

An Architecture and Method using MPEG-V Metadata in Smartphone and Sensor Aggregator

Seong Gon Choi*, Mi Ryong Park**,

* College of Electrical & Computer Engineering, Chungbuk National University, South Korea

**Electronics and Telecommunications Research Institute, South Korea

sgchoi@cbnu.ac.kr, mrpark@etri.re.kr

Abstract—This paper propose a new method generating MPEG-V metadata with interworking between smartphone and sensor aggregator for simplified 4D (4-Dimension) image-making on a smartphone. For this, we made sensor aggregator which detects and collects various sensing factor for 4-dimensional imagification. The sensor aggregator provides the sensing factor information to the smartphone. Then, the smartphone directly makes 4D images by using MPEG-V application (App) based on the sensing information. Consequently, the proposed method can process 4D image-making more simply in comparison to existing method which makes 4D images after 2D or 3D image-making.

Keywords— MPEG-V, metadata, 4D image, Sensor aggregator

I. INTRODUCTION

Nowadays, user's interest and demand for realistic image (i.e. 4D) dramatically increase with the rapid growth of imaging devices market. In the conventional ways, 4D images were made by transforming the materials again after 2D and 3D image-making. By the way, the conventional ways used non-standardized media and image controllers. So, they had difficulties in exchanging and transforming images between non-standard imaging devices.

ISO (International Organization for Standardization) developed MPEG-V (Moving Picture Experts Group-Virtual world) for the standardization of image-making. However, the conventional ways still have a problem which needs much time and costs for 4D image-making. The problem is because the conventional ways have to do 2D and 3D image-making before 4D image-making and then such process is repeated whenever changing media.

In MPEG standardization group, an exploratory activity of creating a standard enabling integrated user experiences of complex sensory effects, including more than video and audio, was initiated in 2007 and called Rose (Representation of Sensory Effects). Activities on ROSE were merged with MPEG-V in 2008 and became a core application domain of MPEG-V [1].

Recently, many users use their smartphone as imaging device. However, the smartphone still has limits for 4D image-making on its own.

For solving the above mentioned problems, we propose a new method generating MPEG-V metadata with interworking between smartphone and sensor aggregator for simplified 4D

image-making on a smartphone. In the proposed method, we made sensor aggregator which detects and collects various sensing factor for 4-dimensional imagification. The sensor aggregator provides the sensing information to the smartphone. Then, the smartphone directly makes 4D images by using MPEG-V App based on the sensing information. As a result, the proposed method can make 4D images more simply than the existing method which makes 4D images after 2D or 3D image-making first.

The rest of this paper is organized as follows. Section 2 describes the related work associated with proposed scheme. Section 3 presents architecture and method of integration between smartphone and sensor aggregator for MPEG-V metadata generation. Section 4 describes the implementation results of smartphone and sensor aggregator. Section 5 presents conclusion in proposed method.

II. RELATED WORKS

To implement the 4D image and MPEG-V, lots of methods have been studied. In existing paper, advances in media technologies brought 3-D TV home and 4-D movies to your neighbour. Author has suggested a framework for 4-D broadcasting to bring 4-D entertainment home based on MPEG-V standard. A complete framework for 4-D entertainment from authoring of sensory effects to environment description and commanding rendering devices for the sensory effects can supported by MPEG-V and other standards. MPEG-V provides tools for describing capabilities of the sensory devices and sensors. Delivery of 4-D contents provides tools to describe sensory effects. Presentation of 4-D contents provides tools to actually interact with the sensory devices and sensors [1].

Another paper proposes the SMMD (Single Media Multiple Devices) method to give users enhanced effects with playing multiple devices rather than the SMSD (Single Media Single Device) method. To give this effect to users, from the beginning of making one media, SMMD produced ne-media that consists of multiple subject related audio/video and the SEM (Sensory Effect Metadata) to evaluate physical device controls. The ne-media is transmitted to the HS (Home Server) to represent multiple audio/videos in multiple A/V players and multiple devices with synchronized way. In conclusion, this paper explained about basic system concepts, sensory effect

metadata, system architecture, and how to represent ne-media in multiple devices [2].

Another paper proposes streaming media with sensory effect. The Digital Cinema technology is pervasive in most of theatres system. Digital Cinema provides movies in streaming way to the theatres simultaneously. Sensory effect method presents a framework for streaming service to bring 4-D entertainment home based on MPEG-V standard. A complete framework for 4-D streaming can be supported from authoring of sensory effects to environment description and commanding rendering device for the sensory effects by MPEG-V and couple of other standards. Now the standard and the framework technology are ready for streaming 4-D contents for users in home [3].

Another paper proposes real-sense media synchronization technology based on the SMMD. Until now, most people mainly used the method SMSD on one device, but user need more than one device to play multiple A/V and multiple sensory effects for effective real-sense media representation. Multiple A/V device synchronization and multiple sensory effect device synchronization are very important part of real-sense media representation. In conclusion, this paper suggests concept of the real-sense media playback, real-sense media playback system architecture, and synchronization algorithm between multiple A/V device and multiple sensory effect devices [4].

The other proposes a device inter-locked media service framework and its technology for media generation. It is hard to realize sensory effects only with presentation of audio/visual contents. Realization of the sensory effects could lead to realistic experiences on the consumption of audio/visual contents in conjunction with peripheral devices which can make it possible the content-associated sensory effect. In conclusion, realistic experiences have been achieved via the devices such as 3-D audio/visual device [5].

III. PROPOSAL METHOD

A. Interworking of Smartphone and Sensor Aggregator

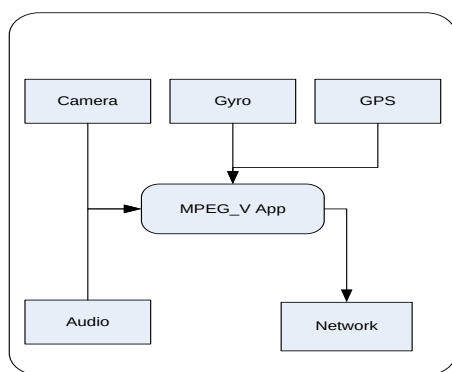


Figure 1. Smartphone configuration

Fig. 1 shows smartphone configuration. The smartphone is basically equipped with camera device for video and audio device for voice. And, the smartphone has gyro sensor on the

inside for realistic effect and GPS device for recognizing the current coordinate and motion of gyro sensor. Also, the smartphone uses MPEG-V APP for MPEG-V metadata generation. For this, the smartphone adjusts time synchronization based on information collected from camera, audio and the rest sensor devices. However, the sensor devices of the smartphone have limits for realistic image-making. So, the smartphone interworks with the sensor aggregator and then generates MPEG-V metadata.

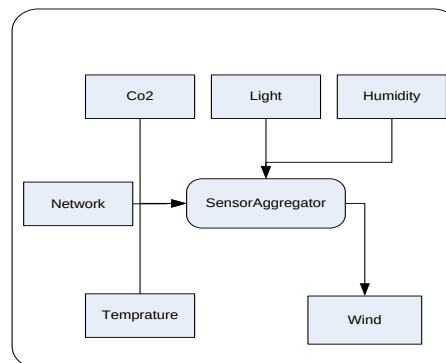


Figure 2. Sensor aggregator configuration

Fig. 2 shows sensor aggregator configuration. The sensor aggregator consists of Co2 sensor which detects Co2 gas, light sensor for generating lighting effect with the brightness of light, temperature sensor which draws thermomagnetic effect via thermometry, humidity sensor for deriving WaterJet effect from humidity detection and wind sensor which detects wind effect with measuring wind strength. Also, the sensor aggregator runs sensor aggregator App for interworking between each sensor on the inside.

B. Operation of sensor aggregator App

The sensor aggregator App operates for realistic image-making as follows.

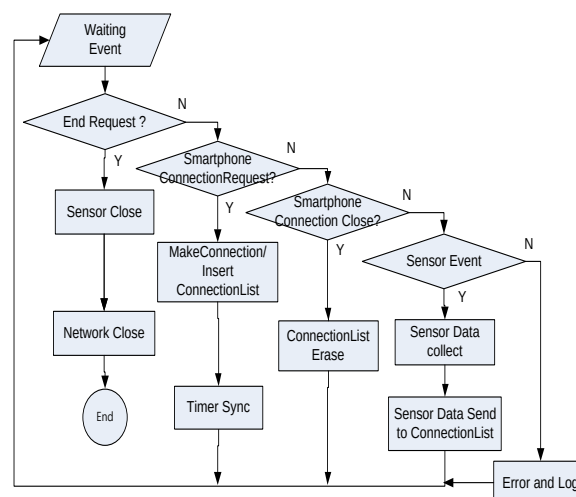


Figure 3. The operation of sensor aggregator App

Fig. 3 shows the operation of sensor aggregator App. The sensor aggregator App initializes network device and sensor devices of the sensor aggregator. Basically, the sensor aggregator App maintains event waiting state before receiving events. If end event is received, the sensor aggregator App terminates the operation of sensor devices and network device and then shuts down itself. In other case, if the sensor aggregator App gets connection request event from the smartphone, it registers the smartphone's IP address on its IML (Information Management List) and then does time synchronization with the smartphone. The sensor aggregator sets up time based on the time received from the smartphone because it does not have chronometer. After time setting process, the sensor aggregator App goes back to event waiting state.

On the contrary to this, if connection release event is delivered, the sensor aggregator App deletes the smartphone's IP address which has been registered on its IML and then returns to event waiting state. In other case, if the received event intends to modify sensing information forwarded to the smartphone, the sensor aggregator App newly collects the sensing information and then sends it to the smartphone. After that, the sensor aggregator goes back to event waiting state. If the sensor aggregator can not process the modification request, the sensor aggregator regards the request as error or logs and then returns to event waiting state.

C. Operation of MPEG-V App in a smartphone

The MPEG-V App of the smartphone operates for realistic image-making as follows. Fig. 4 shows the operation of MPEG-V App in smartphone.

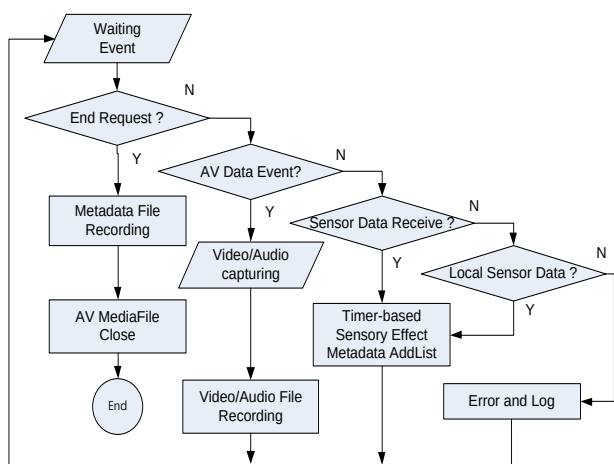


Figure 4. The operation of MPEG-V App in smartphone

Basically, the MPEG-V App knows the IP address of sensor aggregator located in initial network and can record video and audio data simultaneously. First, the MPEG-V App initializes camera/audio/gyro/GPS device in the smartphone to interwork with them. After that, the MPEG-V App sets up connection with and then requests time synchronization to the

sensor aggregator. Then, it is on standby to respond to any event. If the end event is received, the MPEG-V App converts all metadata which have been gathered from sensor devices into file type and then records the files. After that, it closes the AV media file. In other case, if the MPEG-V App receives AV data record event, it each collects video data via camera device and audio data via audio device. Next, the MPEG-V App converts the video and audio data into AV media file and then records the files. The recorded AV media file includes some information on data, time and sequence number. After that, the MPEG-V App goes back to event waiting state.

In other case, if the received event is sensor data event delivered from sensor aggregator App, the MPEG-V records the sensor effect on its metadata list and then returns to event waiting state. In other case, if the received event is local sensor data delivered from GPS and gyro device in the smartphone, it also records the sensor effect on its metadata list and then goes back to event waiting state. If some event which is impossible to process is received, the MPEG-V regards the request as error or logs and then returns to event waiting state.

IV. IMPLEMENTATION RESULTS

Fig. 5 shows process of metadata generation. Sensor aggregator filters data based on raw data collector and information generated from smartphone. After filtering, aggregator handles data based on profile information (e.g. sex, age, preference, etc.). After processing data, sensor aggregator generates sensor effect metadata.

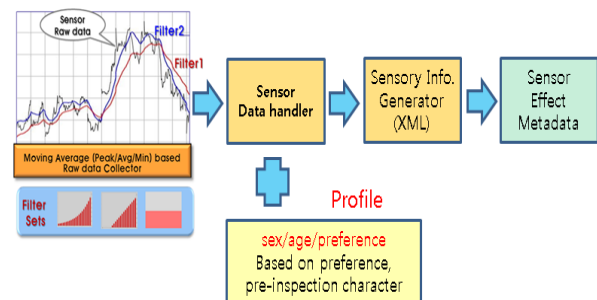


Figure 5. Metadata generation process

Fig. 6 shows implementation results between the smartphone and sensor aggregator using network topology by proposed method

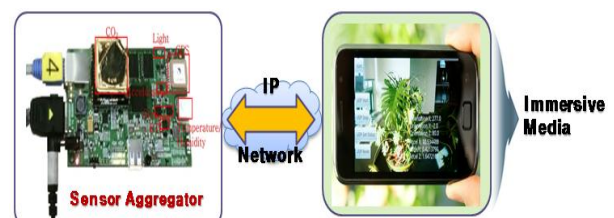


Figure 6. The implementation results of smartphone and sensor aggregator

The smartphone include camera, audio, the rest sensor devices and gyro sensor for realistic effect. MPEG-V App in smartphone generates MPEG-V metadata and adjusts time synchronization based on information collected from movie, audio and around the sensor device.

The sensor aggregator includes Co2 sensor, light sensor, temperature sensor, and humidity sensor. Based on the information received in smartphone, sensor aggregator generates 4D image using various sensing factor. Sensor aggregator makes realistic effects through this mechanism.

In order to transmit sensory effect metadata, the smartphone and sensor aggregator each includes a network device which can interwork with Wi-Fi/3G/LTE technologies. The MPEG-V App in the smartphone and the sensor aggregator App interwork each other via two devices.

In this way, 2D image taken from a smartphone records 4D metadata by adding a realistic effect. As a result, 4D image can make a short period of time than existing method by proposed method. Also, 4d images can be used to other device using MPEG-V App and supporting communication.

V. CONCLUSION

This paper propose a new method generating MPEG-V metadata with interworking between smartphone and sensor aggregator for simplified 4D image-making on a smartphone. In the proposed method, we made sensor aggregator which detects and collects various sensing factor for 4-dimensional imagification. The sensor aggregator provides the sensing information to the smartphone. Then, the smartphone directly makes 4D images by using MPEG-V App based on the sensing information. Therefore, the proposed method can make 4D images more simply than the existing method which makes 4D images after 2D or 3D image-making first.

ACKNOWLEDGMENT

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education, Science and Technology(2010-0023980)

*Corresponding Author : Seong Gon Choi (sgchoi@cbnu.ac.kr)

REFERENCES

- [1] Kyoun Gro Yoon, Bum Suck Choi, Eun Seo Lee, Tae Beom Lim, "4-D Broadcasting with MPEG-V, Multimedia Signal Processing(MMSP), 2011 IEEE International Workshop on.
- [2] Jae Kwan Yun, Jong Hyun Jang, Kyeong Deok Moon, "Development of the Real-Sense Media Broadcasting Service System based on the SMMD", 2011 IEEE International Conference on Consumer Electronics(ICCE).
- [3] Bum Suk Choi, Eun Seo Lee, Kyoun Gro Yoon, "Streaming Media with Sensory Effect" Information Science and Applications(ICISA) 2011.
- [4] Jae Kwan Yun, Jong Hyun Jang, Kwang Ro Park, "Real-Sense Media Synchronization Technology based on the SMMD" Consumer

Electronics(ICCE), 2010 Digest of Technical Papers International Conference.

- [5] Bum Suk Choi, Sang Hyun Joo, Hea Yong Lee, "Sensory Effect Metada for SMMD Media Service" 2009 Fourth International Conference on Internet and Web Application and Services.