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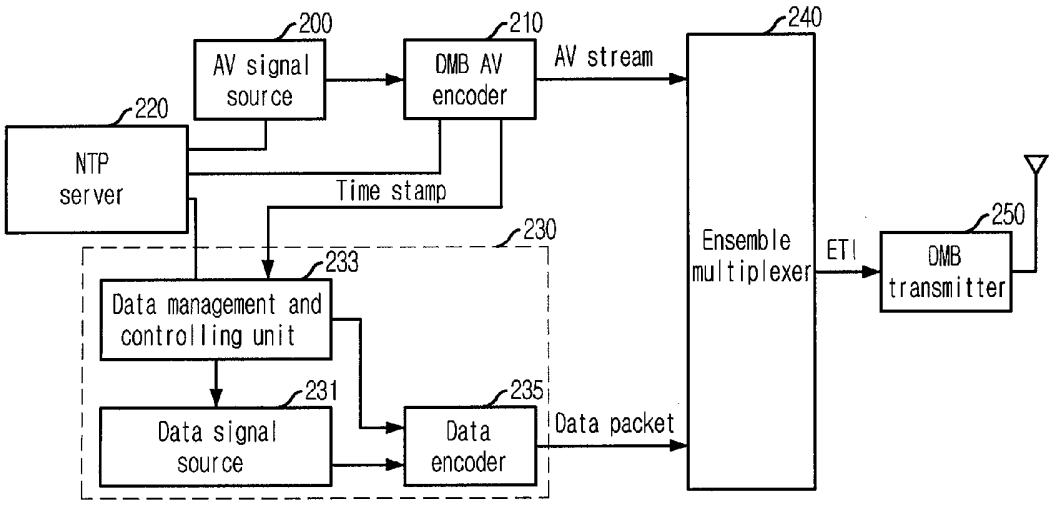
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(54) Title: METHOD AND APPARATUS FOR SYNCHRONIZING DATA SERVICE WITH VIDEO SERVICE IN DIGITAL MULTIMEDIA BROADCASTING



(57) Abstract: Provided is a method and apparatus for transmitting an metadata synchronized with audio/vidieo (AV) data on a satellite, terrestrial, cable or proprietary digital broadcasting network. The method includes the steps of : a) receiving an AV time stamp for the AV data; b) calculating a time stamp of the data, which is information on a time point when the data are to be presented in a user terminal, which will be shortly referred to as data time stamp hereinafter, based on the AV time stamp; c) generating sync metadata including the calculated data time stamp; and d) encoding the sync metadata and transmitting the encoded sync metadata.

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METHOD AND APPARATUS FOR SYNCHRONIZING DATA SERVICE WITH VIDEO SERVICE IN DIGITAL MULTIMEDIA BROADCASTING

Description

Technical Field

The present invention relates to digital multimedia broadcasting (DMB); and more particularly, to a method and apparatus for synchronizing data transmitted based on the Eureka-147 with audio and video (AV) data transmitted after coded and multiplexed into Moving Picture Experts Group (MPEG) 4 or MPEG-2.

Background Art

A synchronized data service model provides a means for an application program executed in a terrestrial Digital Multimedia Broadcasting (DMB) middleware to make a performance in synchronization with other media, such as a DMB video service. Herein, a video service means an audio/vieo (AV) service provided based on "Digital Audio Broadcasting (DAB); DMB video service; User Application Specification" (ETSI TS 102 428).

Fig. 1 is an exemplary block diagram showing a conventional terrestrial DMB transmitting system. When an AV signal source 100 generates video signals and audio signals for DMB, a DMB AV encoder 110 encodes the audio and video signals based on a DMB video transmission and reception interface standard to thereby create AV stream. This process includes an MPEG-4 AV encoding procedure and a multiplexing procedure into MPEG-2 transport stream (TS). Meanwhile, to provide a data service based on the Eureka-147, the data signal source 130 generates diverse data having no concern with AV data, and the data encoder 140 encodes the diverse data generated in the data signal source 130 to create data packets.

The AV stream and the data packets outputted from the DMB AV encoder 110 and the data encoder 140 are multiplexed into frames of the Ensemble Transport Interface (ETI), i.e., ETI frames, in an ensemble multiplexer 150. The ETI frames go through Coded Orthogonal Frequency Division Multiplexing (COFDM) encoding in a DMB transmitter 160 to be outputted in the form of radio frequency (RF) signals.

Herein, the ETI frames are basically composed of fast information channel (FIC) data and main service channel (MSC) data. The FIC data and the MSC data are generated in an FIC unit 151 and an MSC unit 152 of the ensemble multiplexer 150, respectively.

The FIC is an information channel for fast access to multiplexing information and service information in a Eureka-147 system, and the MSC is a channel for multiplexing service components each corresponding to each service according to a multiplexing structure set up through the FIC.

Basic audio data, AV stream and diverse additional data are multiplexed and transmitted through the MSC. In the FIC, absolute time is added to FIG-type 0 expansive 10 (FIG 0/10) in the form of universal coordinated time (UCT), and this provides a reference time based on which the MSC data are decoded and presented. Thus, the UCT absolute time information may be added as a standard for timing information when data are encoded.

MPEG-4 and/or MPEG-2 systems use a clock reference and time stamps to synchronize AV data transmitted over elementary stream (ES) and transmit timing information.

In the MPEG-4 systems, a receiving terminal uses a decoding time stamp (DTS) to define a decoding time point of each access unit in a decoding buffer, and uses a composition time stamp (CTS) to accurately define a composition time point of each composition unit (CU).

An object clock reference (OCR) is used to transmit a time mark of given stream to an ES decoder. An OCR value corresponds to an object time base (OTB) value at a time when a transmitting terminal generates an OCR time stamp. OCR values are included in an SL packet header and transmitted.

Korean terrestrial DMB uses both MPEG-4 and MPEG-2. To transmit and synchronize AV data, an MPEG-2 system uses a program clock reference (PCR) and a presentation time stamp (PTS), and a MPEG-4 system uses an object clock reference (OCR), a composition time stamp (CTS), and a decoding time stamp (DTS). Also, the MPEG-4 system is synchronized with the MPEG-2 system by mapping SL packets of MPEG-4 to Packetized Elementary Stream (PES) of MPEG-2 at a ratio of 1:1. A PES header includes PTS of the MPEG-2 only when an SL packet header of MPEG-4 includes an OCR. Otherwise, the PTS of the MPEG-2 is not used. Also, object time base (OTB) that defines a time stamp for MPEG-4 data stream is engaged with a system time clock of MPEG-2.

Meanwhile, the data encoder 140 of Fig. 1 transmits timing information with reference to UTC absolute time information transmitted over an FIC channel, when it encodes data based on multimedia object protocol (MOT), which is a data transmission specification based on a DMB system specification, i.e., the Eureka-147. In short, the data encoder 140 objectizes data on a file or directory basis and then packetizes the objects. Herein, a time stamp, which is timing information on time when one data object is decoded and presented, is added to the header of the data object in the form of UTC. However, this method has a problem that it is hard to exactly synchronize data with DMB AV stream.

Disclosure

Technical Problem

It is, therefore, an object of the present invention to provide a method and apparatus for synchronizing data with audio/video (AV) data in a Digital Multimedia Broadcasting (DMB) by generating timing information on time when a particular event is executed in an application program to provide a data synchronized with a DMB AV service.

Technical Solution

In accordance with one aspect of the present invention, there is provided a method for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), the method including the steps of: a) receiving an AV time stamp for the AV data; b) calculating a time stamp of the data, which is information on a time point when the data are to be presented in a user terminal, which will be shortly referred to as data time stamp hereinafter, based on the AV time stamp; c) generating sync metadata including the calculated data time stamp; and d) encoding the sync metadata and transmitting the encoded sync metadata.

In accordance with another aspect of the present invention, there is provided a method for providing data synchronized with AV data in DMB, the method including the steps of: a) separating receiving signals into AV stream and data packets; b) receiving a system reference time information from an AV stream decoder for decoding the AV stream; c) acquiring a data time stamp from sync metadata included in the data packets; and d) comparing the data time stamp with the system reference time, and decoding and presenting a data object file at a time

point when the data time stamp coincides with the system reference time.

Advantageous Effects

The present invention can synchronize data transmitted based on the Eureka-147 with a video based on Moving Picture Experts Group (MPEG) 4 and MPEG-2. Thus, the present invention can contribute to the spread of diverse Digital Multimedia Broadcasting (DMB) services.

Description of Drawings

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is an exemplary block diagram showing a conventional terrestrial Digital Multimedia Broadcasting (DMB) transmitting system;

Fig. 2 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with an embodiment of the present invention;

Fig. 3 is a view describing a method of calculating a time point when data are to be presented based on a composition time stamp (CTS) value;

Fig. 4 is a view showing a structure of a data carousel shown in Fig. 3;

Fig. 5 is a view showing a structure of sync metadata shown in Fig. 3;

Fig. 6 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with another embodiment of the present invention;

Fig. 7 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with yet another embodiment of the present invention;

Fig. 8 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with still another embodiment of the present invention; and

Fig. 9 is a block diagram showing a receiving system capable of providing data synchronized with video data in accordance with an embodiment of the present invention.

Best Mode for the Invention

Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. Those skilled in the art of the invention can easily implement the technological concept of the present invention. When it is determined that detailed description of a related art may obscure the points of the present invention, the description will not be provided herein. Hereinafter, embodiments of the present invention will be described in detail, with reference to the accompanying drawings.

Fig. 2 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with an embodiment of the present invention.

The terrestrial DMB transmitting system includes an audio/video (AV) signal source 200 for generating AV contents, a Digital Multimedia Broadcasting (DMB) AV encoder 210 for encoding the generated AV contents into AV stream based on a terrestrial DMB standard, a data

server 230 for providing diverse data services, an ensemble multiplexer 240 for multiplexing the generated AV stream and data packets into ensembles, a DMB transmitter 250 for performing Orthogonal Frequency Division Multiplexing (OFDM) encoding and radio frequency (RF) transmission, and a Network Time Protocol (NTP) server 220 for synchronizing the above constituent elements temporally. The data server 230 is composed of a data signal source 231, a data management and controlling unit 233 for managing and controlling the data signal source and a data encoder 235, and the data encoder 235 for encoding generated data based on diverse DMB data transmission and reception standards.

When the AV signal source 200 generates AV data in real-time or takes them out from a storage to provide a moving picture service in a DMB system, the DMB AV encoder 210 encodes the AV data according to a terrestrial DMB video standard based on MPEG-4 and MPEG-2. Herein, for synchronization the DMB AV encoder 210 inserts Object Clock Reference (OCR) and Composition Time Stamp (CTS) at MPEG-4 layer, inserting Program Clock Reference (PCR) and Program Time Stamp (PTS) at MPEG-2 layer. The DMB AV encoder 210 supplies Composition Time Stamp (CTS) of an initial period of a program to the data server 230.

To provide additional data based on the Eureka-147, the data signal source 231 generates and stores diverse detailed data by collecting and authoring JAVA-based application data, texts related to the application data, image, moving pictures and the like. The additional data are encoded in the data encoder 235 and transmitted under the control and management of the data management and controlling unit 233. Also, the NTP server 220 temporally synchronizes the AV signal source 200, the AV encoder 210, and the data server 230.

The data management and controlling unit 233 manages the time points when the data from the data signal source 231 are inserted. It also calculates the time points when the data are presented in a user terminal into video time stamp-based values, i.e., CTS-based values, by using the initial CTS of a program inputted from the DMB AV encoder 210, and known scene information and data adding time from the AV signal source 200. The calculated synchronization information is directly transmitted to the data encoder 235 or becomes metadata for synchronization between video and the data and transmitted to the data encoder 235.

Fig. 3 describes a method of calculating a time point when data are to be presented based on a time stamp value, e.g., a composition time stamp (CTS) value.

In case of a recorded program, time information (V(b)) for a scene where data synchronized with video data are to be added can be exactly extracted in advance. When the video data are encoded in the DMB AV encoder 210, a time stamp, which is restoration time of each scene at the user terminal, such as CTS, is added to the header of an SL packet. In a non-streaming data broadcasting system, data files are broadcasted in the form of data carousels prior to the restoration time in the user terminal. Then, the user terminal downloads the data carousels and performs data restoration at the predetermined time point. Herein, data are of a downloadable application program and/or related data thereof. The data may be stored in a non-volatile memory in advance.

In the present specification, the data management and controlling unit 233 generates sync metadata to presented data synchronized with a particular scene and it transmits the generated sync metadata based on an appropriate data protocol.

Fig. 4 is a view showing a structure of a data

carousel shown in Fig. 3, and Fig. 5 is a view showing a structure of sync metadata shown in Fig. 3.

As illustrated in Fig. 5, the sync metadata may be composed of an identifier, a trigger time, which is a video time stamp, e.g., CTS, a related data indicator, and data. The identifier identifies data, and the trigger time includes a data decoding time, data restoration time, data extermination time in a user terminal, and it is calculated in advance based on the time stamp of video, which will be referred to as a video time stamp, e.g., CTS. The related data indicator indicates data which are synchronized with a particular scene and presented in connection with an application program executed in the user terminal. The data include information instantly needed.

The sync metadata are added prior to a particular video restoration time (V(b)). Thus, the trigger time (Ts(b)) that constitutes the synch metadata should be estimated prior to the video restoration time (V(b)). The time when to calculate the trigger time (Ts(b)) can be acquired based on the known video restoration time (V(b)) and the video time stamp information of an initial period of the application program, which includes video information and time stamp information and is inputted from the DMB AV encoder 210. Herein, the video time stamp information of the initial period of the program is temporally synchronized by the NTP server among all devices, it can be easily extracted.

In case of a simple sync data providing service, as shown in Fig. 4, the video time stamp information is directly added to the header of a data object repeatedly transmitted by a data carousel without using the sync metadata to thereby synchronize the restoration time of the data object with the video.

Hereinafter, the synch metadata will be described in

detail with reference to examples.

In order to provide a DMB service and a sync data service, trigger time synchronized with video and indicating time when a particular event is executed in an application program should be generated, and the generated trigger time should be transmitted from a data server of a transmitting part to a terrestrial DMB middleware within a short time. In other words, when a user terminal executes an application program, the transmitting part should transmit the trigger time and data to be executed or an indicator of the data to execute an event synchronized with video. A message composed of the trigger time and data to be executed or the indicator of the data is referred to as a trigger packet. In short, the trigger packet is an example of the sync metadata.

The trigger packet should be scheduled and transmitted from the data server of the transmitting part prior to a predetermined synchronized trigger time to make the application program execute the event. When it reaches the trigger time, the trigger packet is transmitted repeatedly to make the application program perform a predetermined action indicated by the event at a time synchronized with the video.

The terrestrial DMB uses a Transparent Data Channel (TDC) packet mode which has a small overhead and does not use a data group having a short waiting time. The TDC packet mode is based on ETSI TS 101 759, i.e., Digital Audio Broadcasting (DAB); DAB Data Broadcasting Transparent Data Channel (TDC) standard, to transmit the trigger packet. The trigger packet may be transmitted by using other transmission protocols.

The following Table 1 shows formats of the trigger packet.

Table 1

Format	Number of bits	Bit format
trigger_packet(){		
triggerID	16	uimsbf
triggerTime	33	uimsbf
for(i=0;i<N;i++){		
privateDataByte	8	uimsbf
}		
}		

In the Table 1, "triggerId" is an identifier for identifying a trigger in the application program, and "triggerTime" indicates a time point when an event is generated. A video time stamp such as CTS is used at around the event generation time point to provide a link service. Herein, a video service providing device and the data server need to cooperate to use the CTS at the trigger time.

"privateDataByte" indicates data that are needed for the application program needs to execute an event at the trigger time. The privateDataByte may be composed of a related data indicator and data, which is shown in Fig. 5.

API Model

A terrestrial DMB middleware defines a trigger interface in a dmb.io package, which is defined for data reception through a DMB data channel, to provide a synchronized data service. The API model is what is extended from javax.microedition.Datagram (CLDC 1.1 (JSR 139) at http://java.sun.com/products/cldc/index.jsp) and it is a datagram including event information. Trigger is

used to transmit sync signals to other media. The API model is linked with the ID of the trigger and time information when an event indicated by the trigger is to be executed.

Although a plurality of triggers are received on a broadcasting network, if the triggers have the same ID, they are all treated as the same triggers. A trigger may be transmitted several times to increase a reception possibility or to make sure the time indicated by the trigger because the time may be changed due to discontinuity in system time clocks. When the time indicated by the trigger is past, the trigger is ignored. The ID of the trigger whose time is past and process is completed may be reused by another trigger.

When even one trigger of the same ID is received, a trigger object is received instantly. When the time indicated by the trigger has not come yet, doItNow() is false. A trigger having a false doItNow() is transmitted to the application program only once even though the trigger of the same ID is transmitted several times. If any, when the trigger time is changed in the middle, triggers of the same ID may be transmitted several times. When the trigger time approaches near or get past slightly at an event generation time, a trigger whose doItNow() is true is transmitted to the application program. The application program executes an operation indicated by the trigger instantly. After the execution, even though a trigger of the same ID is transmitted, the trigger is treated as a different one from the trigger whose doItNow() was true.

PrivateData transmitted in the form of trigger packets are read by using a method of Diagram that is an upper class of the trigger.

The following Table 2 defines API for a synchronized service.

Table 2

public interface dmb.io.Trigger
All extended Interfaces
javax.microedition.io.Datagram
Methods
public long doItNow() false, if the trigger informs prior to an event generation time, or true, if operation should be executed as soon as an event is received.
public long getID() returns ID of the trigger.
public long getTime() returns time information indicated by the trigger.

Fig. 6 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing data with video data in real-time in accordance with another embodiment of the present invention. The drawing shows an example of a system where a data server 430 uses a time stamp extracting unit 437, when a DMB AV encoder 410 cannot directly output time information of a video source and the time stamp information thereof to the data server 430. The time stamp extracting unit 437 extracts video time stamp, e.g., CTS of the video, from the AV stream outputted from the DMB AV encoder 410 and the extracted time stamp is inputted to the data management and controlling unit 433.

In this case, to calculate the time stamp (Ts(b)) of data that constitutes the sync metadata in advance, encoding delay time of the DMB AV encoder 410 which can be acquired in advance from experiments should be considered additionally.

Sync data may be serviced more easily when AV data

are encoded in advance and stored in the form of stream, which is shown in Figs. 7 and 8. In this case, time of a video to which data are to be added and a time stamp thereof can be acquired in advance.

Fig. 7 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing video with data in real-time in accordance with yet another embodiment of the present invention.

In the drawing, AV stream is stored in an MPEG-2 file or a Forward Error Correction (FEC)-added file thereof.

Referring to Fig. 7, a DMB transmitting system includes an AV signal source 500, an AV encoder 510 for encoding AV signals based on a terrestrial DMB standard, a storage 560 for storing the AV signals encoded in the form of stream, a data server 530 for generating sync metadata to provide data synchronized with AV data by using an AV time stamp which are supplied from the storage 560, and multiplexers 520, 540 and 550 for multiplexing the output signals of the AV encoder 510 and the output signals of the data server 530. Herein, video time information of a video to which data are to be added and a data time stamp information for data restoration are inputted to the data server 530 in advance. The data management and controlling unit 533 determines when to add the data and generates sync metadata based on the time to add the data.

When data are to be provided in the middle of AV stream transmission out of the DMB AV encoder 510 in a general DMB service which is shown in Fig. 7, stream switching occurs in a switcher. The switcher 520 performs re-stamping, which is a process for guaranteeing continuity of time stamp. The time stamp pre-added to a stream file is re-established in the switcher 520 to be in continuum with the time stamp of the AV stream

outputted from the DMB AV encoder 510. In overall, a predetermined value is added to the time stamp. The data server 530 should receive the time stamp of the AV stream re-established in the switcher 520 and information on the time point when the switching has occurred in order to reflect the re-establishment. The time stamp re-establishment is a movement of the entire time stamps by a predetermined value. Thus, the information needs to be inputted the moment when switching occurs.

Fig. 8 is a block diagram illustrating a terrestrial DMB transmitting system for synchronizing video with data in real-time in accordance with still another embodiment of the present invention.

Differently from the transmitting system of Fig. 7, AV stream is encoded in the form of an MP4 file and directly added to the DMB AV encoder 610 in the transmitting system of Fig. 8.

When AV stream is encoded into an MPEG-4 format and an MP4 file, which is one of storage file formats, is added to DMB, it should be packetized into MPEG-4 SL and an MPEG-2 transport stream (TS) in an M4onM2 processing module 620, which is shown in Fig. 8. This process may be carried out inside the DMB AV encoder 610 but it also may be performed in an additional device.

When an MP4 file is packetized into MPEG-4 SL and MPEG-2 TS, the comparative time information inside the MP4 file is transformed into OCR or CTS. The data server 630 already includes time information of video to which data are to be added and a data time stamp for data restoration. Thus, if it receives the transform information of the packetization from an MP4 file into MPEG-4 SL and MPEG-2 TS, it can predict a data time stamp, which is time when data synchronized with video are presented.

Fig. 9 is a block diagram showing a receiving

system capable of providing a service where data are synchronized with video in accordance with an embodiment of the present invention.

Referring to Fig. 9, the receiving system capable of providing video synchronized with data includes an RF receiving channel decoder 710, an MSC processor 730, a DMB AV decoder 740, and a DMB data decoder 760, and a data presenting apparatus 770. The RF receiving channel decoder 710 receives RF signals, demodulates the RF signals into baseband signals, performs channel decoding, and separates FIC data from MSC data. A FIC analyzer 720 analyzes the FIC data including multiplexing information and service information and provides an analysis result to the MSC processor 730. The MSC processor 730 separates data transmitted through an MSC channel into data packets and AV stream. The AV stream and the data packet are inputted to the DMB AV decoder 740 and the DMB data decoder 760 to be decoded, respectively. The DMB AV presenting apparatus 750 and the data presenting apparatus 770 presented the AV stream and the data at the same restoration time, respectively.

The DMB data decoder 760 receives a system reference time information such as OCR from the DMB AV decoder 740 and compares the system reference time information with the CTS-based data time stamp information added to the header of sync metadata or the header of a data object. What coincides herein becomes the restoration time of the data object file. Finally, the data presenting apparatus 770 executes an application program directed by the sync metadata, and related data indicated by the sync metadata and instant data added to the sync metadata are presented at the extracted restoration time, respectively, to be synchronized with AV data.

The method of the present invention, which is described above, can be realized as a program and stored

in a computer-readable recording medium such as CD-ROM, RAM, ROM, floppy disks, hard disks, magneto-optical disks and the like. Since the process can be easily implemented by those skilled in the art of the present invention, detailed description on it will not be provided herein.

While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A method for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), comprising the steps of:

a) receiving an AV time stamp for the AV data;

b) calculating a time stamp of the data, which is information on a time point when the data are to be presented in a user terminal, which will be shortly referred to as data time stamp hereinafter, based on the AV time stamp;

c) generating sync metadata including the calculated data time stamp; and

d) encoding the sync metadata and transmitting the encoded sync metadata.

2. The method as recited in claim 1, wherein the AV time stamp is extracted from AV stream acquired from encoding.

3. The method as recited in claim 1, wherein the AV time stamp is provided from an AV stream file in storage.

4. The method as recited in claim 1, wherein the sync metadata are trigger packets composed of information for executing an event which is synchronized with the AV data.

5. The method as recited in claim 4, wherein the trigger packets include a field for identifying a trigger in an application program at a receiving part, a field indicating a time point when an event is generated, and a field indicating data to be executed by the application program at the trigger time point.

6. The method as recited in claim 5, wherein the trigger packets are transmitted repeatedly prior to the trigger time point.

7. A method for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), comprising the steps of:

a) separating receiving signals into AV stream and data packets;

b) receiving a system reference time information from an AV stream decoder for decoding the AV stream;

c) acquiring a data time stamp from sync metadata included in the data packets; and

d) comparing the data time stamp with the system reference time, and decoding and presenting a data object file at a time point when the data time stamp coincides with the system reference time.

8. The method as recited in claim 7, wherein the sync metadata are trigger packets composed of information for executing an event which is synchronized with the AV data.

9. The method as recited in claim 7, wherein the sync metadata are trigger packets composed of information for executing an event which is synchronized with the AV data.

10. The method as recited in claim 9, wherein the trigger packets include a field for identifying a trigger in an application program at a receiving part, a field indicating a time point when an event is generated, and a field indicating data to be executed by the application program at a trigger time point.

11. The method as recited in claim 9, wherein if the trigger packets are for informing generation of a predetermined event in advance before the event is generated, a false signal is transmitted to the application program of the receiving part, or if the trigger packets are for processing data instantly in response to generation of the event, a true signal is transmitted to the application program of the receiving part.

12. An apparatus for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), comprising:

an AV encoder for encoding AV signals based on a terrestrial DMB standard and providing an AV time stamp into a data server;

a data server for generating sync metadata to provide data synchronized with AV data by using the AV time stamp;

a time synchronizing server for temporally synchronizing the AV encoder with the data server; and

a multiplexer for multiplexing an output signal of the AV encoder and an output signal of the data server and transmitting a multiplexed signal.

13. The apparatus as recited in claim 12, wherein the data server includes:

a data signal source for generating diverse data related to the digital multimedia broadcasting;

a data management and controlling unit for calculating a data time stamp, which is a time point when the data are to be presented in a user terminal, based on the AV time stamp, and generating sync metadata including the calculated data time stamp; and

a data encoder for encoding the diverse data and the sync metadata into data packets.

14. The apparatus as recited in claim 12, wherein the sync metadata are trigger packets composed of information for executing an event which is synchronized with the AV data.

15. The apparatus as recited in claim 14, wherein the trigger packets include a field for identifying a trigger in an application program at a receiving part, a field indicating a time point when an event is generated, and a field indicating data to be executed by the application program at a trigger time point.

16. The apparatus as recited in claim 14, wherein the trigger packets are transmitted repeatedly before the trigger time point.

17. An apparatus for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), comprising:

an AV encoder for encoding AV signals based on a terrestrial DMB standard;

a storage for storing the encoded AV signals in a form of stream;

a data server for generating sync metadata to provide data synchronized with AV data by using an AV time stamp provided from the storage; and

a multiplexer for multiplexing an output signal of the AV encoder and an output signal of the data server and transmitting a multiplexed signal.

18. The apparatus as recited in claim 17, wherein the sync metadata are trigger packets composed of

information for executing an event which is synchronized with the AV data.

19. The apparatus as recited in claim 18, wherein the trigger packets include a field for identifying a trigger in an application program at a receiving part, a field indicating a time point when an event is generated, and a field indicating data to be executed by the application program at a trigger time point.

20. An apparatus for providing data synchronized with audio/video (AV) data in digital multimedia broadcasting (DMB), comprising:

an RF receiving channel decoder for receiving DMB signals, demodulating the DMB signals into baseband signals, and performing channel decoding;

an MSC processor for separating AV stream from data packets based on multiplexing information and service information;

an AV stream decoder for decoding the AV stream; and

a data presenting means for providing the data synchronized with the AV stream by using the sync metadata included in the data packets and a system reference time information provided from the AV stream decoder.

21. The apparatus as recited in claim 20, wherein the sync metadata are trigger packets composed of information for executing an event which is synchronized with the AV data.

22. The apparatus as recited in claim 21, wherein the trigger packets include a field for identifying a trigger in an application program at a receiving part, a

field indicating a time point when an event is generated, and a field indicating data to be executed by the application program at a trigger time point.

23. The apparatus as recited in claim 21, wherein if the trigger packets are for informing generation of a predetermined event in advance before the event is generated, a false signal is transmitted to the application program of the receiving part, or if the trigger packets are for processing data instantly in response to generation of the event, a true signal is transmitted to the application program of the receiving part.

FIG. 1

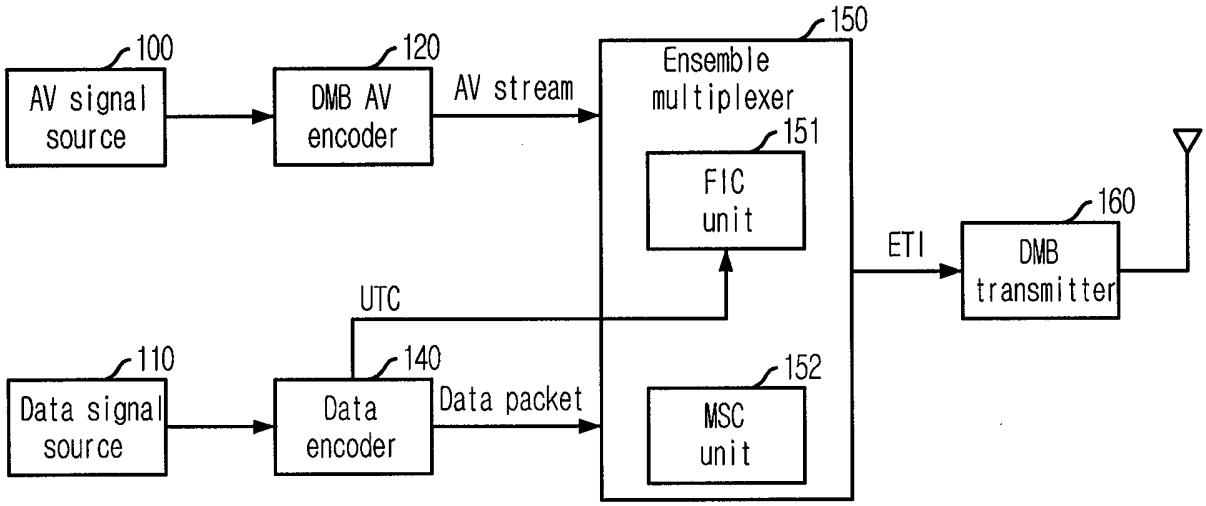

100
AV signal source
120
DMB AV encoder
AV stream
150
Ensemble multiplexer
151
FIC unit
160
DMB transmitter
ETI
UTC
110
Data signal source
140
Data encoder
Data packet
152
MSC unit

FIG. 2

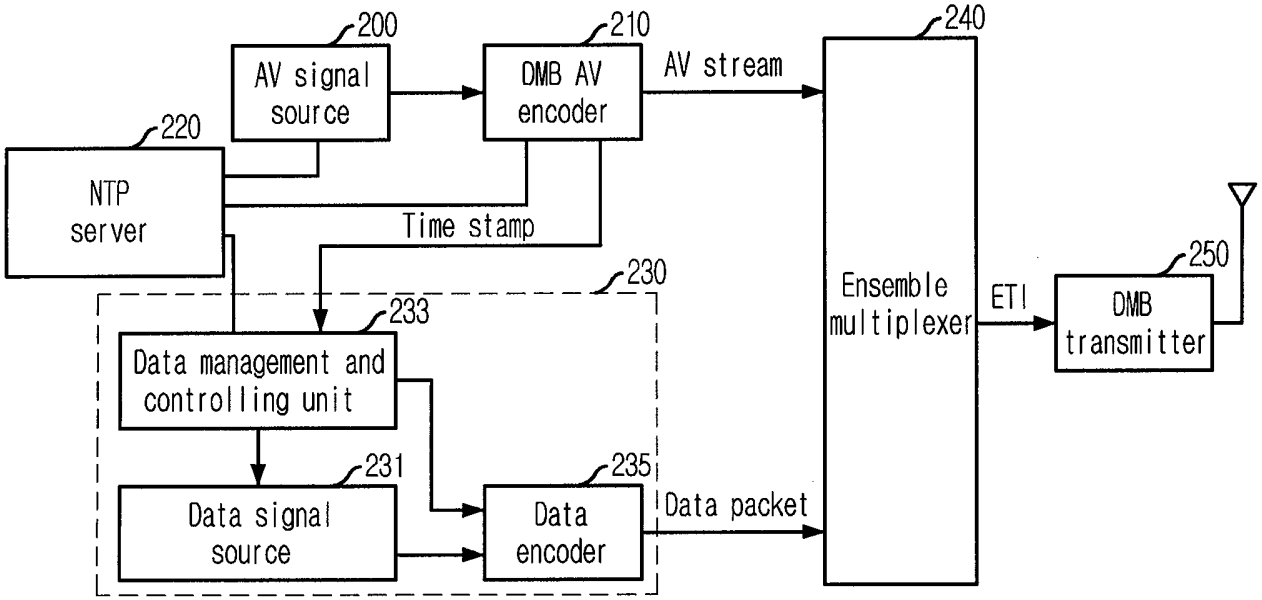

200
AV signal source
210
DMB AV encoder
AV stream
240
220
NTP server
Time stamp
230
233
Data management and controlling unit
231
Data signal source
235
Data encoder
Data packet
Ensemble multiplexer
ETI
250
DMB transmitter

FIG. 3

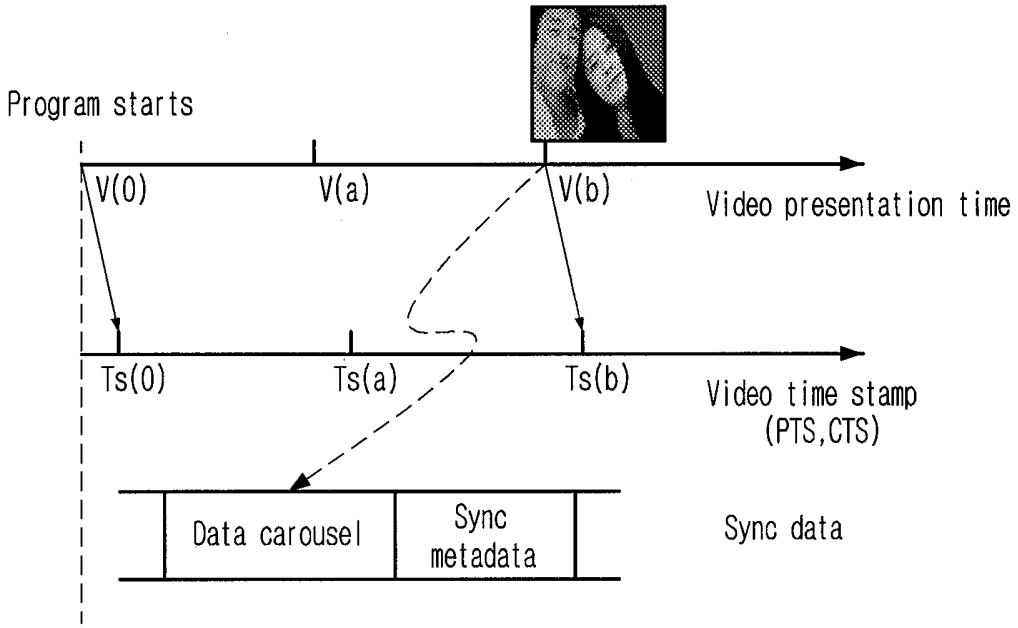

Program starts
V(0)
V(a)
V(b)
Video presentation time
Ts(0)
Ts(a)
Ts(b)
Video time stamp
(PTS,CTS)
Data carousel
Sync metadata
Sync data

FIG. 4

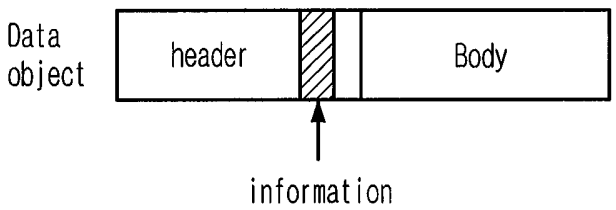

Data object
header
Body
information

FIG. 5

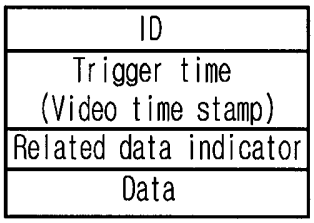

ID
Trigger time
(Video time stamp)
Related data indicator
Data

FIG. 6

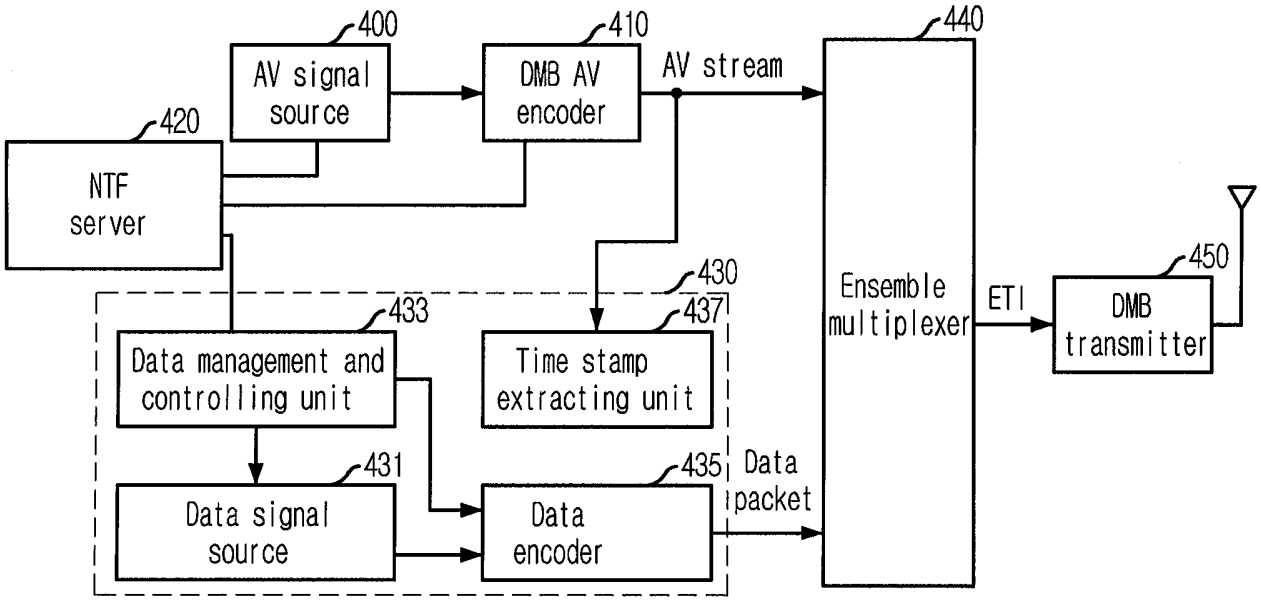

400
AV signal source
410
DMB AV encoder
AV stream
440
420
NTF server
430
433
Data management and controlling unit
437
Time stamp extracting unit
Ensemble multiplexer
ETI
450
DMB transmitter
431
Data signal source
435
Data encoder
Data packet

FIG. 7

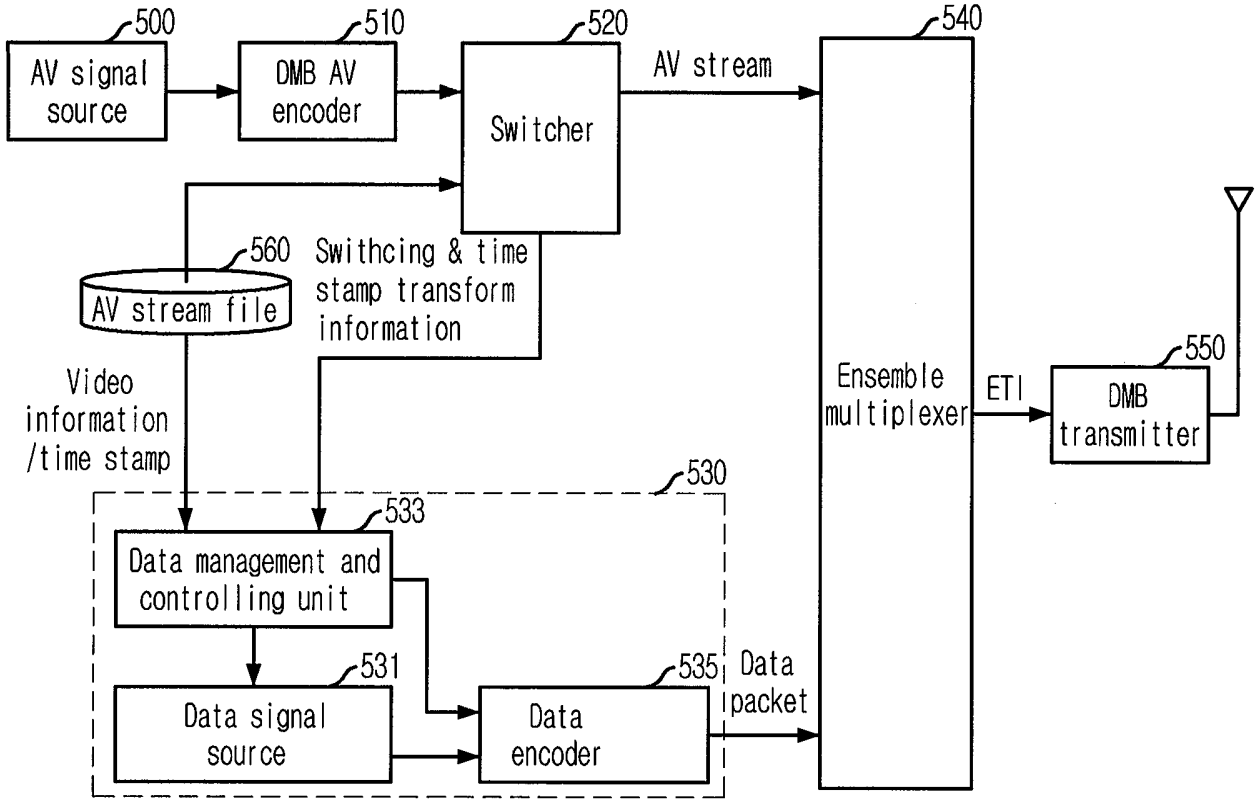

500
AV signal source
510
DMB AV encoder
520
Switcher
AV stream
540
Ensemble multiplexer
ETI
550
DMB transmitter
560
AV stream file
Swithcing & time stamp transform information
Video information /time stamp
530
533
Data management and controlling unit
531
Data signal source
535
Data encoder
Data packet

FIG. 8

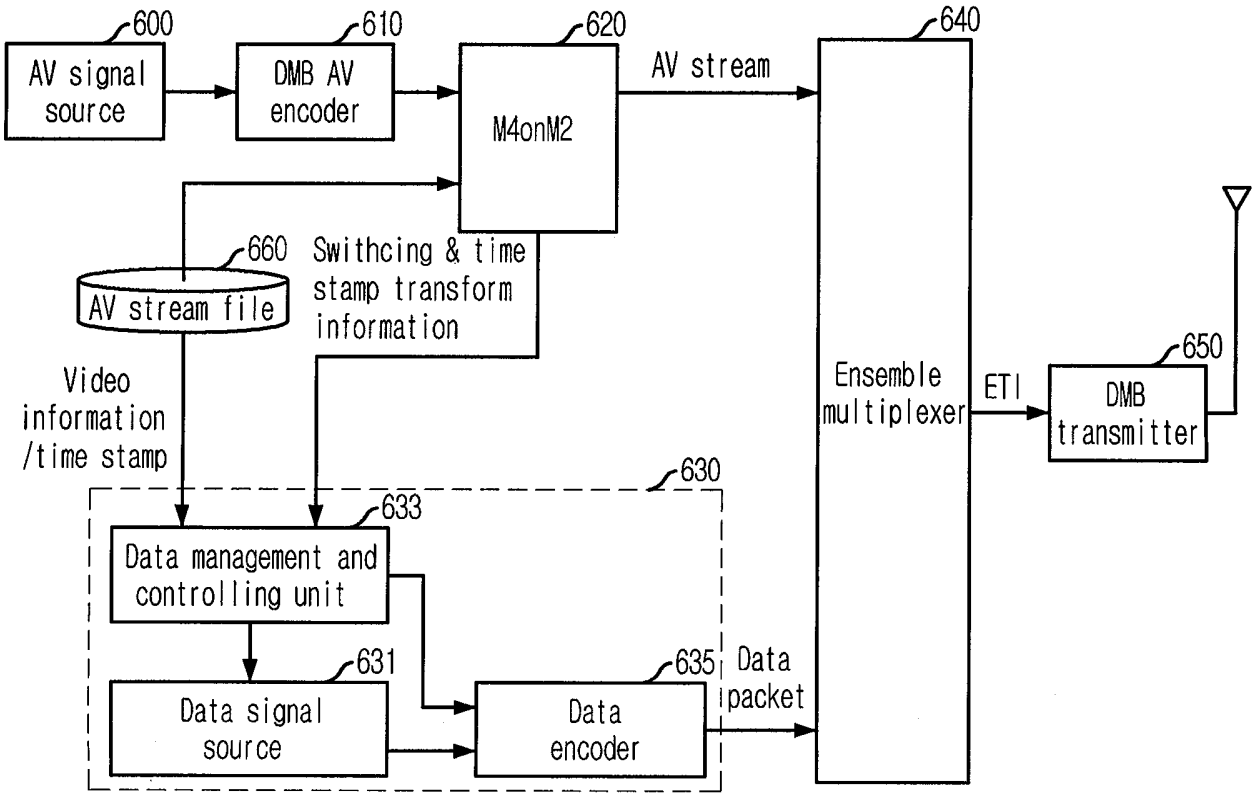
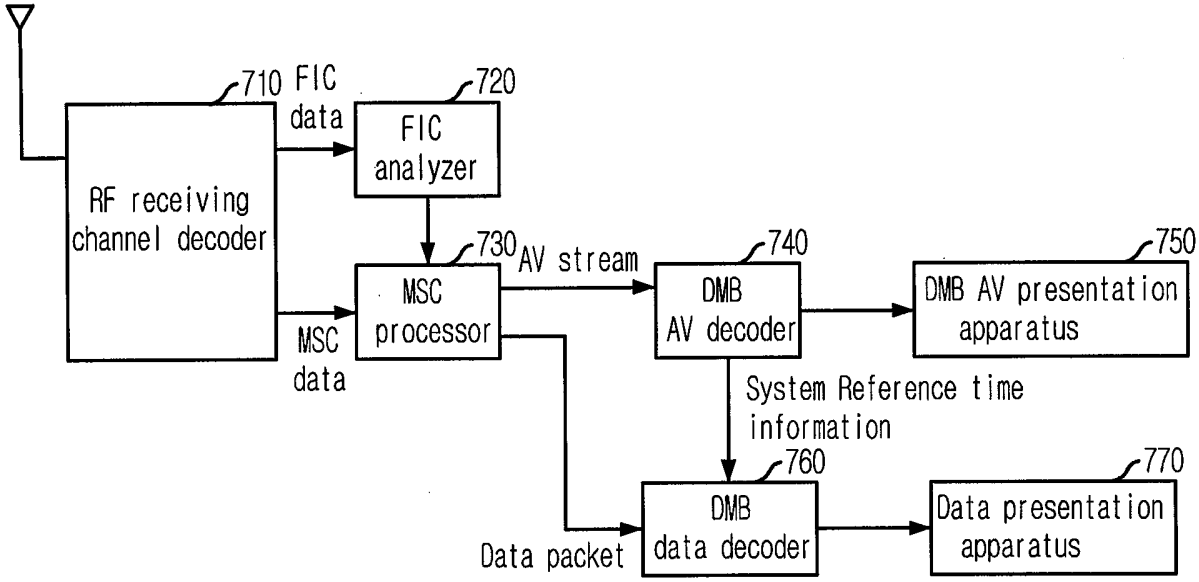

600
AV signal source
610
DMB AV encoder
620
M4onM2
AV stream
640
Ensemble multiplexer
ETI
650
DMB transmitter
660
AV stream file
Swithcing & time stamp transform information
Video information /time stamp
630
633
Data management and controlling unit
631
Data signal source
635
Data encoder
Data packet

FIG. 9


710
RF receiving channel decoder
FIC data
720
FIC analyzer
730
MSC processor
MSC data
AV stream
740
DMB AV decoder
750
DMB AV presentation apparatus
System Reference time information
760
DMB data decoder
Data packet
770
Data presentation apparatus

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/002011

A. CLASSIFICATION OF SUBJECT MATTER

H04N 7/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975
Korean Utility models and applictions for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

eKIPASS, SEARCH TERMS: TIME STAMP, SYNCHRONIZING DATA, and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2003010905 A2 (AKIHIRO TANAKA et al.), 06 February 2003 See abstract, page4, line4-page18, line25	1-23
A	JP 2000-244433 A (SONY CO., LTD.), 08 September 2000 See abstract, page6, left-hand column, line7-page10, right-hand column, line33	1-23
A	KR 10-2003-0056103 A (ETRI), 04 July 2003 See abstract, page3, line17-page5, line13	1-23
A	JP 2002-238048 A (NEC CO., LTD.), 23 August 2002 See abstract	1-23

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 AUGUST 2006 (22.08.2006)	**22 AUGUST 2006 (22.08.2006)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer SHIN, Jae Chul Telephone No. 82-42-481-8215

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/002011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO2003010905A2	06.02.2003	AU2002355318A8	17.02.2003
		CN1557101A	22.12.2004
		EP01444839A2	11.08.2004
		EP1444839A2	11.08.2004
		JP15006473	10.01.2003
		JP16537214	09.12.2004
		JP2003006473A2	10.01.2003
		JP2004537214T2	09.12.2004
		JP3605110B2	22.12.2004
		KR1020040018523	03.03.2004
		US20040263689A1	30.12.2004
		US2004263689A1	30.12.2004
		US2004263689AA	30.12.2004
		WO03010905A2	06.02.2003
		WO2003010905A3	30.10.2003
JP12244433	08.09.2000	NONE	
KR1020030056103	04.07.2003	NONE	
JP14238048	23.08.2002	NONE	