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CARDA: Content Management Systems for Augmented Reality with Dynamic Annotation

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Abstract. This paper designed and implemented a CMS (content management systems) to provide interactive augmented reality content to users. We used a method to store and manage 3D models and additional information by separating them, instead of storing and managing 3D model and additional information used for augmented reality as one object by integrating them. If this method is used, an administrator can easily revise and edit information, and various service applications can be carried out in the future. There is also an advantage offering quick augmented reality response service using a method to provide relevant additional information, according to user's request.

Keywords: CMS, 3D asset, augmented reality, dynamic annotation

1 Introduction

Augmented reality (AR) refers to the environment expressed by overlapping realistic images shot by a camera with digital information such as sound, image, video and graphic [1]. Especially, the information expressed with 3D graphical object is very effective, because it can provide realistic information that cannot be viewed in a video. Due to realistic user experience effect offered by 3D graphics, the AR technique greatly receives attention in the advertisement field recently [2].

The number of newly supplied mobile smart devices has recently surpassed the number of PCs. This means portable smart have become a major channel to access information or advertisement through the Internet. The portable smart devices, to which a camera and GPU (graphic processing unit) are installed, are appropriate devices for the AR environment embodiment combining realistic images with 3D graphics. Although, there is a merit that more useful information can be offered to consumers in using AR, there is a demerit that production and management of advertisement can become difficult. Especially, lots of time and efforts are necessary in the 3D model production process in comparison with the production of photos or videos. In addition, the revision of information or conversion into another usage is also needed, after combining a 3D model with additional information.

This paper designed and implemented a CMS to offer interactive AR content to the consumers using portable and Internet accessible smart devices. To enhance the efficiency of AR content production and management process, this paper used a

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method to separately manage 3D models, the core information of AR, and additional information. Toward this end, this paper designed 3D model by dividing it into two layers, and deployed auxiliary objects connected with additional information in the lower layer. This paper also defined and embodied communication protocol between AR browser and server with JSON.

2 Proposed Content Management System

AR technology includes marker recognition, 3D model to be expressed by being registered with the marker, and various components such as audio and video.

Static link is generally used for the AR content service mode as shown in Fig. 1(a). To connect a 3D model and other components in the AR content production process, some specialized programming skills are necessary. A demerit that huge specialized personnel and time are required in this process can cause that AR industry becomes difficult to be quickly combined with other industries.

To efficiently solve such a problem, this paper proposes a method using dynamic link as demonstrated in Fig. 1(b). In this method, various components are combined at the time of using the AR app by separating the build time, a stage before AR app, which is the section requiring specialized programming technology, is distributed, and the running time, which is the time for users to use AR content.

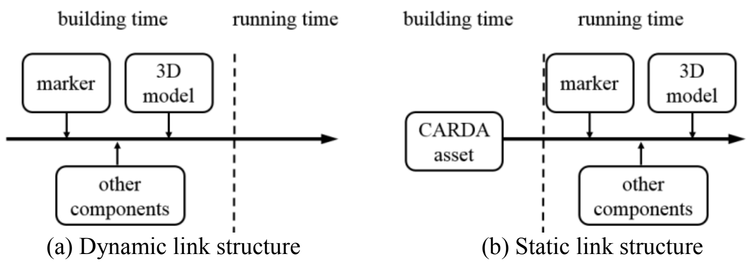

Fig. 1. Comparison of dynamic link and static link structure-based AR content services

To realize the service structure using dynamic link, an app built with CARDA Asset needs to be used, as shown in Fig. 1(b). CARDA Asset includes interface that can mutually combine various components at running time. Interface is designed to be used from both user and operator aspects.

From the user aspect, the interaction section, through which users can actively cope with various additional information such as surrounding environment recognition, CRM (customer relationship management), purchase, inquiry and SNS that can occur during the use, is included. From the administrator's operation aspect, quick coping with product model change and the re-composing of components are possible.

The CARDA system's structure and design characteristics of dynamic link proposed by this paper are as follows.

2.1 CARDA Structure

CARDA consists of the following three modules: database storing components, database management module, and AR Editor, which is a GUI type editing tool through which an administrator without the program experience can easily create additional information in terms of a variety of user app's additional information.

The CARDA system stores components such as 3D model, marker information, audio and video in the database through CMS Web Interface as shown in Fig. 2.

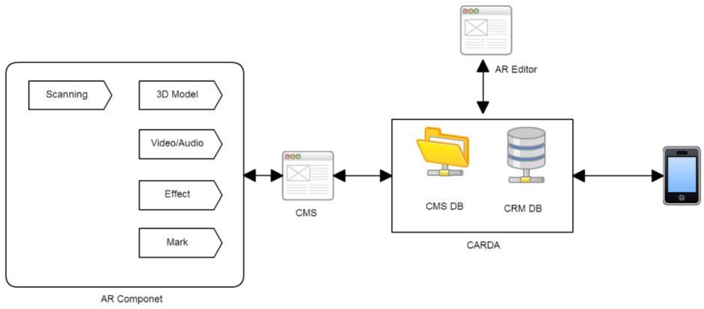

Fig. 2. Block diagram of CARDA

2.2 Basic Model of CARDA Asset

For the service of AR content, a technology to process the size, location and direction of a 3D model to be registered with images shot by a camera installed in a mobile device is important. Image registration technology can be generally divided into marker-based and nonmarker-based methods. There are such various technologies as QR-Code [3], ARTag [4], ARToolkit [5] and ARToolkitPlus [6] in the marker-based method.

Nonmarker-based technologies are the method to extract characteristics from image, connect corresponding points between frames based on the characteristics, and trace movement path. SIFT (scale-invariant feature transform) technique is a representative method [7]. However, there is a problem that service quality drops in the actual environment, due to increase of system load, because the nonmarker-based method is in charge of operation required for mobile device to extract characteristics.

In this paper, Qualcomm's Vuforia Cloud service was used for marker registration [8]. This paper offers the basic model unit, which is CARDA Asset for link service composition. As shown in Figure 3, CARDA Asset defines a virtual model as a cube model having layers, and actual media model is not included. The basic model of CARDA Asset includes background or image effect. This has an advantage that quick distribution is made at the time of service, since build size is relatively small, due to non-inclusion of actual component information.

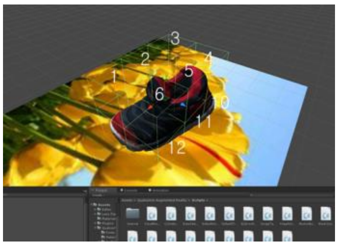

Fig. 3. Example of CARDA asset

2.3 Data Transmission Method

The basic model of CARDA Asset links necessary components, according to a scenario, as service is carried out, after the time of distribution. There is a method to use XML and JSON (JavaScript Standard Object Notation) as a method defining communication procedure between app and CARDA. Because, JSON is lighter than XML, communication can be made with just 60~70% of data, when JSON is used, compared with the case of using XML [9][10]. Therefore, this paper used JSON as a communication method for communication with the CARDA system.

JSON is very effective for the scenario service technology to be described in Section Four, as well as for CARDA Asset. The following shows an example of simple communications result between CARDA system and app.


```
{
  "carda_host":"210.115.230.111",
  "login_id":"hallym0123",
  "login_pass":"1234",
  "vuforia":{
    "vuforia_id":"FASE0120",
    "vuforia_pass":"1234",
    "vuforia_mark_name":["model01","model02","model03"],
  }
  "bgm":{
    "bgm_id":"\bgm\bgm_test.mp3",
     "bgm_time":{"st":1234,"end"3345"},
   }
```


3 Experiment

We measured simple responding speed for performance measurement of the proposed syste. As for mobile communications network, 4G and 3G networks were used, and the test was conducted using two devices: Samsung Galaxy Note3 (Android 4.4, CPU 2.3Ghz, 2GB RAM) and LG Optimus Big (Android 4.0 CPU TI OMAP3630 1Ghz, 512MB RAM) as mobile device. For the AR content used in this paper, Android App having a total of 18MByte capacity including 3D model, voice and image information was used. To check performance that becomes different, according to the use of cache embedded in the device, this paper comparatively measured initial stage response time and second response time. As shown in Table 1, this paper checked that dynamic link has no difference with static link, due to the use of internal cache, after initial connection. This paper actually checked more remarkable difference in the device with low specifications. When a device with low specifications is considered, the quick response speed of dynamic link system is conjectured to be of help to service quality improvement.

Table 1. Comparison of Response Time of Dynamic and Static Links(4G-Samsung, second)

	Application Install	Marker Detection	3D Model	Sound	Movie
Static Link (first)	3.0	1.1	1.0	1.1	1.3
Dynamic Link (first)	1.2	1.1	1.2	1.2	1.4
Static Link (second)	-	1.1	0.9	1.1	1.2
Dynamic Link (second)	-	1.1	0.9	1.1	1.3

(3G-Optimus, second)

	Application Install	Marker Detection	3D Model	Sound	Movie
Static Link (first)	11.9	2.1	1.5	1.5	2.8
Dynamic Link (first)	4.8	2.1	2.6	2.5	3.3
Static Link (second)	-	2.1	1.4	1.6	2.1
Dynamic Link (second)	-	2.1	1.5	1.6	2.1

4 Conclusions

This paper proposed CARDA system to operate an effective mobile AR service. CARDA was designed for each user to receive differentiated AR view service, according to desired AR service-required time using AR app (CARDA Asset).

System resources are different for each user, and blanket downloading mode has a demerit that content production process and re-use are difficult, and that a user has no other choice but to download the data not required. Meanwhile, the system proposed in this system has easy content production process, and re-use is possible, since the system can add or revise component information, centered on CARDA Asset. In addition, the proposed system has a merit of good response time and good channel efficiency by transmitting dynamically-linked components, whenever a user requests. This paper designed message processing using JSON protocol in order to reduce transmitted data amount upon data transmission. Terminal device's operation and network load were minimized by making 3D model and various components two layers. An experiment using a variety of devices is planned to be added in various communications environments in a further study.

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