A Study on the Personal Program Guide Technique Within Ubiquitous Media Community Environment Using Multi-band Sensor Gateway

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Abstract. The media community service and user interface that can be supported in an ubiquitous environment is a basis for sharing through various media informations and personalized service. Experiments on the conceptual and technical elements and its application were carried out in this study. Some mobile devices, which were equipped with sensor network with a 900 MHz, 2.4GHz frequency substitution and a media server, which was equipped with sensor gateway for arbitration of each media device, were used to establish a multi-substitution ubiquitous media community environment. Under such an environment, the context information of a device was exchanged with another through a gateway in a media server and each device was able to interwork by context information generated on a different mobile device, in a different substitution, effectively.

1 Introduction

The sensor network is different from passive RFID and is semipermanent. Using a low power technology, it can transmit data to a long distance through ad hoc technology. It is developed in a 900 MHz and 2.4 GHz frequency band and studied in a various fields, such as bridge monitoring, necklace tag, temperature detection and position tracing. But we tried to apply sensor network to the media device for sharing a public media information and viewing a personal information and then eventually, to design a media community for ubiquitous society. So, we assumed that a current home looks like a ubiquitous and we established a local ubiquitous network under multi-band sensor networks. For instance, the media server is used as a sensor network gateway, each mobile device connect to it by sensor network and each device is able to exchange another with the media information or interwork each other through it. Receiving and transmitting sharing information between devices by sensor network, showing the necessary information based on user interface or interworking other networks through the

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media server, a wide media community environment is able to established. On this supposition, we adopted a media environment for digital broadcasting as a subject of study. The details of this paper is described as follows. The existing UI related study is introduced in a Chapter 2. The sensor working together technical contents between devices are shown in a Chapter 3. An individualization UI technology is described in a Chapter 4. The simple experiment results are shown in a Chapter 5.

2 The Trend of Researching Electronic Program Guides

Nowadays, a various EPG services are studied and built for applying digital broadcasting with a different method by many researchers. One of the examples is to use a only character information. This type of information includes the general characteristics of a TV program guide, that is, time, station, title and date, etc. of news, an interviews, sports, documentaries and movies. These are categorized into some more detailed types and is currently used by EPG of TiVo[1] and Diego [2]. It is a very generous method to navigate a electronic program guide and support services for Digital TV. Second is to use an audio Pattern Information. After analyzing an audio characteristic of a TV program, it separates a jenre of TV program using a probable variance of analyzed data. The analyzed audio patterns are saved in the storage and can be used for video indexing and segmenting of TV programs. The electronic program guides uses simple text based information about genre for whole programs, but this determines genre information at the level of program segments.[3] And third is to use medatata. The Metadata means 'data about data', and can be divided into 4 categories: Content Description Metadata, Instance Description Metadata, Segmentation Meta data, and User Preference. It can be provided more detailed program information than a current electronic program guide. In this way it is called, Advanced EPG.[4] Finally, it is to use a habit information. The broadcasting channel becomes larger than an analogue broadcast, and a lot of trouble occurs in a channel search or channel setting. In order to solve these troubles, it uses a recommendation method that an audience make a favorite TV program select based on the watching time, favorite program, preference, age, sex, job, etc. It is called, Personalized Program Guide(PPG).[5],[6]

3 Sensor Network Synchronization Technology Between Different Bands

3.1 SGMI Fragment Data Format

The SGMI data is transmitted to another device with a Fragment Data Section part in the Sync Agent Protocol Message structure and it has a 17 bytes length at this time. The front 1 byte is set up as the ID value, which can partition off SGMI data for 17 bytes, and the last byte is set up as the value that can confirm whether a normal data transmission exists. An explanation about of the

meaning of an each field is as follows for Fragment Data. The identity ID is a random value that can confirm an agreement of SGMI data transmitted in 4 bits in size, and a random value is used, and 16 kinds of SGMI data acknowledgement codes are made. The class ID is the value that SGMI data transmitted in 4 bit size can classify any kind of data into. 0x00 is meaningless with NULL, 0x01 is UI, 0x02 is the User Preference, 0x03 is the EPG data, and 0x04 0x0F is the reserved value. SGMI Data means the SGMI data that are transmitted from source to 15 bytes size, and Checksum is the value that can confirm whether the data transmitted to Fragment Data Section are normally data that have been received in 1 byte size.

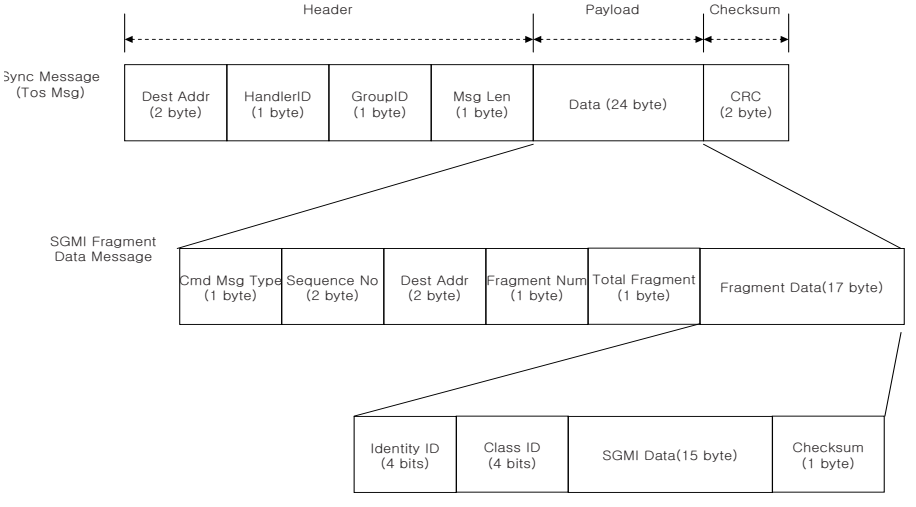

Fig. 1. A Structure of SGMI Data in TOS Message

3.2 Sync. Agent

Sync.Agent is an agent technology that it is able to control the sensor network between devices and transmit data on it. It is necessary for a user to share information with a local community even if a user does not intend to send contextual information through the sensor network module attached to the media device. An explanation about working together between devices using Sync. Agent is as follows.

Figure 2 shows the operation stream of a synchronization protocol. It broadcasts using the MMP Sync Agent which generates a MMP Discovery Req Message for User SGMI DB configuration in a Data Aggregator module of an embedded media station for a different kind device user SGMI data collection if media server is run, and accesses the sensor network for each band. It transmits an ID Beacon Message which the environment recognition Sensing value

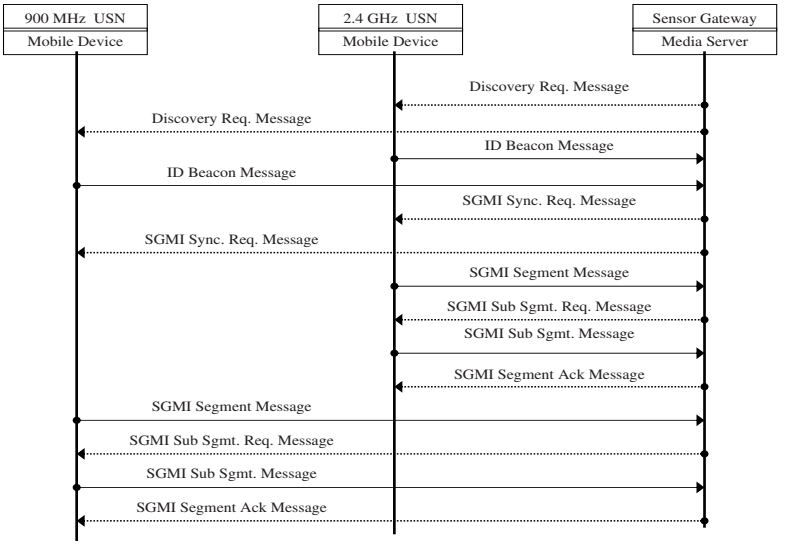

Fig. 2. Sync. Agent Synchronization Protocol Operation Flow

that Sync Agent Device Id, SGMI Version, to have gained of the MMP device that received the MMP Discovery Req Message which a broadcasting becomes with each band is simple was included in to media server for one second. It is composed Sync Agent Tree existing through Id Beacon Message parsing transmitted through multi-hop routing to a band star. It transmits SGMI Sync Req Message to the specific device that corresponds to each band through thed accessed Sync Agent if it carries out the User Profile and Version Matching that exists in the User SGMI DB as for the media server while making its round a node of Sync Agent Tree, and transmission of new SGMI data are requested. It is not a compulsive transmission, and it transmits multi-hop routing through the re-broadcasting method of a Sync Agent node in the case of this message. That is, it distinguishes whether its own ID value can be compared with the Destination field value, and the node that received the SGMI Sync Req Message was transmitted from a message to itself. It broadcasts again, and it transmits the message that it is not a message transmitted to itself, and is received by all nodes in the RF Range. The Sync Agent of MMP carries out segmentation in order to transmit the User SGMI Info accumulated in a device. Because the Payload size (25bytes) of the SGMI Segment Message transmitting User SGMI Info is limited, it is transmitted through a message fragment. It is assigned to the media server that received the first SGMI Segment Message according to the Total Fragment value of the Message Slot, and the SGMI Segment Message is transmitted in the order it is saved in the corresponding Slot and Assembling make another User SGMI Messag. The SGMI Sub Sgmt Req Message ordering

the Segment that was not received again is transmitted from the transmitted Segment Message to an MMP device by packet loss if receipt becomes inferior. Reset does the Slot which massage receipt judges an impossibility if the SGMI Sub Segment Message request that is not received in media server is requested by three times, and Req Count reaches 3, and massage receipt is canceled, and was received. Also, a receipt failure node is deleted from the Sync Agent Tree generated by the media server. If the divided User SGMI Info is received all in order, and the SGMI Slot is filled, the media server lets the SGMI Segment Ack Message to be transmitted to an MMP device, and it is received successfully.

4 The Context and Method for UI Presentation

The user interface is different from the technical interface (the interface used between devices). The technical interface is performed through direct interaction, but the user interface is performed indirectly through the interface with a computer. Also, it is not hard to make this interface. It is played in the order that the data in a system are seen, or may be changed. A command had more easily and clearly communicated through the technical interface. These can be seen with the basic structure of the basic user inter-face, and UI-related researchers have thought about the basics. D-UI (Dynamic UI) supports enough six Factor of Usability in this study,[7] and is done with the aim of providing a user interface that can adapt itself to variety in an ubiquitous environment. The details are as follows.

4.1 The Transmitted Context Information

Program Context. Seeing the ATSC(Advanced Television Systems Committee) document, a various standard table information transmitted from the digital terrestrial /cable broadcasting station is described, and a various information such as time information, program information, version information is transmitted along the MPEG-2 stream using these tables. An EIT(Event Information Table) that transmits information related to a program is mainly used in this study and all kinds of information about some program, that is, Video PID, Audio PID, the start/stop time and the like is tranmitted. [8]

User Context. A user context is composed of 4 types of informations: user ID, Device ID, user symbol information and device information. The User ID is used to confirm that transmission of the users context information to a network was authorized. The User ID value, which confirms that the user is registered to use the device, is extracted from the related media device. An random hexadecimal number value for the user was used in this study. Adding a mobility to a dynamic EPG in a wide meaning, the device ID is the value that describes the type of related media device. The broadcast-related information that a user prefers in a media device (jenre, actor, etc) is recorded in the user preference information.

UI Context. Because the UI context used in this study is applied to electronic program guide technology in digital broadcasting, it will be described with restriction. The background screen, date, time interval, broadcasting station and a program output screen were drawn on one screen on an electronic program guidebook. The screen explained a program with 6 sub-screens. The structure of this part and 1:1 mapping were got completed in this study, and to connect to a component one individual was made. EPGBack, EPGData, EPGTimeIntercal, EPGStation, EPGProgram, EPGDescription are the components that correspond individually, and a structure that can express the information that a user set up information about this with fluid by a foundation was designed.

4.2 Software Structure

MIPM(Meta Information Processing Module). The SGMI(Self Generated Meta Information) information that is the inputted Meta information is transmitted from the outside through a network (a sensor, TCP/IP) to each media device. This information is composed of user-related preference information or UI information and other a lot of information, and is transmitted in a regular structure to a remote media device. The Meta Information Processing Module was necessary, and the structure is shown in Figure 3 in order to extract UI data of the form that a user wanted through these data.

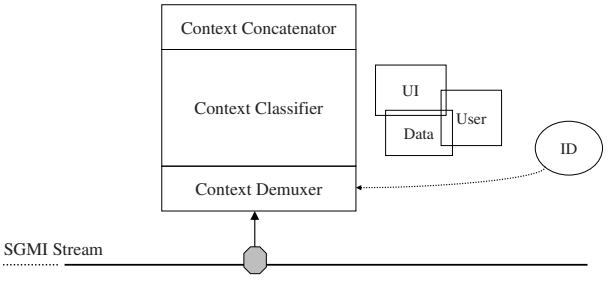

Fig. 3. A Meta Information Processing Structure

Three MIPM were executed (Context Demuxer, Context Classifier, Context Concatenator.). The Context Demuxer extracts data to make ID agree with the ID value set up at the receivubg device when a lot of data are transmitted to the SGMI Stream. The Context Classifier classifies the data extracted from the Context Demuxer. This information includes what kind of data have been classified in the SGMI Stream, and role to gather the information at the place that did data to have information with a base at the same day is carried out. The Context Concatenator is made from the total data size from the source before the transmitted data have been classified in the Context Classifier from source.

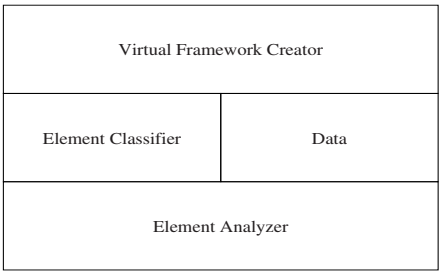

Fig. 4. A Rendering Structure

That is, the size of the date should be small, and the data that have been divided are put together, and the original data are made.

RM(Rendering Module). The data skipped through MIPM are different from the actual GUI with data of a text form.Therefore, the middle intermediate which can let convert it in the middle in order to express data of a text form to a screen with a picture must be, but it is Rendering Module(RM) to play this. The meaning of each Element is interpreted, and, as for the data that RM deals with, this can make a structure to see from XML-like data skipped in pure MIPM.Four RM are executed: the Element Analyzer, Element Classifier, Virtutal Framework Creator and Data Storage. The Element Analyzer separates the XML-like data. They are analyzed with the structure Element for Element, the User Preference for UI and Element for data are separated, and can be dealt with. The Element Classifier separates these analyzed data into a group. That is, data for UI do it in order to connect the each object to an event in GUI, or User Preference does it in order it is classified particularly, and to be able to deal with each ID. The Virtual Framework Creator functions before being shown in an actual screen in order total configuration tries to be expressed with a virtuality, or to monitor it. It is played in order it is marked by an actual screen, and to be able to all inspect it internally. Data Storage saves the data transmitted through a network, but the data of this time are saved according to the rules that were predefined so that it is used suitably when UI is expressed.

GPM(Graphic Processing Module). The GPM deals with the D-UI finally so that the GUI that a user requests on an actual screen is expressed, and the interaction is presented to a user.

The GPM performs three executions. Virtual Framework Analyzer, Graphic API Mapper, and Presentation Engine. The Virtual Framework Analyzer analyzes the Virtual Framework information generated in RM. The information that was analyzed here is communicated with the Graphic API Mapper, but graphic API and 1:1 mapping are done so that it can be marked by an actual screen. This information is displayed on the screen by the actual graphic engine.

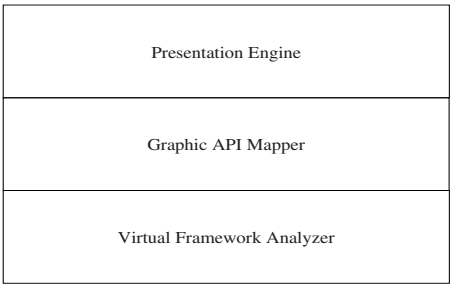

Fig. 5. A Graphical Process Structure

5 Experiment

If a mobile media device get into the local media community environment, the user information and UI information saved in a device is transmitted to the media server through a sensor network, and the information transmitted to a media server is saved per user. At this time, it is confirmed whether there is relevant user information on the media server if a user requests an EPG screen display in a mobile device. If there is a registered user information, it is displayed EPG on a screen based on the information by using a electronic program guide program. If not, it is displayed EPG supported basically. Figure 6 is a mobile device equipped with sensor network for experiment and Figure 7 shows an experiment environment.

The user context information that is transmitted from a mobile device to a media server is used for EPG context extraction from the MPEG-2 stream. An UI context information transmitted from a mobile device is used for configuring UI components and properties so that an complete electronic program guide screen is made. Because there are a lot of media community environments in real life and we cannot configure it, so we was only used the restriction of a cable

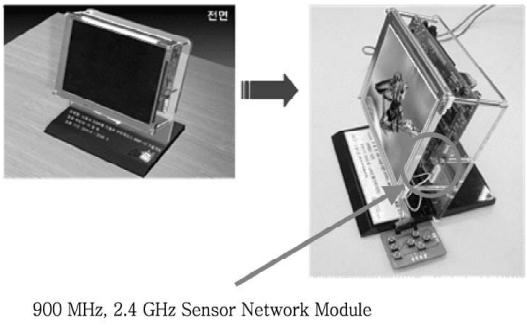

Fig. 6. A mobile device equipped with sensor network for experiment

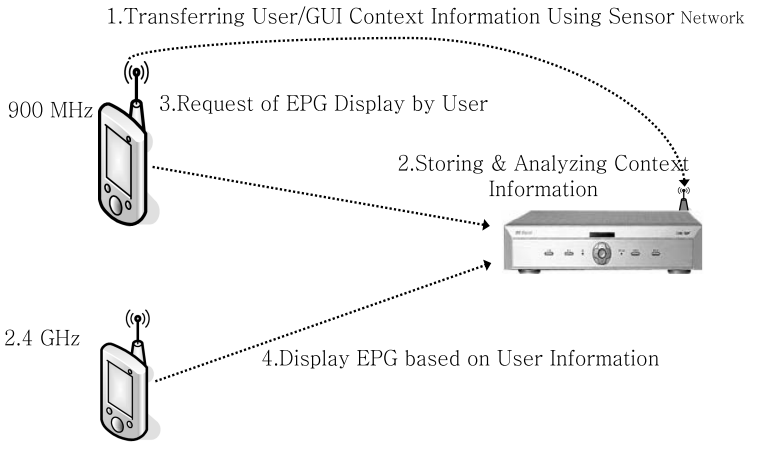

Fig. 7. An experiment environment

network based on an ATSC standard in this study. The local media community environment was composed through a sensor gateway of the media server with a sensor network of different bandwidths and lots of mobile device are arbitrated to communicate with each other by a media server. In this study, we showed the possibility of the EPG service with a User Context/UI Context/EPG Context using a sensor gateway. But it took a considerable time to transmit the EPG Context and the same large data restricted the transmission speed of a sensor network, and the bottle-neck phenomenon to have obeyed transmission occurred. But the application was able to show that considerable possibilities for a media environment that uses a sensor network.

6 Conclusion

Although a lot of burdens follow, it was very effective in a measure to use a sensor network within a virtual ubiquitous environment. While one is unconscious, some data were transmitted to another device, reproduced in a media device and displayed on a screen. Even though a media device is under a multi-band, the media community was established through media server with sensor gateway and the information was shared each other. As a result of a study, we proved that a sensor network can be used to transmit some information in a media environment and applied to a ubiquitous media environment sufficiently.

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