Design of a Content Registration System

Changyong Han, Minsu Kim, Jaegeol Yim[1]
Dongguk University at Gyeongju, Gyeongju, Gyeongbuk, Korea
*{cyhan, mskim, yim}@dongguk.ac.kr*

Abstract

Open Smart Platform (OSP) is a system on which any authorized person or organization can upload content and from which any authorized person can use any uploaded content. Therefore, OSP consists of many components including content registration system (CRS), user management system, content management system, content distribution system, billing system, and meta-data management system. This paper introduces our design of CRS. Our CRS allows a content provider to register his/her content via the web portal, editor, and API.

Keywords: IPTV, Content, Registration, VOD, Metadata, Database

1. Introduction

Open Smart Platform (OSP) is an open content repository system. It is open in that anybody can upload his/her content to OSP and anybody can use any content in OSP to build new applications [1]. Since OSP is open to both content providers and software/hardware developers, OSP will perform the roll of content market place. Consequently, it will make a great contribution to the content industry.
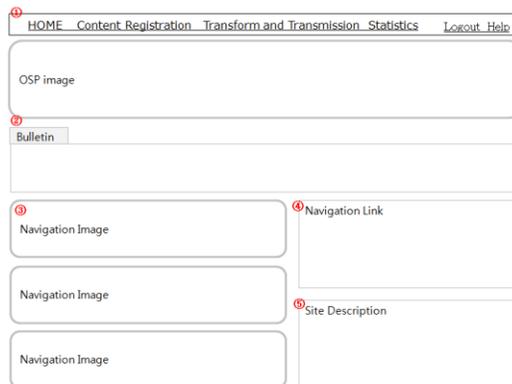
Figure 1. User Interface of the Open Smart Platform

An example OSP user interface is shown in Figure 1. The interface mainly consists of the following five parts and they are numbered in the figure.

1) There are four main menus. The meaning of them is obvious from the menu.

2) Users of OSP are classified into content providers, content distributors and system managers. A bulletin boards for the users is located here.

---

[1] Corresponding Author

3) OSP consists of the following subsystems: content registration, essence hub, distribution, log manager. Banners representing those subsystems are displayed here.

4) An image that represents the most popular menu is displayed here and linked to the service routine.

5) Description of this site appears here.

Registering a piece of content is similar to launching a product to a market place. Therefore, a content registration system (CRS) must be one of the main components of OSP. This paper discusses our design of CRS.

2. Related Works

We survey some CRS related works in this section. Invention of system and method for secure registration, authentication, valuation and exchange of virtual goods and objects is published in [2]. Any virtual good or object may be registered and ownership information is embedded within the virtual good as meta data. If the term "virtual good" is replaced with "content", then the invented system is very similar to our system.

A content registration system is very similar to an archieve system in the sense that both systems are used to store large quntity of information. The authors of [3] designed a low-load architecture to communicate and archieve medical images.

Conventional satellite image registration tasks are achieved by feature based techniques which are to be identified and matched before estimating transforms and resample the moving or slave image to a fixed or master image. The authors of [4] proposed an adaptive stochastic gradient descent optimization for satellite image registration.

To deter content theft in digital cinema applications, forensic watermarking has been proposed to track a digital content and to determine the time and the place where the theft occurs. The authors of [5] reviewed a number of video registration algorithms proposed for forensic watermark detection in digital cinema applications.

Since designing watermarks that can withstand attacks is extremely difficult, the registration of a pirate content with the reference content, prior to the decoding of an embedded forensic mark is preferred. Digital fingerprinting provides a relevant framework for automatic semi-blind content registration. In order to guarantee an accurate alignment while keeping the fingerprint size as small as possible, the authors of [6] proposed a temporally adaptive approach.

The authors of [7] suggested a method for character recognition and the handwritten or printed text translation into editable text. The method identifies handwritten characters with the help of neural networks and converses handwritten documents into an editable text.

Digital object identifiers (DOI) are unique and persistent names assigned to any entity for use on Internet digital network. Therefore, a registration system using DOI is a useful and practical way to promote the oublication and sharing of the content. The authors of [8] outlined the architecture of registration system for scientific content using DOI, and then analyzed the registration workflow between different stakeholders involved in the system.

Registered content is delivered to end users via Content Delivery Network. The authors of [9] proposed content distribution and management using metadata system in order to guarantee quality of service. It will be nice if content service is emotion based. The authors of [10] discussed combining context awareness computing with wearable computing to develop personalized emotion based content service system. Development of e-learning content for advertising theory applying Gagne's Nine Events of Instruction is introduced in [11]. The authors of [12] presented a hybrid content distribution network integrating complementary

advantages of content delivery network and peer-to-peer network in order to improve efficiency of large-scale content distribution. The authors of [13] presented a receiver-based, bandwidth estimation rate control mechanism with content-aware probability retransmission to limit the burden on the congested network.

As we have discussed, a virtual goods registration system, medical image registration systems, satellite image registration systems, document registration systems, and digital object registration systems are all example registration systems. Our registration system allows video, audio, and image files to be registered.

3. Design of Content Registration System

Three of the most important main menus of OSP are "Content Registration," "Transform and Transmission," and "Statistics" as shown in Figure 1. We design our content registration page as shown in Figure 2. The main parts of the page are numbered from 1 to 6. In the region ①, we can find the menus to handle the content the current user registered. For example, if we click Whole under *My content, then a list of all contents registered by the current user is displayed in the region ④, whereas if we click Whole under *Whole, then a list of all registered contents will be displayed in the region ④. If we click Broadcast instead of Whole, then a list of content that belong to Broadcast category is displayed. All the TV programs including Dramas, TV shows, TV documents, and TV News belong to Broadcast category. We sometimes use the term Type instead of Category.

Figure 2. Design of the "Content Registration" Page

A content item must belong to a Group. For example, "Infinite Challenge" is a name of group and "Infinite Challenge 1," "Infinite Challenge 2," and so on are contents that belong to "Infinite Challenge" group. Contents groups are classified into Types (Categories): "Broadcast," "Movies," or/and "Education". Since a content must belong to a content group, we sometimes need to register a content group that belongs to a type. The first step of registering a "content group" is to click the type name to which the "content group" belongs or Whole in Figure 2. For example, if we want to register "Infinite Challenge" that belongs to "Broadcast", then we click either Whole or Broadcast in Figure 2. Then part ④ will be filled with the list of registered content groups.

At this moment, we can click "registration" button in order to access the content-group-registration page as shown in Figure 3. Metadata about a 'content group' can be classified into

'Basic info' and 'Copyright info'. Metadata items belong to 'Basic Info' include program, title, 'harmfulness class,' 'content group ID,' and 'Change Thumbnail image.' The TV program in which the content group is played is specified in 'program'. 'Harmfulness class' can be violent, drug, suggestive, lascivious, vulgarism, and/or gambling. We can designate a thumbnail image of the 'content group' at 'Change thumbnail image'. 'Content group ID' can be provided by the user, and the system checks if the provided ID is valid (not identical to any existing ID). The process of 'Change Thumbnail Image' starts when the user click 'File search' button. The designated file appears at 'Thumbnail image'. After type in all basic information, we can save it by clicking 'save' button at the bottom of the window.

Basic Info	Copyright info				
Program		Country		Language	
Program(English)		Broadcasting station		Channel	
Original Title		Year of creation		Number of episode	
Title (English)		Production			
Content group ID		Content Type	Broadcast, Movies or Educational		
TAG		rate	PG, R, ... or X		
Harmfulnes class		Thumbnail image			
description					
Description (English)		Change T. image		File search	
					Save

Figure 3. Design of the "Basic Information" Window

Basic Info	Copyright info			
Owner	KBS	Owner(English)	KBS	
Contact phone	02-111-1234	Use or not		
Description		Description (English)		
Rights in Detail		Add		
Right of transmission	Region	Period Begin - End	Edit	
			save	correction
			save	correction
				Save

Figure 4. Design of the "Copyright Information" Window

After activating 'copyright information window' by clicking 'copyright info' button, we can type in copyright information of the 'content group' through the 'copyright information' window shown in Figure 4. Default values of 'right of transmission,' 'region,' and 'period of begin' and 'period of end' are 'whole', 'whole', the date of today, and one year from today, respectively. The values of 'right of transmission' include 'streaming service only', 'download only' and 'whole'. The values of 'region' include all the provinces of the country and 'whole'. Suppose the current 'right of transmission' and 'region' are 'streaming service only' and 'GyeongSangBukDo' and we want to add 'JeonLaNamDo' to the region. Then we click "Add"

button to get another row and type in 'JeonLaNamDo' in the 'region' column, then click 'save' button. After type in 'copyright information', click 'save' button at the bottom of the window.

A content must belong to a content group. Only after registering a content group, we can register a content. In the list of content groups as shown in Figure 2, if we click the 'content' column, then a list of contents displayed in the new window. In the new window, "Content registration" button is included. If we click this button, then 'content registration window' pops up as shown in Figure 5 and 'Basic Info' is enabled in it, by default. Only after fill in 'Basic Information', we can type in 'Program info', 'Copyright info', and 'Essence info'. Several important items of 'Basic info' are:

1) Content ID: This is automatically generated by the system. For example, CKORKBS... could be a content ID. In CKORKBS..., C standards for Content, KOR stands for Korea, and KBS stands for KBS that is the creator of the content.

2) Mother content: If an episode of a series is being registered, then its previous episode is said to be its 'Mother content'.

3) TAG: Index terms are listed here.

4) Category: Content can be categorized into War, Entertainment, Sports, Drama, Educational, Action, Comedy, Thrill, Documentary, Classic, News, Animation, Cook, Fitness and Children.

5) File or URL: Content file, URL of content, or both can be registered.

6) Content can be an episode of a series or a program item.

7) Show in the main page or not: We can specify whether this content should be displayed in the main page or not.

8) Thumbnail image: When this content is retrieved, this thumbnail image will be displayed in the user interface.

9) Change thumbnail image: We can designate a thumbnail image by clicking 'File search' button. If we do not designate a thumbnail image, then the first frame of this content is used as the thumbnail image.

After 'Basic Info', we can type in 'Program Info'. Broadcast information of this content is supposed to recorded in this step. In 'Program Info' window, 'Program Name', 'Production Country', 'Broadcast Station', 'Channel', 'Language', 'Rate' and 'Year of production' are automatically filled in. They are from 'Content Group' registration page shown in Figure 3. In addition to those information from 'Content Group' registration page, we can type in subtitle, content length in terms of broadcast time, broadcast time, total number of episodes, rate, harmfulness class, director, producer, production crew, characters, and description in "Program Info" page.

Basic info	Program info		Copyright info	Essence info	
Content ID	CKORKBS …		Title	Dancing with the star	
Mother content			Title (English)		
Content group ID			TAG		
Content type	Broadcast, movie, education		category	Sports, entertainment, …	
File or URL			Episode or Program item		
Show in the main page or not			Thumbnail image		
Description					
Description (English)			Change thumbnail image		File search
					Save

Figure 5. Design of the "Content Registration" Window

By clicking "copyright Info" button in Figure 5, we can type in copyright information of this content. "Copyright Information" page for content is similar to that page for "Content group" registration.

Finally, by clicking "Essence Info" button in Figure 5, we can access the "Essence Info" window shown in Figure 6. Through the window, we can upload audio files, video files and image files of this content. A video file that can be uploaded must be in MP4 format, H.264 codec, and under 10Mbps bit rate. When an essence file is uploaded, the system automatically assigns a new name to the file and listed under "File name" column. If we click the "Play" column next to a file name, then the file is played so that we can see if the upload task has been successfully done.

A content usually consist of video files, audio files, image files and text files. Therefore, we usually upload many files in order to complete registering one piece of content. An audio file is usually in MP3 format whereas an image file is in JPG or PNG format. One piece of content usually needs a caption file in SMI, ST, SSA, or AAS, a cue sheet file and a script file. For each media type, we have a unique user interface. For example, the user interface for uploading an audio file has codec, bit rate, sample rate and replay time, but the user interface for uploading image file does not have them. It has resolution instead. The user interface for uploading a caption file has 'caption file type' and language.

A system manager can activate or deactivate a content and all contents belong to a content group. If a content is deactivated, it does not appear in any user interface. An authorized user can ask the system manager to activate or deactivate a content or all contents belong to a particular content group.

Users of the system are classified into system managers, content providers, and content distributors. When a content distributor access the system, the purchase content menus and a list of content groups available to the distributor appear. The purchasing process consists of two steps: selecting content groups and clicking the purchase buttons associated with the selected content groups. Just before clicking the purchase buttons, they can specify file types: original, for set top boxes, for tablet PCs, or for smartphones.

System managers can also access the content registration system. The menus available to system managers are quite different from the menus available to content providers and content distributors. Our design of the user interface for system managers is shown in Figure 7.

Figure 6. Design of the "Essence Information" Window

Figure 7. Design of the UI for System Managers

If a system manager clicks the registration button at the top of the figure, thumbnails of newly released contents and the contents picked by staffs appear as shown in Figure 8. If a system manager clicks 'Dismiss' button, then the associated thumbnail disappears from the 'Staff Picks' list. If a system manager clicks an empty box, then a list of whole contents appear so that the manager can select one that will appear in "Staff Picks".

**Figure 8. Design of the UI of Registration Menu for System Managers**

If a system manager clicks the 'Whole' button in Figure 7, then a list of whole content groups appears. A manager can select a content group and activate or deactivate it. Each content group in the list accompanies the number of contents belong to the content group. If a system manager clicks one of the numbers, then a list of contents belong to the content group appears. By clicking a button in this list, a system manager can activate or deactivate a specific content. If a title of content in this list is clicked, then a new window similar to Figure 3 appears and the system manager can update 'Basic Info' and 'Copyright Info' of the content.

During content registration, the system collects metadata about the content. ContentId, parentContentId, contentGroupId, contentProviderId, contentType, contentSection,

contentTitle, contentDescription, contentTag (tag for search), registrationDate, modificationDate are metadata items to be typed in.
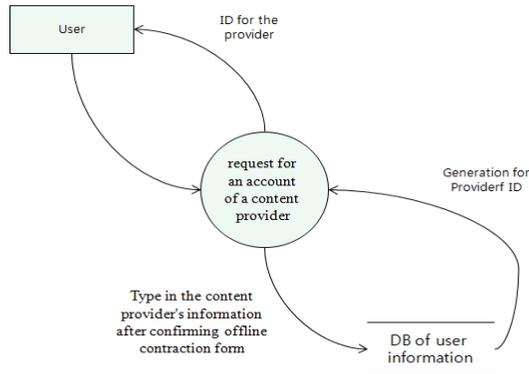
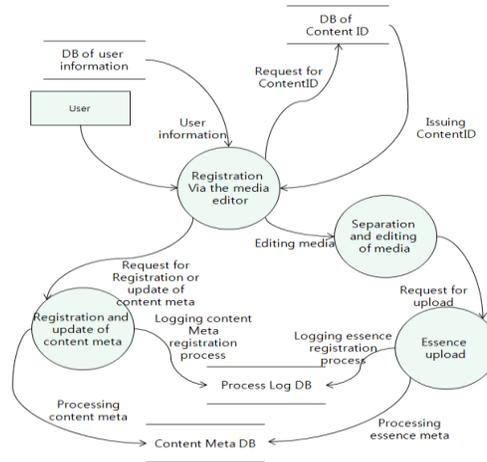**Figure 9. The Flow of Content Provider's Registration Data**
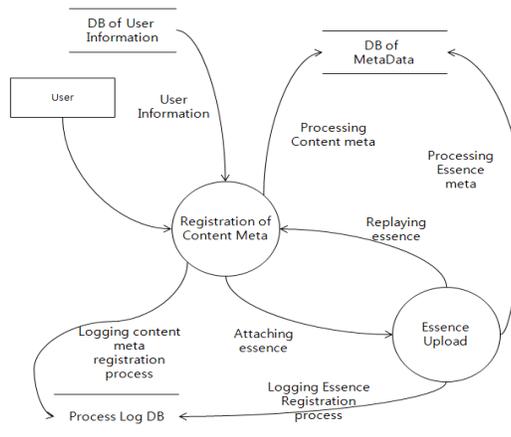
Figure 10. The Flow of Web-Content-Registration Data

The flow of content provider's registration data is shown in Figure 9. Only after an off-line contract is made, the content provider's information can be registered. The flow of content registration data is shown in Figure 10. For user authentication, the system refers to the "DB of User Information". Both content metadata and essence metadata are stored in the "DB of Metadata". All events are logged in the "Process Log DB".

Content can also be registered through the editor provided by this registration system. The flow of data during content registration through the editor is shown in Figure 11. Metadata items about a program include programCode, pdNation (The country where this program produced), pdCompany, pdLang, totalProgramNo(total number of produced episodes), evaluationGrade (popularity grade. This is closely related to the number of peoples watching this program), viewGrade (PG, R, *etc*.), badGrade (how harmful this program is. For example, violent, sexual, *etc*.).

Metadata items about a copyright include copyrightHolder, copyrightDescription, possessionRight, transmissionRight, rightStartDate, rightExpirationDate, rightClearFlag, rightInfoContact (telephone number for information of the right).

Metadata items about a content provider include providerId, providerName, passwd, businessNo (business registration number), companyId, providerType, contractStatus, contractStartDate, contractEndDate, providerAuthKey, providerLogo, providerAddress, providerPhone, providerFax, providerEmail, providerHomepage, providerDescription.

Figure 11. The Flow of Media-editor-registration Data

The work flow of management of content providers is shown in Figure 12. A content provider who wants to upload its content has to make an offline contraction with us, the owner of CRS. We make two hard copies of the contraction, one for the content provider and the other one for us. A system manager of CRS records the contraction information in the system and transmit an e-mail in order to inform the content provider of "Contraction has been done successfully and you can access the system with the attached temporary ID and Passwd in order to upload your content."

After receiving the e-mail, the content provider can apply for his account. After evaluating the application form, the system manager issues an account and inform the provider of the account information. Then, the content provider can access the system and upload its content.
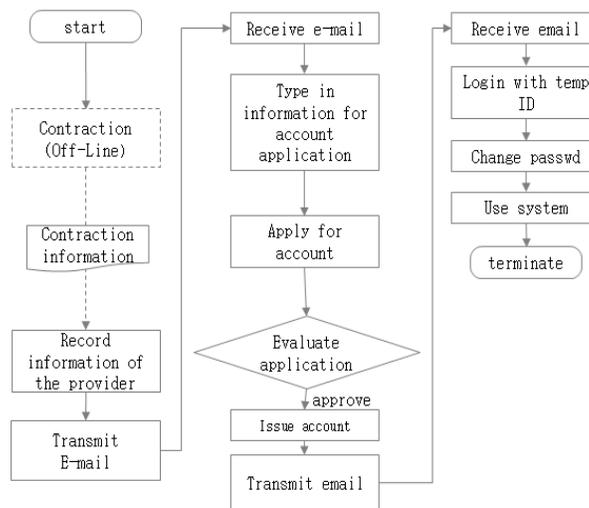
Figure 12. The Flow of Management of Content Providers

As it is shown in Figure 13 and we have discussed so far, there are three ways of registering content: directly, through the editor, and through the APIs. A content consists of multiple essence files (video files, audio files, caption files, and image files) and it repeats uploading an essence file. There are ten star marks in the figure representing log positions. For example, Gen. content ID is marked with a star and it represents that the event of content ID generation should be recorded in the log file.
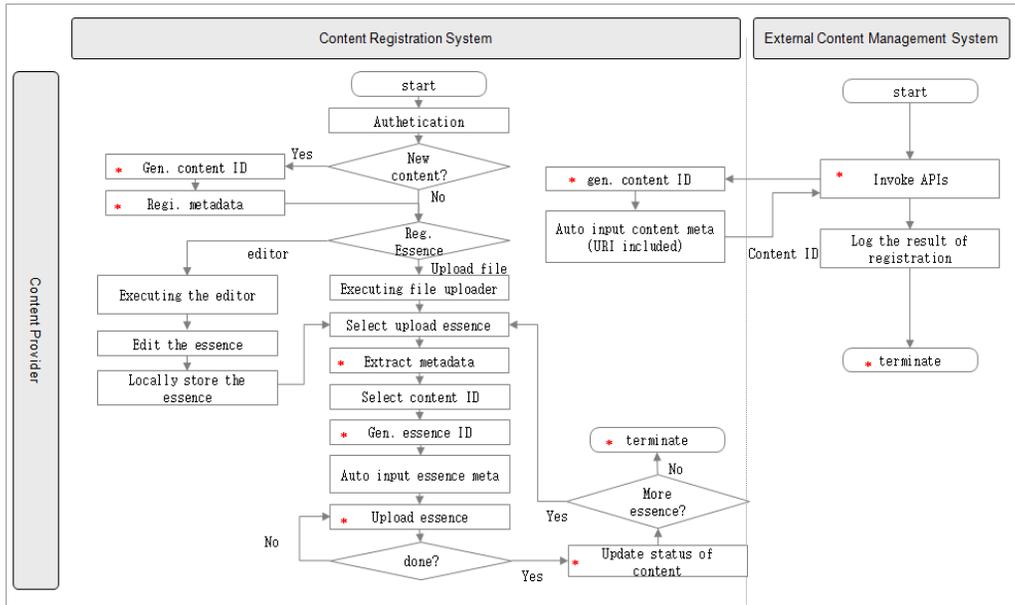

Figure 13. The Workflow of Content Registration

Figure 14. A Screenshot of our Content Registration through the Internet
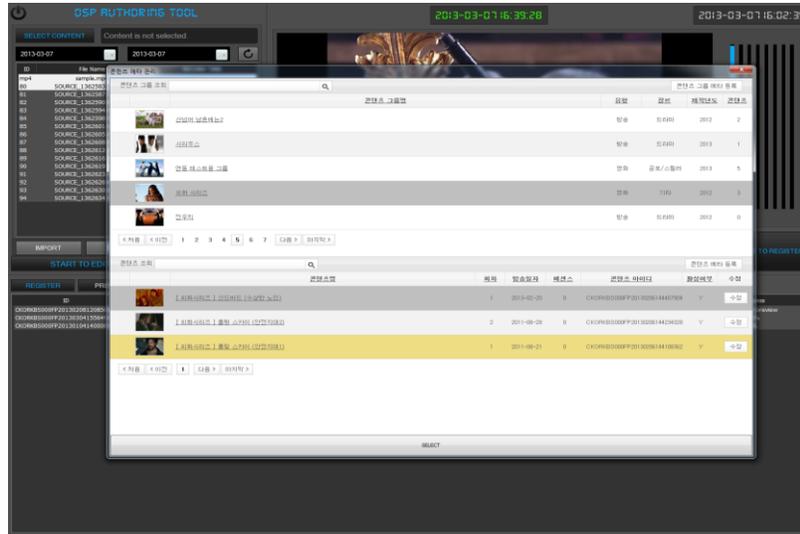
Figure 15. A Screenshot of our Authoring Tool

4. Experiments

We have implemented a content registration system based on the design described in the previous section. A screenshot of registering a video file using the system through the Internet is shown in Figure 14. This screenshot shows that program information of the 'Dancing with the Stars' is being registered. This implies that uploading a video file entitled 'Dancing with the Stars' and registering basic information of the file were done already.

Another screenshot of our content registration system is shown in Figure 15. The background window in the figure shows a screenshot of our OSP Authoring Tool. The foreground window pops up when "SELECT CONTENT" button in the authoring tool is clicked. The popped up window consists of two panels. In the upper panel, a list of program groups is displayed. If we select any one of the groups ('foreign movies' is selected in the figure), then a list of videos belong to the selected group is displayed in the lower panel.

5. Conclusions

Our design of a content registration system is discussed in this paper. Three ways of registering content is provided by the system: directly, through the Internet, and through the editor. With our limited knowledge, this is the first content registration system that provides its own editor. Another contribution made by this paper is the comprehensive metadata items for content. Our experimental test results showed that our content registration system works fine.

Acknowledgement

References

[1]   http://211.238.14.162/~iia/bbs/board.php?bo_table=tb01&wr_id=16.

[2]   http://www.google.com/patents/US20130191178.

[3]   Y. Zhao, Z. Wang, Y. Han, S. Guo and J. Cao, "A Low-Load Architecture of Picture Automatic Archiving and Communication System", 4th International Conference on Bioinformatics and Biomedical Engineering (iCBBE), (2010), pp. 1-4.

[4]   M. Moorthi, R. K. Gambhir, I. Misra and R. Ramakrishnan, "Adaptive stochastic gradient descent optimization in multi temporal satellite image registration", IEEE Recent Advances in Intelligent Computational Systems (RAICS), (2011), pp. 373-377.

[5]   H. Cheng, "A review of video registration methods for watermark detection in digital cinema applications", Proceedings of the 2004 International Symposium on Circuits and Systems, vol. 5, (2004), pp. V-704 - V-707.

[6]   S. Baudry, B. Chupeau and F. Lefèbvre, "Adaptive video fingerprints for accurate temporal registration", IEEE International Conference on Acoustics Speech and Signal Processing (ICASSP), (2010), pp. 1786-1789.

[7]   M. Eldhose, and C. Rekha, "Disambiguated archieve rectification", International Conference on Emerging Trends in Computing, Communication and Nanotechnology (ICE-CCN), (2013), pp. 777-781.

[8]   Y. Tu, J. Peng, R. Liu, and H. Zhao, "Developing a Registration System for the Scientific Content Using DOI", Fourth International Conference on Cooperation and Promotion of Information Resources in Science and Technology, (2009), pp. 65-70.

[9]   J. Lim, O. H. Choi, H. S. Na and D. K. Baik, "An efficient content distribution method using segment metadata annotation in CDN", IJAST, vol. 1, (2008), pp. 85-90.

[10]   H. Lee and J. Kwon, "Combining Context-Awareness with Wearable Computing for Emotion-based Contents Service", IJAST, vol. 22, (2010), pp. 13-24.

[11]   J. Lee and Y. Lee, "Development and Application of E-Learning Content for Advertising Education", IJAST, vol. 47, (2012), pp. 1-12.

[12]   H. Jiang, J. Li, Z. Li and X. Bai, "Efficient Large-scale Content Distribution with Combination of CDN and P2P Networks", IJHIT, vol. 2, no. 2, (2009), pp. 13-24.

[13]   H. Yang, X. Chen and R. Hu, "An End-to-End Congestion Control Approach Based-on Content-Aware", IJMUE, vol. 4, no. 2, (2009), pp. 81-90.

Authors

Changyong Han received the Ph.D. degree in Business Administration from Dongguk University at Seoul Korea, in 2013. He is a Professor in the College of Management-Tourism, Department of Business & Economics Dongguk University at Gyeongju Korea. His current research interests include Multimedia Systems, IPTV System and Open Smart media platform.

Minsu Kim received the M.S. and Ph.D. degrees in Computer Engineering from the Kyungpook National University at Korea, in 2000 and 2004, respectively. He is working as a Senior Engineer in the Next Digital Media Centre of Dongguk University at Gyeongju Korea. His current research interests include smart media platform and its applications, mobile solutions, and Location Based Services. He has published more than 15 journal papers.

Jaegeol Yim received the M.S. and Ph.D. degrees in Computer Science from the University of Illinois at Chicago, in 1987 and 1990, respectively. He is a Professor in the Department of Computer Science at Dongguk University at Gyeongju Korea. His current research interests include Petri net theory and its applications, Location Based Service, AI systems, and multimedia systems. He has published more than 50 journal papers, 100 conference papers (mostly written in Korean Language), and several undergraduate textbooks.