

Considerations on Audience Measurement Procedures for Digital Signage Service

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Abstract

The advances of ICT technologies and electronic display make it possible to provide digital signage services. Nowadays, the market of digital signage keeps getting bigger with the addition of newly advanced techniques. In contrast to existing signage solutions that just only provides uni-directional information, digital signage can provides bi-directional service that makes it possible interaction with users and provide more accurate audience response information to the advertisement contents providers. In this paper, we describe interfaces that audience measurement will be occurred and audience measurement related procedures.

Keywords: *digital signage, terminal, audience measurement*

1. Introduction

Due to the advance of ICT technologies and electronic displays, digital signage service has been spread rapidly. Digital signage service provides information through use of displays that are deployed in public or commercial places. It uses texts, audio, image and video for providing information. In general, digital signage displays are located in out-door, but it can be installed in-door as well. Unlike uni-direction conventional signage systems, digital signage systems are connected with each other. This connectivity makes it possible to distribute advertisement contents remotely and interact with audience simultaneously. According to “Digital Signage Market: Key Research Findings 2010” [1], it says that the market size of japan digital signage in 2009 was more than 55 billion yen. It has grown to be double compared to the previous year. The size of system and contents market for digital signage has been grown about 35 billion dollar around the world. It is still under expansion more than 30% in every year [2]. Nowadays, the trends of digital signage tend to be extending their services with the support of newly adopted ICT technologies. For example, more intimate and personalized services and contents, intractable contents, estimation of effects, cooperation with smart devices and so on. One of the most differences from conventional signage is that digital signage can measure responses of audiences, and it makes it possible to make use of measured information for providing more appropriate and personalized contents. Besides, digital signage service can provide how effective it was to the contents provider. Hence, we focus on audience measurement procedures on providing digital signage services in the aspects of digital signage systems, service providers and contents providers.

In this paper, we issue the type of audience, terminal, purpose of contents and interface for audience measure in order to extract audience metrics in chapter 2. In chapter 3 and 4, we propose digital signage service procedures and specify the detail procedures for audience measurement. We also take considerations on privacy protection in chapter 5.

2. Audience Information and Interfaces for Audience Measurement of Digital Signage Services

The digital signage systems can extract audience measurement information through generic several steps as shown in Figure 1.

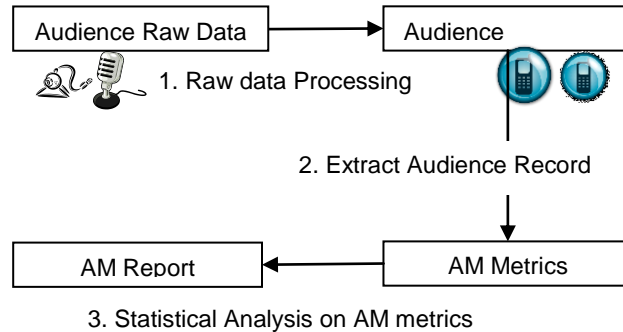


Figure 1. Audience Information Extraction Steps

As a first step, sensor devices that are embedded into digital signage terminal capture raw media data. These raw media such as video, image and video clips should be processed to extract attributes of audiences and responses. For example, it can get rough number of audiences, sex, ages from some kind of image processing. In case of interacting with smart devices, it may skip raw data processing because it has already exchanged discrete information. In the next step, digital signage systems analyze in order to make an audience measurement record from extracted attributes. As a last step, it makes a report with statistical analysis for providing to contents providers.

2.1. Types of Audience

It is important to categorize the types of audience, because it makes differences on extract audience metrics.

2.1.1. Person: A digital signage terminal is aiming at exposure the contents to the audience. This can provide interactive services with audience and focus on extracting information of audience such as the number of person and dwell time.

2.1.2. Vehicle: It is also possible to install a digital signage terminal into a highway for provide contents to the audience that passing by using a car. Since it is impossible to interact with audience directly, it mainly extracts metrics related vehicle or traffic pattern rather than those of audience.

2.2. Types of Digital Signage Terminal

The digital signage terminal may be located in fixed position or mobile such as bus and subway. In case of mobile terminal, it is recommended to provide geo-location functions such as GPS. If the terminal is located in fixed environment, the location information can be allocated manually. Anyway, through use of location information, it can provide more appropriate information to the audience.

2.3. Purpose of Advertising Contents

According to “digital signage system guidebook”[3] that is published at 2009 by digital signage consortium in japan, the purpose of advertisements can be classified into several categories; branding, promotions for sales, propaganda, providing information and emergence broadcasting services. The purpose of contents also should be considered to extract audience metrics because it affects to them.

2.4. Audience Information of Digital Signage

Through audience measurement procedure, it is possible to extract audience information including audience’s response and reactions. In contrast to subscriber-based services such as IPTV, the audience information of digital signage is for anonymous public users. It may include a user, a group of user. It is hard to pre-specify what kind of information should be extracted from the anonymous raw materials. It is rather dependent on the type of contents and contents providers.

The audience information to be measured is for anonymous public users rather than that of subscribers. In subscriber-based service, service provider already knows the super set of information to be delivered, and it chooses subset of the data based on user’s privacy preferences. However, digital signage system does not have any background data for the audience generally. Hence it should gather raw materials such as images, and it should extract related information from that through some kind of processing like image processing.

2.5. Interfaces with Audience and Terminal

2.5.1. Sensor Devices and Terminal: This is most common case in the digital signage services because it does not require any specific user’s action. The sensor devices include camera, microphone, thermometer, etc. For fetching user’s response, the system uses various combinations of sensor devices. For example, it will manipulate embedded camera for getting the response information of audience, and it is also possible to provide weather information through use of internal thermometer and data from the weather center for more accuracy.

2.5.2. Smart Devices and Terminal: Nowadays, most of smart devices support various short-range communication skills such as RFID, NFC, Bluetooth, and infrared-ray. In some meaning, RFID may belong to sensor devices, but we categorized it to smart devices because it can provide digitized discrete information to the terminal. Since Bluetooth and infrared-ray communications requires a series of pairing procedures, this technique may be inadequate to be used for acquiring person’s information. However, it is useful to acquire user’s response actively and provide more appropriate information to the user. In contrast to Bluetooth and infrared-ray, RFID and NFC provide good environment to take user’s information without the user’s interventions and paring procedures. But, this may cause some concerns on leaking of privacy information. Besides of short-range communication method, it is also possible to interact with terminal through the use of Internet connectivity with 3G mobile Internet or Wi-Fi network.

3. Digital Signage Service Procedures with Audience Measurement

Figure 2 shows generic procedures of digital signage service involved with audience measurement. Prior to provide digital signage service, contents provider deliver its contents to service provider. On uploading contents, it also registers its preference on preferred schedule and some polices. The contents server of digital signage service provider converts the

contents into appropriate format for applying the capabilities of terminal because there are various types of digital signage terminal with different ratio, computing power, storage, and so on.

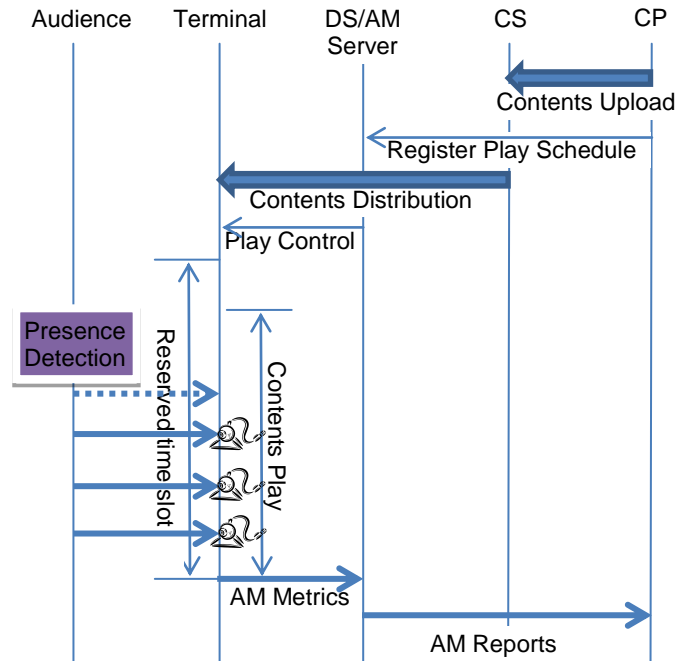


Figure 2. Generic Procedures Digital Signage Service with Audience Measurements

The digital signage server takes charges on distributing the contents to all terminals. When it comes to display the contents on scheduled time, it aggregate audience information periodically or event-driven. In some cases, it may turn off the display if there is no audience in front of terminal. In this case, it is required to support audience detection method.

4. Audience Measurement Procedures

4.1 Acquaintance of Raw Data

A camera of terminal captures images of audience information. It is also useful to aggregate ambient information such as location of terminal, temperature, humidity, and intensity of illumination.

4.2. Audience Information through Analysis of Raw Data

In the “Audience Metrics Guidelines” [4] published by DPAA [5], there are some guidelines on listing up metrics for describing audience information. It categorizes media metrics with visit/exposure, dwell time, frequency and reach. In regarding to audience metrics, it gives examples; the number of visitors for a period of time, dwell time that how long the visitors have been stayed, how often per person and the net number of visitors. These information metrics can be used as basic materials to extract the audience information.

What kinds of metrics should be extracted is dependent on the purpose of contents, terminal capabilities and type of audience. In this paper, we do not list up all kinds of metrics

because the audience measurement procedures can be described without full metrics, and it is quite implementation dependent. Of course, it is important to define audience metrics, the way of description and delivery of the information for interoperability among digital signage systems.

Audience measurement is consists of acquaintance and analysis. The acquaintance procedure gathers audience raw data by digital signage terminal. Through the analysis of raw data, it is possible to get specific audience information. There are two generic procedures on analyzing the raw data; analyze by terminal, or remote server.

4.2.1. Audience Information Analysis on Remote Server: When a digital signage terminal just act as dummy terminal that displays contents through electronic display and has some sensor devices such as camera, it may upload the raw data into specific server that analyze the gathered data as shown figure 3.

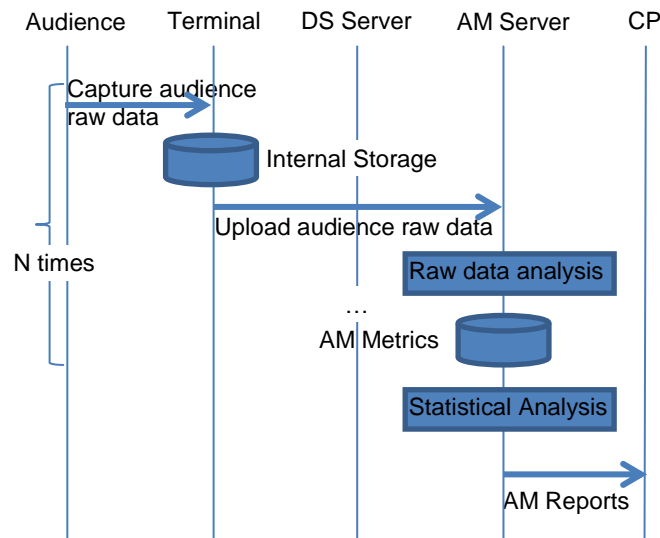


Figure 3. Analysis of Audience Information by Audience Measurement Server

In this case, the terminal does not analyze the raw data. Instead, it sends the data to digital signage AM server periodically. Even though this approach may not be good on providing interactive services, AM server can extract another attribute for further investigation. The AM server extract attribute of audience information through a series of processing such as edge detection, counting of audience, types of audience and so on.

4.2.2. Audience Information Analysis on Digital Signage Terminal

If a digital signage terminal has enough capabilities to analyze the raw data, it can provide interactive advertisements. The terminal just reports the analyzed audience information to the audience measurement server that is located in service provider domain as shown in figure 4. Since the raw media data will be removed after analysis, it is hard to extract additional metrics later.

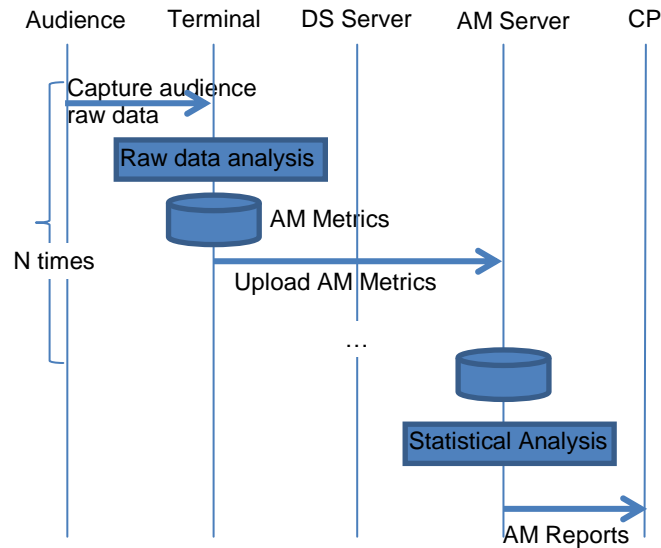


Figure 4. Analysis of Audience Information by Terminal

The metrics of audience information will be limited to the capabilities of terminal, and it will be lack of extensibilities on further analysis because raw data flash away after analysis. This approach have two major advantages; Interactive advertisement and minimized network usage.

4.2.3. Audience Response from Smart Devices: One of the advantages of digital signage system is that it can get discrete response from audience. The terminal is able to interact with audience through the use of kiosk and smart devices. Hence, it is possible to skip the analysis of raw data.

4.2.4. Statistical Analysis on Audience Information: As a last step of audience measurement, audience measurement server performs statistical analysis before providing to contents providers. The statistical audience measurement information is used to make a plan for further scheduling of advertisements.

4.3. Privacy Protection

One of the most concerns of digital signage service is a protection of privacy. Even though the sensor devices of terminal collect anonymous information, it analyzes the audience in order to retrieve characteristics of audience. According to the white paper “Anonymous Video Analytics technology and privacy” (2011) [6], it suggests a privacy bottom line. It includes that it should not collect personal identification, profiling of audience. The terminal extracts audience information with analysis technologies such as face recognition, but it should not identify who it is. Furthermore, the collected data should not be reused for any other purpose except for providing of digital signage service.

5. Conclusions

The advances of displaying devices and ICT technologies make it possible to provide more interactive and advanced digital signage service. The digital signage systems can provide advertisement, education, providing of information and emergency services. In order to

provide interactive services, it is required to gather audience information. In this paper, we have presented considerations on classification of audience information, interaction interface, and procedures for audience measurement with privacy concerns. There are several technical huddles for acquiring audience metrics from raw data such as images and voices. It is hard to decide whether an audience is watching the contents or not with a normal camera devices. Hence there are many attempts to use advanced devices that are able to detect distance and keep track of user's behavior real-timely. This paper does not cover how to extract audience metrics from raw data, but this focuses on how to interact with other components for measuring audience information as a first step for further study. As future works, we have plans to extract audience metrics with more details and make a protocol for exchanging such information.

Acknowledgements

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