Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5, 1637-1646
2024
Publisher: Learning Gate
DOI: 10.55214/25768484.v8i5.1882

A study on the development of O2O operation service platform using augmented reality

MiJung Kim[1], Hyuchan Kim[2*]
[1]Bucheon University, Gyeonggido, Korea; lallegro@bc.ac.kr (M.K.).
[2]Cheju halla University, Jeju, Korea; khc@chu.ackr (H.K.).

Abstract: An attempt of sequence selection is made for multiple alignments of transmembrane proteins in order to detect the structural similarity in the protein families. Treatment for the sequence selection, which is based on the pairwise sequence identities, is applied to ten sequence data sets of functional group of transmembrane proteins extracted from SWISS-PROT. The treatment excludes the sequences with low sequence identity from the divergent data sets effectively. Obtained multiple alignments are evaluated using two newly developed indices. The selected sequences, which are well aligned with few inserted gaps, seem to contain enough information for extracting the structural features of transmembrane functional groups.

Keywords: *AR/VR/XR, Information portal, Motion recognition, O2O service, Virtual experience service.*

1. Introduction

The 4th Industrial Revolution heralds the advent of new technologies and trends across society, culture, and science, with innovation and efforts accelerating in each field. The pace of change is particularly rapid in the ICT sector, driven by the adaptation of existing concepts and the emergence of entirely new ones such as AR(augmented reality), VR(virtual reality), XR (eXtended reality), AI (artificial intelligence), and big data.

The development of technologies stemming from the 4th Industrial Revolution, such as artificial intelligence, drones, and immersive content(AR/VR/XR), is bringing about significant changes across society. Instead of focusing solely on technologies within a specific field, multiple technologies are converging to create new types of services and markets[1]. Services utilizing various devices and 4th Industrial Revolution technologies have expanded, including AR-based image recognition for information guidance, VR-based virtual experiences, and motion sensor-based interactive guidance. These services are being well-received by users.

As the penetration rate of smartphones passes the 80% benchmark, tourism information has an increasingly significant influence on the image determination and satisfaction of tourist destinations. When using tourism information on mobile devices, interactions such as real-time feedback, communication, and new information communication can be performed actively, additionally having a significant impact on tourist satisfaction[2]. With the growth of smartphones and the rise of social communities, social media and mobile devices have not only transformed how people communicate with friends, but also how providers interact with consumers. Since the widespread adoption of smartphones, exhibition guide systems using location-based technology, such as 'beacons' — Bluetooth-based wireless recognition devices — have been widely used. However, due to issues such as inaccuracies in given information, difficulties in installation and management, compatibility problems with existing systems, and various other inconveniences, their influence is gradually diminishing. To address these shortcomings, various technologies such as GPS location-based services, indoor map positioning, QR codes, and NFC recognition are being applied, but these solutions also introduce complexity in both the system and its usage.

In particular, customers are rapidly shifting from offline to online purchases with the advancement of IT technology and the convenience of internet and mobile payment systems. This shift has led to the rapid growth of 'O2O (Online to Offline)' services. O2O refers to a business strategy that promotes product sales through marketing

* Correspondence: khc@chu.ackr

that connects online and offline channels. Global multinational companies such as Amazon, Apple, Google, and Alibaba are incorporating O2O business models alongside domestic portal companies such as Kakao and Naver.

As economic recession continues both domestically and internationally following the COVID-19 pandemic, the online-to-offline platform industry, which blurs lines between the online and offline, is emerging as a major pillar of our industry[3]. The industrial paradigm is shifting toward O2O business models based on IoT (Internet of Things) convergence services. O2O platforms, which possess the characteristics of an Internet platform, play a crucial role in the development of innovative technologies based on information and communication technology (ICT) such as web platforms, smartphones, and the IoT by integrating online and offline environments[4]. However, existing O2O platform systems are often developed separately for each piece of content or device rather than being integrated into a single system. This fragmentation makes integrated management and continuous operation challenging, shortens the lifespan of services, and makes it difficult to respond flexibly to the diverse and changing needs of users. As a result, despite the need for efficient management to enhance customer satisfaction, user satisfaction is declining. To address these issues, there is a need for an augmented reality-based application service that includes O2O features such as reservations and payments, as well as the development of a service platform that allows for integrated management of public relations and marketing. This would enable more efficient utilization of users' performances and exhibitions.

In this study, we applied augmented reality technology to existing promotional materials (posters, flyers, etc.) to make them more convenient and accessible for cultural industry workers who may lack IT expertise and promotional marketing experience. Additionally, we replaced the existing high-cost reservation system by developing an O2O service operation platform linked to the local cultural industry.

This study is organized as follows: Chapter 1 provides an introduction, Chapter 2 offers an overview of O2O and related case studies, Chapter 3 details the system configuration for O2O services, Chapter 4 covers system implementation and self-evaluation, and Chapter 5 presents the conclusion.

2. Literature Review

O2O(Online to Offline) services, which have recently gained significant attention, are closely related to smartphones and social media. They seamlessly connect online and offline elements to create new value and deliver it to customers. This system encourages purchases by sending discount coupons directly to phones[5]. Additionally, O2O draws interest from both online and offline companies because it facilitates various connections, such as linking restaurants with customers, accommodations with travelers, and taxis with users through apps[5].

Figure 1.
O2O service concept diagram.

O2O services originated with the goal of creating a new market by combining the advantages of online platforms, where information distribution costs are low, with offline environments, where actual consumption occurs. Services like Baedal Minjok and Kakao connect suppliers and users in real time through mobile apps. These services include online beauty salon reservations, food orders, taxi/rental car calls, lodging/leisure reservations, real estate contracts, and housekeeper requests. Representative examples include taxi services and Starbucks' Siren Orders[6]. These services enable offline orders to be placed online, allowing customers to conveniently access them from any

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

location at any time.

O2O services began by supporting offline activities online, combining the strengths of both online and offline industries. The entry of various companies into O2O services will enhance human efficiency and convenience. Companies can use information gathered both offline and online to engage with consumers and expand the collection of data related to consumer activities in the process[7].

O2O services began by supporting offline activities online, combining the strengths of both online and offline industries. The entry of various companies into O2O services will enhance human efficiency and convenience. Companies can use information gathered both offline and online to engage with consumers and expand the collection of data related to consumer activities in the process[8].

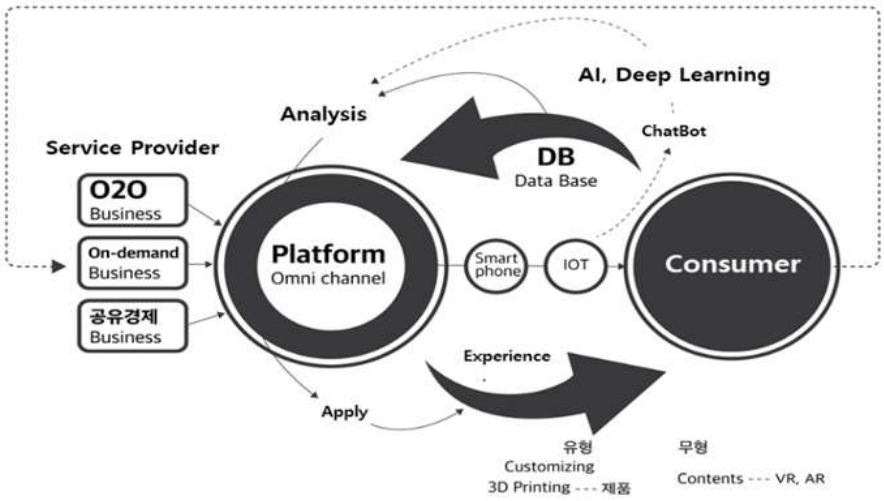

Figure 2.
O2O platform service flow chart.

2.1. Domestic Cases

Kakao Taxi is a representative example of an O2O service, connecting users with taxis — an offline service — through a mobile app. Payment is made via pre-registered options such as Kakao Pay. Unlike traditional call taxis, there are no call fees, and payment is simple and easy, leading to increased usage of the service.

Yanolja is an O2O service company that has revolutionized the existing lodging reservation industry. It displays nearby small and medium-sized accommodations based on GPS or search results. Initially launched as a platform for booking low-cost accommodations online, it has since evolved into a comprehensive O2O service that connects travelers with offline hotels and leisure activities. Users can search for and book rooms and activities online, then experience them offline. This combination of online reservations and offline travel and leisure activities exemplifies the O2O model, offering numerous benefits to users through various events, including customized travel plans and in-app coupon payments.

Baedal Minjok is a company that partners with 'all delivery restaurant businesses.' The Baedal Minjok app determines the consumer's location based on GPS results and displays nearby registered businesses. Consumers then place orders by considering factors such as food photos, prices, and reviews. While payment can be made directly upon delivery, the app also offers a wide variety of payment options, including Kakao Pay, card payment, and mobile phone payment[9].

Zigbang offers a 'mobile model house' service by incorporating cutting-edge technologies such as 3D computer graphics (CG) and virtual reality (VR). It gained attention during the COVID-19 pandemic because it provided all information about properties online, eliminating the need for in-person visits to find rooms[10]. By integrating information technologies such as AI and big data with real estate brokerage apps, Zigbang is leading the non-face-to-face brokerage transaction culture in the COVID-19 era.

Table 1.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

Categories and their examples of O2O services in Korea.

Category	Company	Description	Service details
Errands and delivery	Baemin	- Food delivery, errands, quick service	- Easy ordering and delivery via app.
	Coupang eats	- Provides fast food delivery service	- Exclusive delivery service by Coupang Eats.
	Barogo	- B2B delivery platform	- Provides errands and delivery services for businesses.
	Yogiyo	- Expanding partnerships with various restaurants	-Offers various discount coupons and benefits.
	Wemakeprice O	- O2O (Online-to-Offline) delivery service by Wemakeprice	- Allows ordering food with affordable delivery fees.
Vehicle	Kakao T	- Provides various vehicle-related O2O services such as taxis, proxy driving, and parking	- Offers short-term rentals through vehicle sharing services.
	Socar	- Vehicle sharing service	- Allows renting vehicles by the hour.
	GreenCar	- Vehicle sharing service	- Enables eco-friendly vehicle rentals via app.
Accommoda-tion and reservation	Yanolja	- Accommodation reservation platform	- Provides global accommodation and leisure reservation services.
	Good Choice	- Provides accommodation and leisure reservation services	- Allows reservation of hotels, motels, and pensions
	MyRealTrip	- Specialized platform for independent travel reservations	- Provides information on travel destinations worldwide.
Real estate	Zigbang	- Provides real estate listings and brokerage services	- Enables map-based property searches.
	Dabang	- Provides residential real estate listings	- Offers detailed information on listings.
	Hogangnono	- Provides apartment and house price information	- Offers sales and rental information.
Coupon download	Naver	- Provides various discount coupons through integration with Naver Pay and Smart Store	- Coupons available for online shopping.
	Kakao	- Provides various coupons through KakaoTalk	- Coupons available for various brands and can be used through the app.
	Laundrygo	- Contactless laundry service	- Enables laundry pickup reservation 24/7 via app.

2. 2. Foreign Cases

Uber is an American ride-sharing service or company that calls taxis and private cars to a nearby location through a mobile app[11]. Uber, which allows customers to conveniently request cars regardless of location with

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

just smartphone access, has gained sensational popularity worldwide. It is a representative shared economy service[12].

Airbnb is the world's largest accommodation sharing service. Any space where a person can live, such as a room, house, or villa, can be rented out on the platform to complete strangers, not just relatives or friends. It is popular among young travelers, as it offers the opportunity to stay in well-appointed homes at a lower cost than traditional accommodations[13]. Airbnb's O2O characteristics include supporting reservations and payments through an online interface and providing a unique offline experience of staying in a local home while immersed in the local culture.

Amazon is an American company that provides e-commerce and cloud computing services under the name Amazon Web Services. Founded in Washington in 1994 by Jeff Bezos with the idea of selling books on the Internet, it was one of the first companies in the world to create an e-commerce service[14]. It has since established itself as a comprehensive platform that meets both online and offline needs by offering various O2O services such as Amazon Fresh, Amazon Go, Amazon Lockers, and Amazon Services.

Grubhub is a popular food delivery service in the United States. Users can order and pay for food online through the app and then receive the food delivered offline. This service connects restaurants with delivery workers and offers features such as a wide selection of restaurants, real-time order tracking, and the ability to repeat previous orders.

OpenTable is a restaurant reservation platform and an O2O service that allows users to search for restaurants online, make reservations, then enjoy meals in person offline. This service enables users to easily make reservations while allowing restaurants to manage them efficiently. It offers features such as real-time reservation confirmation, variety of restaurant options, management of reservation history, and the ability to write reviews.

3. Augmented Reality O2O Platform Design and

3.1. Content Management System

In this study, a real-time CMS (Content Management System) was implemented to allow users to easily receive AR content directly from performances and cultural event content through their smartphones. The overall service system configuration diagram is shown in Figure 3.

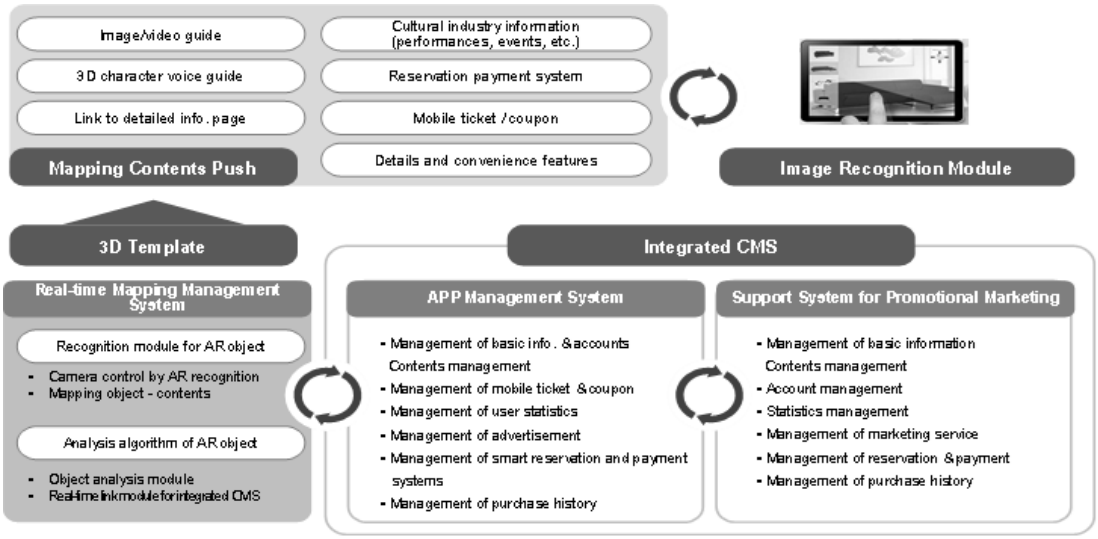

Figure 3.
Service system configuration diagram.

3. 2. UI Design and Scenario

The system developed in this study enables cultural organizers to easily load realistic content and users to explore real-time cultural content through their smartphones. This approach is expected to improve user

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

satisfaction with content services while reducing the cost burden for operation managers. Figure 4 illustrates the service scenario.

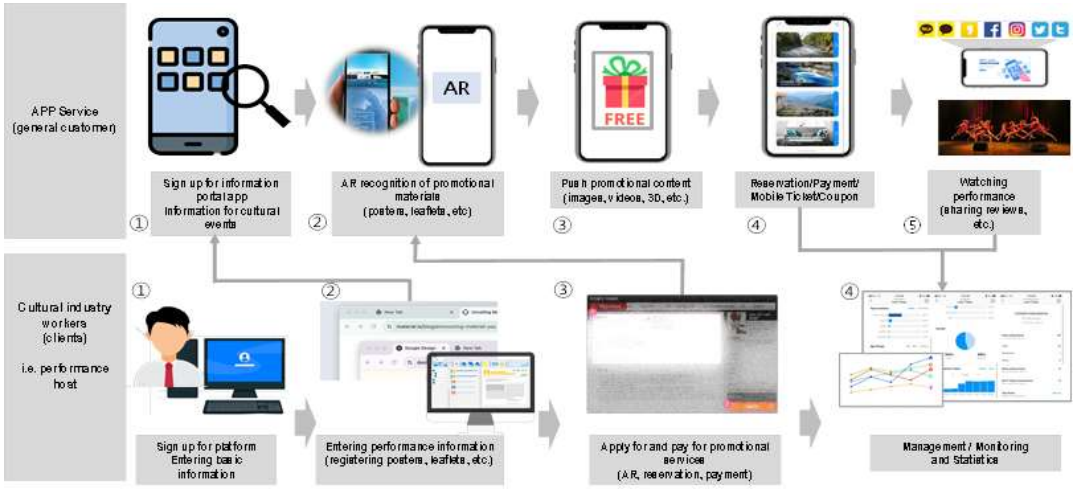

Figure 4.
Service scenario.

Figure 5 displays the process of email membership registration and simple registration (linking SNS accounts) for user convenience.

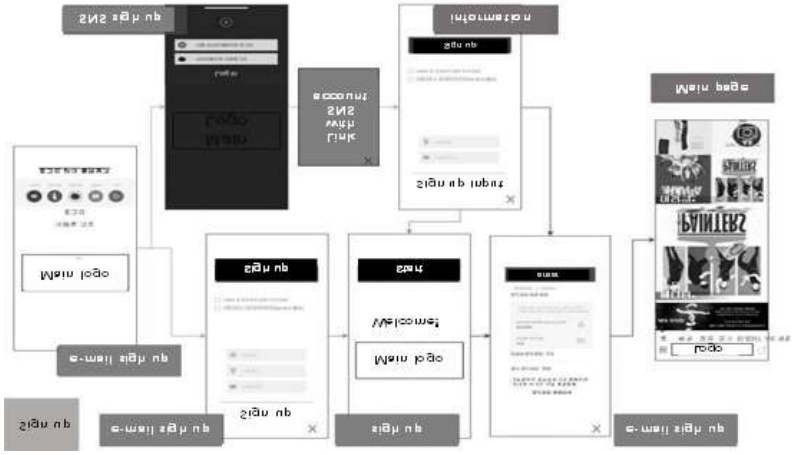

Figure 5.
Member sign-up screen.

3.2.1. Login Screen

Figure 6 shows an email login or simple login screen similar to membership registration, allowing users to easily access the platform.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

Figure 6.
Intro and login screen.

3.2.2. Administrator Screen

Figure 7 shows the marketing support platform's manager mode screen, which includes search conditions, detailed information about the event, event registration, the AR content list for the event, and event modification options.

Figure 7.
Marketing support platform manager mode screen.

3.2.3. App Service Screen

Figure 8 shows the screen of the app service developed in this study. It includes the home screen, poster image recognition, real-time AR mapping content exposure, performance reservation, payment and simple payment, and coupon processing screens.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

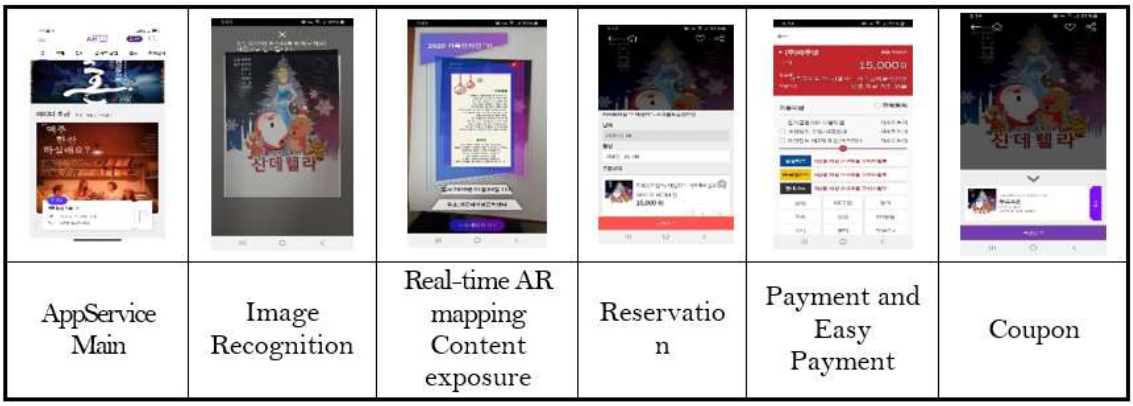

Figure 8.
Main App service screen.

4. System Implementation and System Self-Evaluation

This platform was implemented to provide content and accurately recognize objects following AR recognition response in an Android OS development environment. The test environment setup is shown in Figure 9.

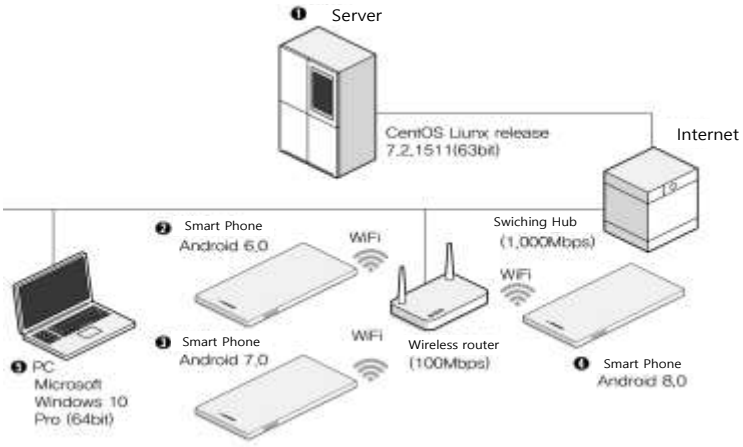

Figure 9.
System test environment.

Server	DBMS : MySQL 5.6.35. , JAVA : Oracle JDK 1.8.0_171, WAS : Apache Tomcat 8.0.50
SmartPhone	Android 11.0 OS : Qualcomm Snapdragon808, Memory : 6GB, HDD : 128GB Android 12.0 OS : Samsung Exynos8, Memory : 6GB, HDD : 128GB Android 13.0 OS : Samsung Exynos8, Memory : 6GB, HDD : 128GB
PC	Intel(R) Core(TM) i5(1.70GHz) , Memory : 16GB, HDD :1TB
Network	1000Mbps Switching Hub & Wireless Sharing

The APK file (Android App APK) was installed, and the marker was pre-registered in the integrated CMS. Three types of smartphones, each running a different version of the Android OS, and a poster displaying the marker were provided in thumbnail form for AR object recognition. The speed of AR object recognition and exposure, as well as the response time for various elements such as reaction time, computer vision performance algorithm, real-time content mapping, and 3D content template push response, were measured for each item. Figure 10 below shows the poster images provided as samples.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882

Figure 10.
Poster images.

The results of the performance self-evaluation according to the system evaluation method for implementing augmented reality content through an app are as shown in Table 2.

Table 2.
Performance self-evaluation result of the app implementation platform.

5. Conclusion

The development of technologies based on the 4th Industrial Revolution, such as artificial intelligence, deep learning, drones, and AR/VR, is driving significant social and cultural changes. These advancements are not only creating new types of services but are also forming new markets through the convergence of multiple technologies. While securing support budgets and facilities is important for the cultural industry, it is especially necessary for small to medium-sized companies and workers in this sector to achieve self-sufficiency through the sales expansions. Therefore, it is essential to have professional and convenient promotional marketing support tools as basic infrastructure to increase the sales of performances, exhibitions, events, festivals, and more.

In this study, existing promotional materials such as posters and flyers were utilized in their original form, while augmented reality(AR) technology was applied to replace the expensive reservation system. This approach was designed to be more convenient and accessible for corporate workers who may lack IT expertise and promotional marketing experience. As a result, a marketing platform and a dedicated application specialized for augmented reality-based O2O services were developed with a focus on the cultural industry.

The augmented reality-based O2O service platform developed in this study enables cultural industry operators to easily integrate and showcase realistic content, allowing users to explore cultural content in real time through their smartphones. This approach not only enhances user satisfaction with content services but also significantly reduces the cost burden on operational managers, making it an efficient and effective platform for the cultural industry. Specifically, this O2O service platform is expected to evolve into a cultural industry service that applies the latest ICT technology by combining image recognition modules with smartphone app services. This will allow cultural industry operators to easily upload promotional content and support marketing through 3D AR content.

References

[1] Young-ick Kim., and Min-cheol, Kim., A Study on the Constructing Information Portal App of O2O Services based on Augmented Reality Specialized Local Culture Industry, *The Society of Convergence Knowledge Transactions* , Vol.8, No3(2020),105-114.

[2] In-Seon, Kim., Chi-Seo, Jeong., and Kye-Dong, Jung., AR Tourism Service Framework Using YOLOv3 Object Detection, *The Journal of The Institute of Internet, Broadcasting and Communication (IIBC)*, Vol.21, No.1(2021), 195-200.

[3] https://m.etnews.com/20210415000194

[4] Seung-Gon, Choi., Ho-Gyu, Choi., The Effect of O2O Platform Quality on Relationship Quality and Personal Behavior Value, *International Journal of Advanced Culture Technology(IJACT)*, Vol 7. No 4(2019), 86-95.

[5] Byung-Ho, Cho., Analysis and Design of Smart-phone App. for O2O Restaurant Service, *Journal of Korea Institute of Information, Electronics, and Communication Technology*, Vol.10 No.2(2017), .125-132.

[6] Ministry of Science and ICT, 2020 O2O Service Industry Survey, 2021.

[7] Jong-dae, Kim., Na-kyung, Kim., O2O, connecting online and offline, opens up possibilities for innovation, *LG Economic Research Institute*, 2015.

[8] Seung-Gon, Choi., Ho-Gyu, Choi., *Korean Review of Corporation Management*, The Effect of O2O Platform Quality on Relationship Quality and Personal Behavior Value, Vol.12. No1(2021), 143~162.

[9] https://m.blog.naver.com/PostView.naver?isHttpsRedirect=true&blogId=ojkuih9788 &log No=220753973031

[10] https://m.etnews.com/20210415000194

[11] https://ko.wikipedia.org/wiki

[12] Dong-soo, Kim., Kwan-ho, Kim., Don-guk, Choe., and Jae-Yoon, Jung., Service Issues and Policy Directions for Promoting the O2O Industry in Korea, *The Journal of Society for e-Business Studies*, Vol.21, No.4(2016), 137-150.

[13] https://www.moef.go.kr/sisa/dictionary/detail?idx=1922

[14] https://blog.naver.com/PostView.naver?

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 8, No. 5: 1637-1646, 2024
DOI: 10.55214/25768484.v8i5.1882