include 'Banana Rocket AR' and 'Smart Fate'. 'Banana Rocket AR' is an educational app for children to view the Augmented Reality contents of Woongjin Thinkbig's book "Banana Rocket for Science Book of Picture Book" [3]. If you turn a certain page onto a camera and turn the picture book on by voice guidance, the contents will be displayed as a 3D animation on the book. This feature is similar to the ability to enjoy 3D snowflake characters and animations when recognizing certain target cards among the entertainment features of this app. However, it does not provide a function to recognize general objects such as buildings.

'Smart Sookmyung' is an app developed by Sookmyung Women's University. It is an app that students use to get school information such as attendance management, reading room reservation, etc. [4]. In addition to the functions described above, it also provides various information about Sookmyung Women's University such as book search and online classroom confirmation. This app is similar to the application of this article in that it is an app that provides college information, but the function of guiding the campus is to show the map of the campus of the homepage. There is a difference.

## 3. Overview of school guidance app using Augmented Reality

The name of the app developed in this paper is' Let me know about snowballs' and it is aimed to provide information about school buildings and facilities to freshmen who entered Sookmyung Women's University. To do this, we use augmented reality and 'Snowflake' 3D characters to provide more realistic and interesting information. This app provides school information in the form of building information through building awareness and department facility information through college letterman jacket recognition. The following are the main features of the app developed in this paper.



(fig.1) Building Guide Screen through Building Recognition

# (1) Building guidance function through building recognition

(Fig. 1) shows the information about the building by recognizing the building in this app. For example, if you see a building with a camera using the app in front of a building as shown in Figure 1, the app recognizes the building and finds that the building is a 'hundred years memorial' Show. When you click on the 'Grandmothery' icon, you can see what departments and offices are in the building at a glance. If you click the 'Exhibition Hall' and 'Resting Space' icons, you can see

detailed information about each department. Especially, in order to give more familiarity to users, 'snowflake', a school character, was introduced and information was used to guide the information. Next to the window that provides information, you can see the "Snowflake" animation and see the snowflake walking or jumping.



(Figure 2) Department guidance screen through college letterman jacket recognition

(2) Department guidance function through college letterman jacket recognition

(Fig. 2) is a screen showing facility information of the subject department by recognizing the department and the uniform in this app. For example, when you find a college letterman jacket, you turn on the app to recognize the uniform (Figure 2). This screen provides information about the department, office, telephone number, department, and all facilities of the department. Here too, you can see the "snowflake" animation next to the screen as well as the building guide.



(Figure 3) Character goods purchase screen

#### (2) Character setting function

This app provides coins to the user every time he recognizes a school building or recognizes a school uniform for entertainment purposes. This coin is used by the user to purchase merchandise related to the "snowflake" character in the shop. Items that can be bought include clothes that 'Snowflake' wears and background when performing animation function. (Figure 3) is a user's purchase of a product related to 'snowflake' in the shop as a coin obtained. As you can see in Figure 3, users can purchase various shapes and backgrounds. If you select the clothes you bought here, you can see 'snowflake' wearing new clothes on the screen like (Figure 1) and (Figure 2).



(Figure 4) Character Animation Screen

#### (2) Character animation function

This app provides the ability to show 3D character dance animation whenever it recognizes the designated target card. You can see animations that change with the time you touch the character. (Figure 4) shows the 'snowflake' character dancing to the music in the dress and the background selected by the user. When you press the dance button, you can see various kinds of dancing snowflakes to match various music. In Figure 3, the mountain clothes and background can be seen when performing this function. You can adjust the volume of the music through the volume buttons. If you press the animation button, you can change the kind of animation randomly to see various dancing snowflakes.

#### 4. Implementation technology

The application of this paper is implemented using C # in Unity [5], a 3D game development engine, and building and department lock recognition is implemented using Vuforia SDK. This chapter describes the specific implementation methods used to implement the major functions described above.

• Building guide function

At the heart of this app's building guide is building

awareness. In this paper, building awareness function is implemented using Vuforia SDK which is augmented reality solution development platform. The Vuforia SDK provides the ability to run a camera when a user launches an application and to run predefined augmented reality content when a particular image is recognized by the camera. In this paper, we applied this function and let the user recognize the building instead of the specific image with the camera. In order to make the Vuforia SDK aware of the buildings, I have stored in advance the pictures of buildings taken in advance in the Vuforia database. At this time, since the user can view the building from various angles through the camera, about 10 photographs taken from various angles are registered as data. It is confirmed that the recognition rate of building is greatly increased through this method. When the building is recognized in this way, a 2D guidance screen is displayed corresponding to the unique number of the building instead of the augmented reality contents.

• Realization of college letterman jacket recognition function

The college letterman jacket recognition function was implemented in the same manner as the building guidance function. First of all, we store the jumbo photographs of each department in advance in the database. Then, when the college letterman jacket is recognized through the camera, it is compared with the images stored in the database to identify which college letterman jacket. Finally, a screen is displayed on the screen that displays the information of the department identified and the convenience facilities of the department identified.

• Realization of character motion in Augmented Reality screen

In the main screen of this app, when recognizing a specific card (target), the in-school character produced in 3D appears on the screen. The user can change the motion or rotate 360 degrees by touching the character displayed on the screen. You can also press various buttons to make various dances. The camera recognizes the target image and uses the same principle as the building guide function to display the 3D character. I recognized the time when I was touching the screen, and operated different animations by time. (After 3 seconds of touching the screen, the character walks 5 seconds later and 10 seconds later.) The ability to rotate the character is implemented using the Unity basic function OnMouseDrag (). Through this, the

application recognizes the direction of the screen touch of the user and can rotate the character 360 degrees left and right with the finger. The function that the character randomly dances is implemented by assigning a unique number to each dance operation and generating a random value from a random function.

• Implementation of coin acquisition function for building recognition

For entertainment purposes, this app allows users to acquire a certain amount of coins if they recognize campus buildings or department jumbo. These acquired coins are available on the shop page. In the OnTrackingFound () function, which is called when the target is recognized by Vuforia, we call recognizeBuilding (), which is a function that identifies which building is recognized. The recognizeBuilding () function divides the building by each unique number and increases the coin only 20 minutes after recognizing each building. This is to prevent the coins from being acquired continuously in the same place. To calculate how long it took for the last 20 minutes to be recognized, the app stores the last time it recognized the building as PlayerPrefs. Then use DateTime.Now to get the current time the building was recognized and subtract the time previously recognized as the PlayerPrefs from the current time. Finally, when the timeDiff value after this operation is over 20 minutes, the coin is raised.

#### Time saved as 'timeDiff = DateTime.Now – PlayerPref's

#### 5. Conclusion

In this paper, we developed a school guidance app using augmented reality. The school guide app developed in this paper recognizes the building exterior, college letterman jacket, provides building guidance and department guidance, and allows snowflakes, which are the representative character of Sookmyung Women's University, to be enjoyed in a 3D augmented reality screen. Using the apps developed in this paper, new students who are not familiar with campus facilities will be able to receive school guidance as augmented reality, a new and exciting way. It can also be expected to have a publicity effect on the character snowflake that represents the school. Future research will be to develop a system that provides information on schools in a more effective way by utilizing augmented reality more widely.

#### 6. Judge

This paper is based on the results of research conducted by the Korea Research Foundation (No. NRF-2015R1C1A1A02037071).

#### 7. References

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