# Design of Media measurement and monitoring system based on Internet of Things

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**Abstract.** With the recent emergence of diverse smart devices, people are now able to enjoy various forms of media anytime. Forms of media based on countless smart devices and media applications are hardly measured via existing static and portable-based audience rating measurement methods. Therefore, there are limits in terms of measuring their usage for industrial purpose. In this paper, we propose a concept of Machine-type Media Measurement System which can gather diverse types of media usage from users through distributed M2M Network and extract/visualize such usage information as media measurement by using Machine-type People Meter and Bigdata platform.

**Keywords:** Media measurement, Machine-type communication, IoT application, Smart media.

## 1 Introduction

The development of IT is heading toward a convergence with various industrial areas and creatively improves these areas with innovation. Such IT convergence goes beyond existing fixed methods and forms and is developing toward providing support so that diverse forms of information can be exchanged. The media has also entered an era in which many users contact one another through various devices, such as smart phones, smart pads, smart TVs, personal computers, navigators, and smart watches. Thanks to this, media can now be interoperated freely between devices, and users can incessantly contact media. Diversity in the environments in which to approach media, together with the diversification of users' devices, has led to a wider range and more complexity in terms of collecting and utilizing media usage information [1].

Audience ratings refer to how many people watch a certain broadcast program during a fixed period of time. These are expressed as percentage. Audience ratings include audience shares, which are the percentages of households using a certain channel among those that are watching broadcast programs at a certain time, and program ratings, which are the percentages of households watching a certain channel at a certain time among all those that own TV sets within the viewing zones of the relevant program [2]. Such existing audience rating calculation methods are limited to determining the viewing trends within the live broadcasting channels. Of course,

increasing smart terminals and media polymorphism have led to the emergence of the Viewer Behavior Monitor (VBM), the Portable People Meter (PPM), and TouchPoint [3] an opinion meter for smart devices. The analysis of viewing information via the VBM should be interoperated with set-top boxes, which provide certain collection equipment or broadcasting. Thus, VBM is insufficient in terms of collecting overall viewing information within a diverse media environment [4]. Although tools intended to collect information and opinions, such as TouchPoint, have emerged and their usefulness and usability in advertisement have increased, they have some limitations in terms of supporting the active collection of diverse viewing information.

Today, the term Internet of Things (IoT) has risen to prominence. Machine-type communications, one method via which to realize IoT, refers to a technology that provides the functions of a sensor and communication to all objects, as well as forming networks among objects, thereby collecting information intelligently and exchanging it with other forms of technology. In other words, it is an intelligent technology via which all apparatuses around us may give and take collected data through sensors via networks, making human life more convenient [5].

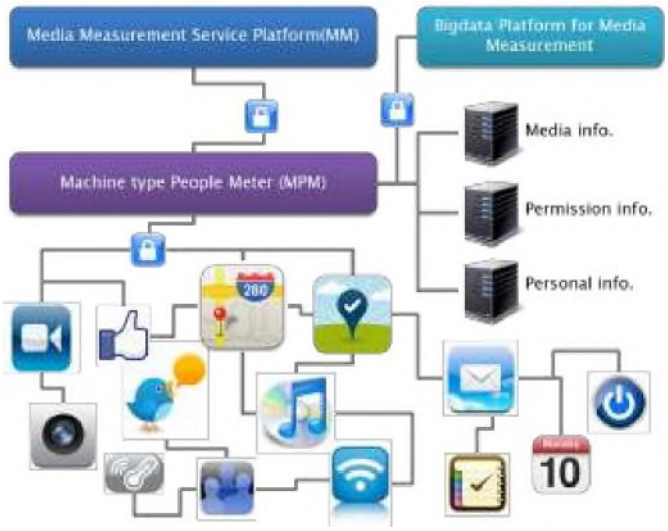


Fig. 1. Concept of Machine-type Media Measurement System

In this paper, as shown in Fig.1, we propose a Machine-type Media Measurement System which can gather diverse types of media usage from users through distributed M2M Network. And extract/visualize such usage information as media measurement by using Machine-type People Meter and Bigdata platform. Through this Machine-type Media Measurement System, it is expected to gather and analyze versatile media usage information in conjunction with versatile sensor data, social data and personal data for the purpose of understanding human intention and preference more actively and autonomously. In addition, if devices with Machine-type communications become widespread, more generalized data could be collected from universal users, and the accuracy of audience ratings information is expected to increase.

This paper consists of the following: Chapter 2 deals with previous relevant studies. Chapter 3 describes this study's design and functional data flows. Chapter 4 introduces future research and reaches a conclusion.

## 2 Related works

### 2.1 Method of investing audience ratings

In 1987, A.C. Nielson, a survey agency in the U.S., introduced the People Meter method. Thus, the individual viewing patterns of panel family members could be investigated. In the environment of terrestrial broadcasting and analog cable TV, the People Meter method was effectively applied, but since the 2000s, as changes in the media environment have converted TV use patterns from common use into segmented individual use, a new challenge has emerged. The U.S. media industry, which had depended on results provided by audience rating survey agencies represented by A.C. Nielson, formed the Coalition for Innovative Media Measurement (CIMM) in October of 2009 in order to cope with a market environment in which changes in TV viewing methods, particularly increases in the viewing of Internet videos, were conspicuous. CIMM performs set-top-box-related research and cross-platform audience rating surveys through viewer behavior measurement (VBM) in order to improve audience rating survey methods. In this way, the accuracy and usefulness of audience rating survey methods based on existing set-top box records are expected to improve. CIMM will also survey how broadcasting and advertisement content is consumed via diverse terminals, such as mobile devices, computers, and TVs, via survey participants, as well as set-top-box records [4],[6]. Together with VBM, one of representative measurement methods of new media use patterns is the Portable People Meter [4],[7]. The PPM is a portable media use measurement device that operates via the sound detection method developed by Arbitron [8] in order to overcome the limitations of existing surveys of media use that utilized the existing People Meter. Specifically, it is a transmission method in which signal sounds representing certain channels (or content) are inserted during broadcasting or content production. The PPM, which is carried by panels, perceives and transmits the channel (or content) that the panels are exposed to by using an acoustic detection method. The PPM can detect any broadcasting content, such as TV or radio, through ground waves, satellite, or cable at any given time, including both analog and digital, and can detect signal sounds by channel by inserting them in satellite or new media as well as broadcasting watching through the Internet. Therefore, the fact that measurement preciseness should still be improved may act as an obstacle.

Single Source Data [9],[10] is what Britain began to use in the early 1990s. It is a quantitative or qualitative marketing survey method designed to discover preferences regarding advertisements or goods, the degree of consumption desire, and the lifestyle of panels who survey audience ratings. In this way, demographic characteristics, viewing patterns, and the actual state of advertisement contacts are combined with marketing survey results and used, thereby more delicately measuring advertisement

effects and enabling more precise linkages with actual product sales via consumer behaviors.

### 2.2 Machine-to-Machine (M2M) communications

M2M [5],[11] is a form of data exchange in which intervention by humans is minimal or nonexistent. It refers to a technology that may be utilized for diverse applications, such as smart metering, healthcare, remote control, and financial transactions. Here, "communications" refers to communications between devices and objects, as well as between devices. Such communications by diverse devices and objects will encase humans' daily routines within a smart environment equipped with media. In addition, users will be able to interact with diverse smart objects, create new applications, and mutually participate without special technologies. The development of such M2M technologies will allow diverse information and events to be interoperated mutually with a number of users, and access to and use of such information will be easier.

## 3 Design of Machine-type Media Measurement System

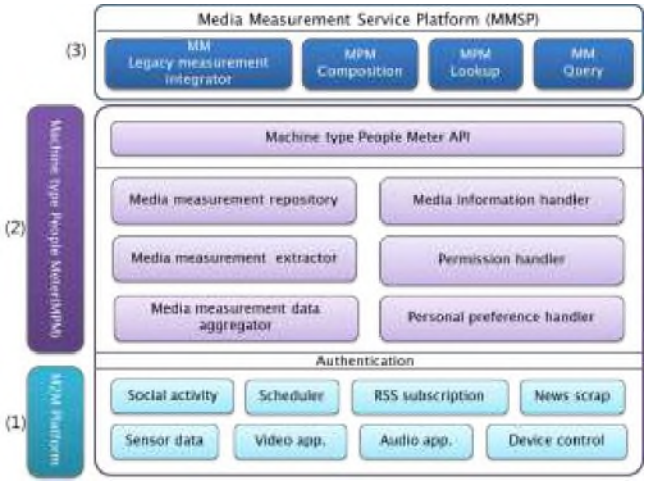


**Fig. 2.** Architecture of Machine-type Media Measurement System

This chapter will explain a system designed to efficiently collect and analyze media measurement information as shown in Fig.2. In the M2M platform and its network (refer to Fig.2(1)) for gathering media measurements, applications that support M2M communications with types of equipment owned by countless media viewers are installed. Each application delivers media usage information collected through M2M communications or sends media usage information generated from device itself to service platform. The M2M application records the relevant media usage information (channel, title, start time, current time, etc.) on the terminal and delivers it to the service platform regularly when users start to view certain broadcast

programs or other types of media sources. The application collects and delivers all kinds of sensor data, data on users' social media use, information on news scraps, and the RSS subscriptions to which access was permitted by users, together with data delivered to service platform.

The Machine-type People Meter (MPM, refer to Fig.2(2)) gathers such media and additional information collected from distributed smart terminals through data aggregators and converts such detailed media information, information on users' preferences, and users' disclosure scope, into audience rating information through extractors. Such decentralized network-based information can be analyzed and visualized on a close-to-real-time basis through MapReduce-based parallel time data mining in order to analyze each user's personal history and predict users' life logging and each user's viewing pattern changes

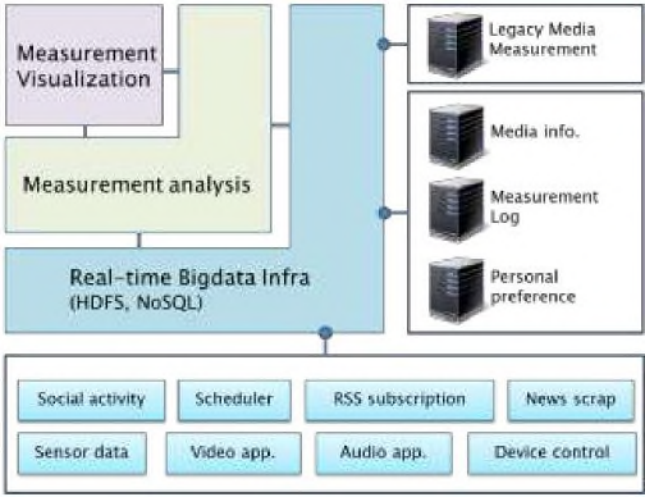


Fig. 3. Architecture of Bigdata platform based on Machine-type Media Measurement System.

The Media Measurement Service Platform (MMSP, refer to Fig.2(3)) integrates traditionally collected audience rating information with audience rating information collected through Machine-type People Meter(MPM)s. In addition, all kinds of queries are written and sent, and the function of lookup or service composition, aimed at mixing the viewing information of certain groups or an unidentified number of people, is provided through MPM.

The detailed media collection and delivery procedures are as follows:

When a request for a media measurement is made from outside, the Management Module Service Platform (MMSP) forms the request query based on the relevant information requested and delivers it to the MPM. In addition, the MPM constructs specific request composition information that corresponds with the relevant query, generates an MPM application for collection, and delivers the request to the M2M platform. The M2M platform segments information on the relevant request, forms a group, and generates and delivers an application based on details including composition information on the request by each sub-class. When the information corresponding with the request is collected, the M2M device of the stage of the lowest

order delivers it to the upper order symmetrically or asymmetrically. The M2M Platform receives all reply information from the M2M devices and delivers it to MPM. The MPM identifies specific media information, the relevant user's disposition information, and item information that the relevant user permitted sharing and then delivers the refined information to the MMSP. The MMSP accumulates the relevant information and analyzes it via the Bigdata platform, including visualized information, and sends it to the requested application as shown in Fig.3.

## 4 Conclusion and future work

This paper proposed a method via which to collect diverse information based on Machine-type communications and to provide more universal viewing information in this way. Although completely analyzing viewing trends, including audience ratings, is impossible, in the current reality, as diverse forms of media emerge, this study is expected to be a complementary resolution in terms of analyzing and utilizing integrated media.

Future research will concern creating an algorithm that performs current status of utilization, pattern, and prediction via media by using bigdata platform that is collected on a real-time basis.

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