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The O2O Marketing System Using Augmented Reality and Beacon

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Abstract

Recently, the supply of the smartphone serving as the main personal communications terminal and the development of the Bluetooth-based beacon technology have induced the appearance of a new shopping method known as the O2O marketing. However, the problem is that the current O2O marketing using beacon has been sending unbridled push signals to the users, and, thereby induced the users to think of the O2O marketing information as the spam information. In addition, since the beacon only provides the simple push-based product information, there are limits in providing accurate and diverse information to the users. In this thesis, the beacon signals preferred by the users are selectively received so that the information definitely required by the users are provided to the users instead of the spam information. In addition, the augmented reality is applied to the O2O marketing, and, therefore, the system providing a wide range of diverse information to the users is proposed.

Keywords*: Beacon, Augment Reality, O2O, BLE*

1. Introduction

Currently, we live in the big data environment where a tremendous amount of information is produced and consumed based on the expansion of the personal mobile devices represented by the technical development of internet and smartphone. Various companies have been considering the new business models through the use of such big data, and as one of the results, the O2O(Online to Offline) commerce, a combination of price competitiveness of the online stores and customer experience in the offline stores has been born [1-3]. The bluetooth-based beacon technology serves as the basis for the development of such O2O commerce. The O2O is a method for attracting the customers to the offline stores through the IT-based online marketing. The short-distance communication or location-based technology can be used to send coupons to the customers near the offline stores and attract the potential customers, and the store data can be analyzed to deduct the most effective method for securing the new customers or the regular customers. Moreover, since it is possible to actualize an elaborate customer management through providing more benefits to the customers determined to be more loyal based on the customer visit information, it is being considered a new method for expanding the profits from the offline stores. However, due to the rapid development of the beacon technology and O2O commerce, in addition to the user-preferred information, the unnecessary information sends the indiscreet push signals to the users, and, thereby, created a problem where the users determine such push signals as the spam messages from time to time. In addition, the provision of the marketing information through the simple push signals created a problem where it is difficult to provide the accurate and reliable information to the users [4]. In this thesis, in order to send only the user-preferred and user-selected push signals so that it is possible to attract their interest and enhance their immersion, the concept of the augmented reality is introduced to the beacon-based O2O commerce. This thesis is organized as follows. In Chapter 2, the technology related

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to actualizing the system proposed in this thesis is analyzed. In Chapter 3, the system design is described. In Chapter 4, the actualization of the system proposed in this thesis is described. In Chapter 5, the conclusion is specified.

2. Related Research

2.1. Beacon

The beacon, a BLE (Blootooth Low Energy)-based communication method, was initially introduced at WWDC (World Wide Development Conference) by Apple in 2013. It is one of the technologies that have been attracting the interest of the people based on its various strengths in comparison with other technologies. Since the beacon uses the BLE-based communication method, it is applicable to above iOS 7, Android 4.3 and most of the devices featuring other BLE-based communications. In addition, since its maximum signal transfer distance is 70m, it requires no short-distance contact, and, thereby, requires no manual action to be taken by the users. In addition, as shown in Figure 1, its size is compact, meaning that it can be manufactured in diverse types of beacon [5].

Figure 1. Examples of Beacons

The beacon, as shown in Table 1, serves diverse purposes in diverse marketing fields. The beacon is used as a means of marketing in the stores, and is also used in diverse fields such as missing child/loss-preventive location tracing, distribution and tourism [6].

Recently, the Bluetooth SIG (Special Interest Group) consisted of Ericsson, Nokia, IBM, Toshiba and Intel opened the bluetooth version 5, a product scheduled to be released in the second half of 2016 or the first half of 2017, to the public. The transfer distance of the bluetooth version 5, in comparison to that of the bluetooth version 4, has been enhanced by 4 times, and the BLE-based connection speed has been enhanced 2 times. In addition, the non-connection data broadcast capacity has been enhanced by more than 8 times. Based on the broadcast message capacity enhanced by 8 times, the bluetooth version 5 is expected to be widely selected and used by the companies specializing in diverse industrial fields such as home automation and beacon/location-related services[7].

The beacon has been attracting the interest of the people as a new device featuring the internet of things, a technology allowing the organic communication between people and things as well as things and things [8].

Table 1. Beacon Service

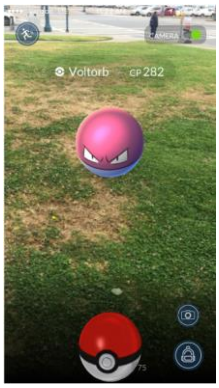
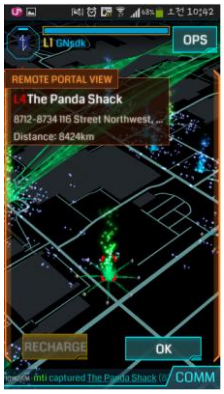
			
Syrup O2O commerce service by SK Planet that shows discount benefits from affiliated stores nearby based on Beacon's location based service	yap This is the first marketing service platform using Beacon technology in Korea. It uses independently developed beacon and communication method that combines Bluetooth and high frequency. It has wide usage as it can be used without activating Bluetooth.	Track & Go This luggage loss prevention service by 'Samsonite' uses beacon by Google. The Eddystone short indicator by Google is built into the travel bag so that user can track and find the luggage.	Siren Order This application by Starbucks automatically orders beverages without even visiting the counter. It is easily accessible by application users as the nearest store can be selected without having to wait in queue.

2.2. Augmented Reality

The augmented reality, as part of the virtual reality, is a computer graphic technique used to compose the virtual object/information into the actual environment in order to make such virtual object/information seem as if they exist in the original environment. The term ‘augmented reality’ is a compound word consisting of the term ‘augmentation’ meaning ‘increase/expansion/ and the term ’reality’ meaning actual reality visually seen. This augmented reality technology, different from the virtual reality technology where the users are generally immersed in the virtual world and become incapable of viewing the actual environment, allows the users to view the actually existing environment through the camera/monitor to acquire the virtual information(object) additionally mixed with the actual environment. In other words, the difference between the virtual and augmented realities is that the virtual reality is a new environment created through the substitution of the actual world, whereas, the augmented reality provides the users with the virtual information(object) mixed with the actual world [9].

The mobile augmented reality is a technology where the 3D model of the virtual world mixed with the actual world is displayed in real time through the mobile [10]. The mobile augmented reality system can be divided into the location-based system, marker-based system and non-marker-based system depending on the technology used for tracing the target. The location-based augmented reality, as shown in Table 2, is the most widely used augmented reality technology based on the location information of the GPS(Global Positioning System).

Table 2. Location-based Augmented Reality Services

			
Pokemon Go	Ingress	Hi Star WALK 2	Discover Honkong AR

However, for the location-based augmented reality system, in cases where there are more than two contents existing in the identical location of the screen, the overlapping phenomenon may disturb the users from acquiring their preferred information, and in cases where the information of the actual world changes, the only way to secure the reliability of the information is to update the information of the augmented reality[11].

The marker-based augmented reality system, as shown in Figure 2, has square-shaped borders and a white background color. In this system, the 3D coordinate system is created on the recognized marker to match the 3D entity. However, in most of the cases, since the black markers are used, the weakness is that it is very sensitive to the lighting, and that the partially covered markers cannot be used [12].

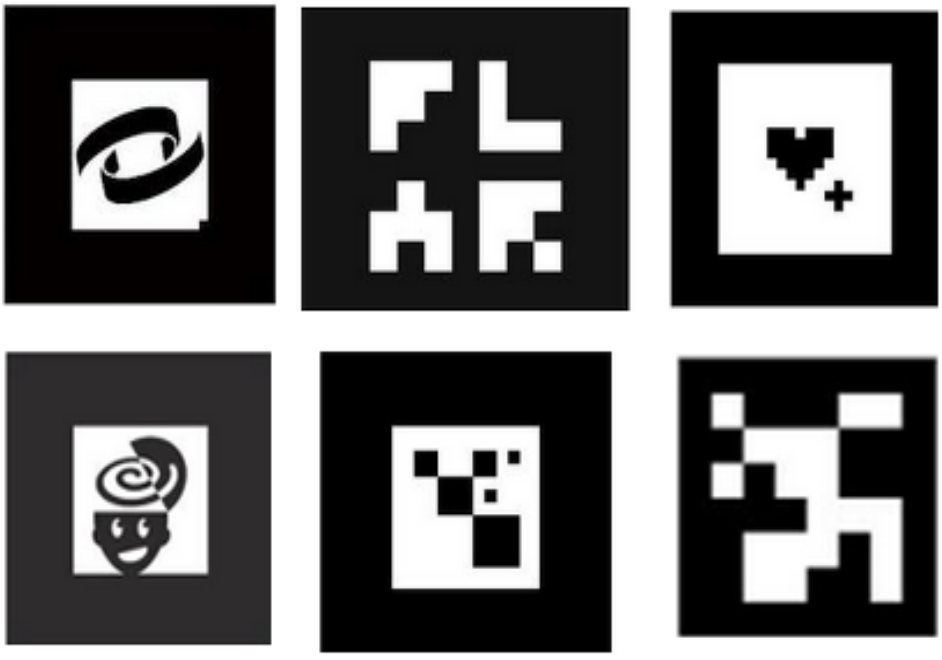


Figure 2. Examples Augmented Reality Marker

The non-marker-based augmented reality system uses the images of the actual world to supplement the problems displayed in the marker-based augmented reality system. As shown in Figure 3, the feature points extracted through the camera images are applied.

This is considered the most difficult and important technology used in the field of augmented reality [13-14].

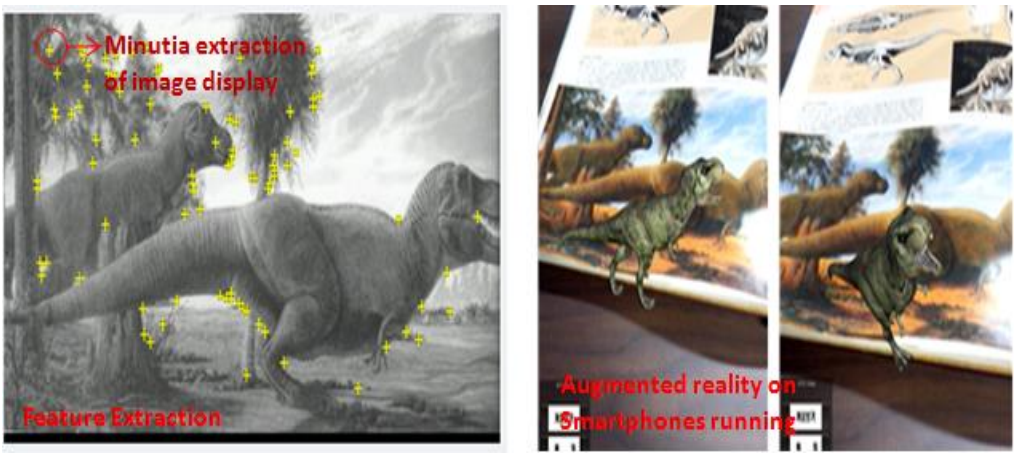


Figure 3. Examples Augmented Reality Non-marker

3. System Design

Figure 4 shows the blocked structure of the system proposed in this thesis. The structure is divided into client terminal, server and beacon. The client terminal recognizes the beacon sensor and collects the user data, or, depending on demand, makes a request to be provided with the data from the database. In cases where the users make a request, the augmented/marketing information is provided as the 3D model to the users through the augmented reality system.

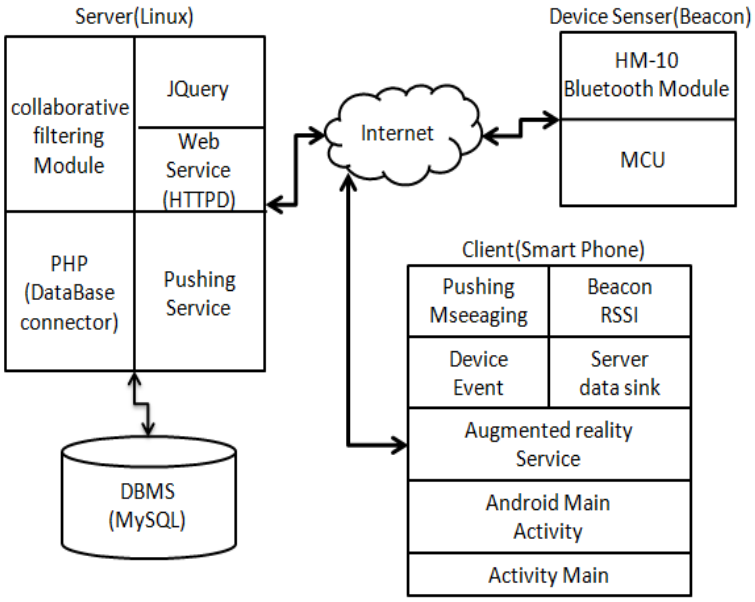


Figure 4. System Architecture

CentOS 6.8 is used as the server operation system for the system proposed in this thesis, httpd-2.2 is used as the server for providing the web service, MySQL-5.6 version is used as the DBMS, and PHP-5.5 version is used as the database connector. The smartphone using the Android version 5.0.1 and 4GB memory is used to test the beacon's

push signal reception as well as to test the augmented reality system. Finally, HM-10 Bluetooth Module is used as the beacon.

3.1. Beacon Design

The beacon used in this thesis, as shown in Figure 5, is manufactured through the use of HM-10 Module(bluetooth module) and Arduino Uno R3. Considering the size of the beacon, 240mAh CR2032 Coin Battery is used as the power source.

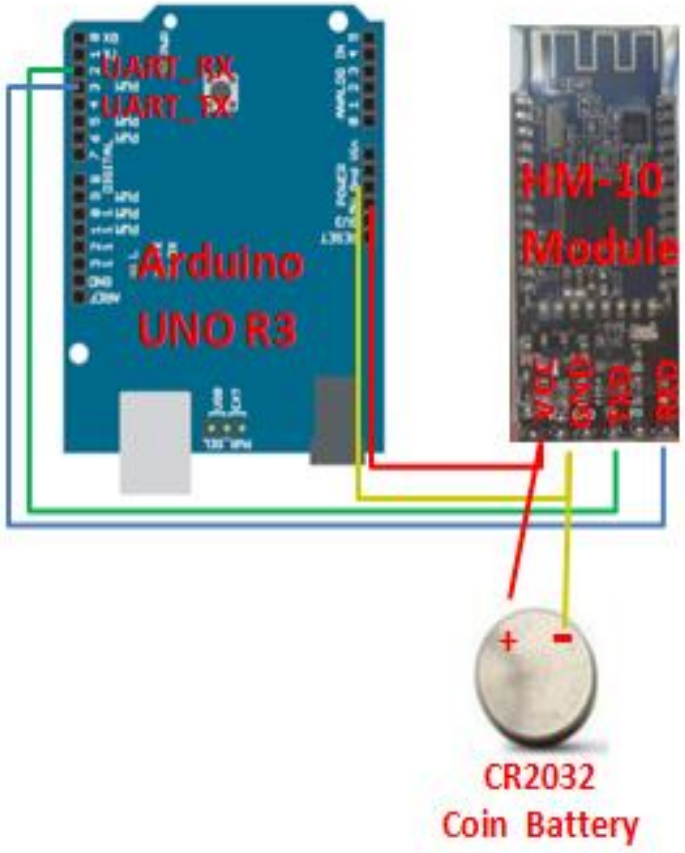


Figure 5. Beacon Architecture

While Arduino is connected with the computer, the 2nd/3rd digital pins are used to connect HM-10 Module. Then the software serial is used to establish a communication with the module, and 74278BDA–B644-4520–8F0C-720EAF059935 is used as the UUID of the beacon.

3.2. Augmented Reality System Design

The augmented reality system service used in this thesis, as shown in Figure 6, uses the non-marker-based augmented reality technology in a form of smartphone application. The actualized augmented reality system is designed to attract the interest of the users through the augmented 3D model and promptly and accurately deliver diverse information to the users through the connection with the database management system. In addition, it is designed to allow the both-way communication between system and users to provide a convenience to the users in services such as reservation system. Qualcomm's Vuforia version 5.5 SDK and UNITY version 5.3.5(game manufacture application software) are used to develop this augmented reality system service.

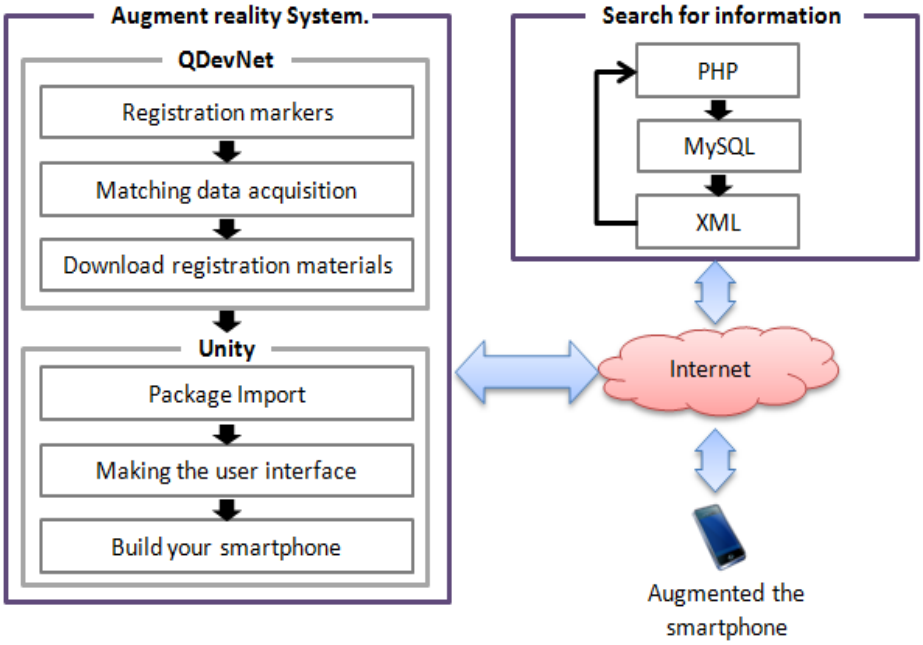


Figure 6. Augmented Reality System Architecture

4. System Realization

Figure 7 shows the finally actualized bluetooth module beacon. It can be confirmed that the communication with the smartphone application is operating normally.

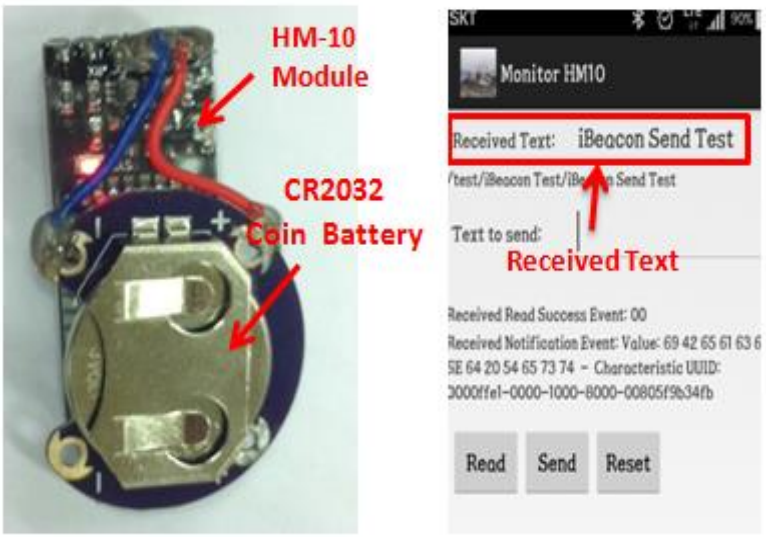


Figure 7. Checked the Completed BEACON and Communication

Figure 8 shows the screen displaying the beacon location and marketing information sent from the beacon to the smartphone application. It can be confirmed that the system proposed in this thesis is operating normally.

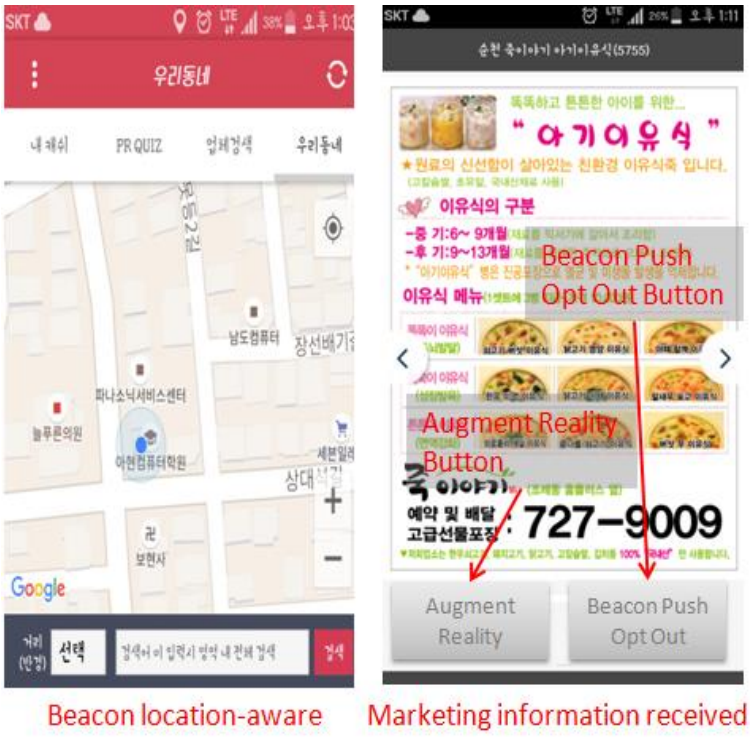


Figure 8. Receiving of Marketing Information Using the Push Signals

Figure 9 shows the screen displaying the augmented result after selecting the augmented reality menu on the smartphone application. It can be confirmed that the 3D entity/store information is normally processed through the offline marketing.

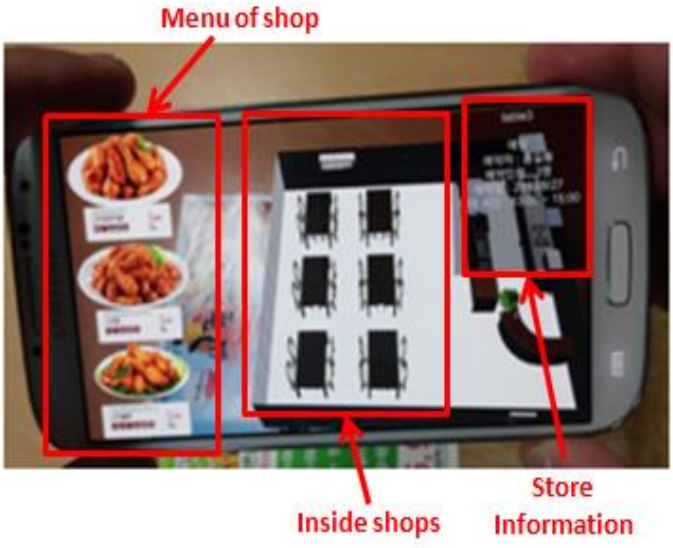


Figure 9. The Results of Augmented Reality

6. Conclusion

The most of the recent O2O marketings are serviced in a form of providing the marketing information through the simple push signals of the beacon. However, the users are demanding the diversified/differentiated servicing of the continuously increasing O2O

marketing. In this thesis, a method allowing the users to selectively receive the information from the indiscreet push information delivered through the beacon is proposed. Moreover, through the augmented reality, in addition to simply providing the information to the users, the information being provided to the users has been diversified to enhance the efficiency of the O2O marketing. The O2O marketing system to which the augmented reality/beacon serving as the results of this thesis are applied is expected to enhance the users' approach to and satisfaction of marketing information through surpassing the level of simply providing the mobile marketing information. The system proposed in this thesis is designed so that the users may only receive the selected the O2O marketing information. However, the possibility that the information being received may be considered a spam is not completely removed. Accordingly, in the future, it is necessary to conduct a research to provide the users with their selected information as well as the big data-connected user-customized information.

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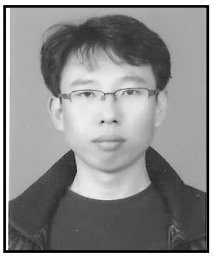

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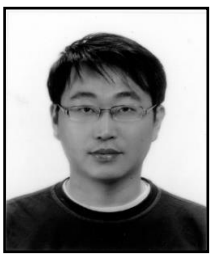

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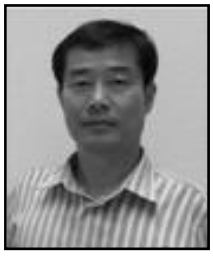

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