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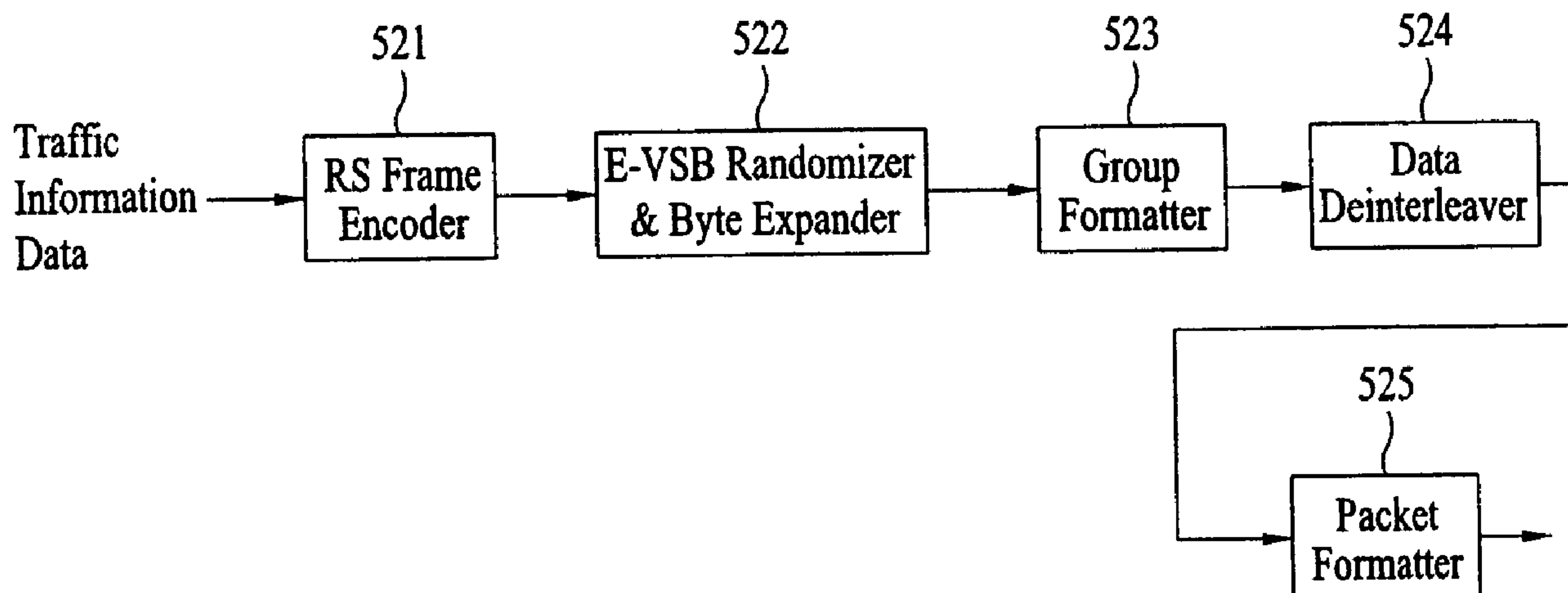
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(57) Abrégé/Abstract:

A digital broadcast transmitting/receiving system and a method for processing data are disclosed. The method for processing data may enhance the receiving performance of the receiving system by performing additional coding and multiplexing processes on the traffic information data and transmitting the processed data. Thus, robustness is provided to the traffic information data, thereby enabling the data to respond strongly against the channel environment which is always under constant and vast change.

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ABSTRACT OF THE DISCLOSURE

A digital broadcast transmitting/receiving system and a method for processing data are disclosed. The method for processing data may enhance the receiving performance of the receiving system by performing additional coding and multiplexing processes on the traffic information data and transmitting the processed data. Thus, robustness is provided to the traffic information data, thereby enabling the data to respond strongly against the channel environment which is always under constant and vast change.

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A DIGITAL BROADCAST SYSTEM AND METHOD OF PROCESSING TRAFFIC INFORMATION

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a digital broadcast system, and more particularly, to a digital broadcast transmitting/receiving system and a method for processing data.

Discussion of the Related Art

[0003] Presently, the technology for processing digital signals is being developed at a vast rate, and, as a larger number of the population uses the Internet, digital electric appliances, computers, and the Internet are being integrated. Therefore, in order to meet with the various requirements of the users, a system that can add video/audio data through a digital broadcasting (or television) channel so as to transmit diverse supplemental information needs to be developed.

[0004] Some users may assume that supplemental data broadcasting would be applied by using a PC card or a portable device having a simple in-door antenna attached thereto. However, when used indoors, the intensity of the signals may decrease due to a blockage caused by the walls or disturbance caused by approaching or proximate mobile objects. Accordingly, the performance of the received digital signals may be deteriorated due to a ghost effect and noise caused by reflected waves. Therefore, a system highly resistant to (or robust against) ghost effects and noise is required to be developed. Particularly, in order for the supplemental data to be used in portable and mobile broadcast receivers, a higher degree of resistance (or robustness) against channel interruption and noise is required.

[0005] The supplemental data are generally transmitted by a time-division method through the same channel as the MPEG video/audio data. However, with the advent of digital broadcasting, ATSC VSB digital television receivers that receive only MPEG video/audio data are already supplied to the market. Therefore, the supplemental data that are transmitted through the same channel as the MPEG video/audio data should not influence the conventional ATSC VSB receivers that are provided in the market. In other words, this may be defined as ATSC VSB compatibility, and the supplemental data broadcast system should be compatible with the ATSC VSB system. Herein,

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the supplemental data may also be referred to as enhanced data or EVSB data. Furthermore, as the number of possessed automobiles (or cars) is in constant increase, and with the influence of the working-5-days-a-week policy (which eventually leads to an increase in the usage of cars), the need for traffic information

5 is also increasing accordingly.

SUMMARY OF THE INVENTION

[0006] Accordingly, the present invention is directed to a digital broadcast transmitting/receiving system and a method for processing data that in some embodiments, may substantially obviate one or more problems due to

10 limitations and disadvantages of the related art.

[0007] An object of some embodiments of the present invention is to provide a digital broadcast system and a method for processing data that can be compatible to the ATSC VSB system, that is suitable for transmitting enhanced data, and that is resistant to and robust against noise.

15 [0008] Another object of some embodiments of the present invention is to provide a digital broadcast transmitting/receiving system and a method for processing data that can effectively receive and transmit traffic information by applying the traffic information data as the enhanced data.

[0009] Another object of some embodiments of the present invention is

20 to provide a digital broadcast transmitting/receiving system and a method for processing data that can enhance the receiving performance of the receiving system by performing additional coding on the traffic information data and transmitting the processed data.

[0010] A further object of some embodiments of the present invention

25 is to provide a digital broadcast transmitting/receiving system and a method for processing data that can enhance the receiving performance of the receiving system by multiplexing the known data, which correspond to data known in advance

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according to an agreement between the transmitting system and the receiving system, and the traffic information data.

[0011] Additional advantages, objects, and features of some embodiments of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of some embodiments of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

10 According to one aspect of the present invention, there is provided a digital broadcast transmitter, comprising: a pre-processor for pre-processing traffic information data including a traffic information message, the pre-processor comprising: an RS frame encoder for encoding the traffic information data using a Reed-Solomon scheme; a block-processor for encoding the RS-encoded traffic
15 information data at a coding rate of $1/2$ or $1/4$; a group forming unit for forming a data group including the encoded traffic information data and known data; a data de-interleaver for de-interleaving data in the data group; and a packet formatter for forming traffic information data packets including the de-interleaved data; a
20 multiplexer for multiplexing the traffic information data packets with one or more main audio and video (AV) data packets; an encoder for performing systematic RS encoding on the main audio and video data packets and non-systematic RS encoding on the traffic information data packets; an interleaver for interleaving data in the systematic RS-encoded main audio and video data packets and the non-systematic RS encoded traffic information data packets; a trellis encoder having at least one
25 memory and for trellis-encoding the interleaved data, the at least one memory being initialized by initialization data when the interleaved data correspond to a beginning of a known data sequence; and a data transmission unit which inserts synchronization data into the trellis-encoded data, modulates the trellis-encoded data having the synchronization data, and transmits the modulated data.

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According to another aspect of the present invention, there is provided a digital broadcast transmitter, comprising: a pre-processor for pre-processing enhanced data, the pre-processor comprising: an RS frame encoder for encoding the enhanced data using a Reed Solomon scheme; a block-processor for encoding the RS-encoded enhanced data at a coding rate of 1/2 or 1/4; a group forming unit for forming a data group including the encoded enhanced data and known data; a data de-interleaver for de-interleaving data in the data group; and a packet formatter for forming enhanced data packets including the de-interleaved data; a multiplexer for multiplexing the enhanced data packets with one or more main audio and video (AV) data packets; an encoder for performing systematic RS encoding on the main audio and video data packets and non-systematic RS encoding on the enhanced data packets; an interleaver for interleaving data in the systematic RS-encoded main audio and video data packets and the non-systematic RS encoded enhanced data packets; a trellis encoder having at least one memory and for trellis-encoding the interleaved data, the at least one memory being initialized by initialization data when the interleaved data correspond to a beginning of a known data sequence; and a data transmission unit which inserts synchronization data into the trellis-encoded data, modulates the trellis-encoded data having the synchronization data, and transmits the modulated data.

[0012] A digital broadcast transmitter according to an embodiment of the present invention includes a

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traffic information message generator, a pre-processor, a multiplexer, a trellis encoder, and a transmitter.

[0013] The traffic information message generator may generate a traffic information message including status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information. The pre-processor may pre-process traffic information data including the traffic information message by encoding the traffic information data and by generating a traffic information data packet including the encoded traffic information data and known data. The multiplexer may multiplex the traffic information data packet with one or more main audio and video (AV) data packets. The trellis encoder may have at least one memory and trellis-encoding the multiplexed data packets, the at least one memory being initialized by initialization data when data outputted from the multiplexer correspond to a beginning of a known data sequence. The data transmission unit may insert synchronization data into the trellis-encoded data, modulating the trellis-encoded data having the synchronization data, and transmitting the modulated data.

[0014] In another aspect, a digital broadcast transmitter may include a traffic information message generator, a pre-processor, a multiplexer, a post-

processor, a data encoding and interleaving unit, a trellis encoder, and a transmitter.

[0015] The traffic information message generator may generate a traffic information message including status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information. The pre-processor may pre-process traffic information data including the traffic information message by encoding the traffic information data for at least one of error correction and error detection and by generating a traffic information data packet including the encoded traffic information data and known data. The multiplexer may multiplex the traffic information data packet with one or more main audio and video (AV) data packets. The post-processor post-processing the multiplexed data by encoding only traffic information data included in the multiplexed data with a coding rate of G/H , wherein G and H are positive integers and G is less than H . The data encoding and interleaving unit may add first parity data into the post-processed data and interleave the post-processed data having the first parity data. The trellis encoder may have at least one memory and trellis-encoding the interleaved data, the at least one memory being initialized by initialization data when data outputted from the data encoding and interleaving unit correspond to a beginning of a known

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data sequence. The data transmission unit may insert synchronization data into the trellis-encoded data, modulating the trellis-encoded data having the synchronization data, and transmitting the modulated data.

[0016] In another aspect, a digital broadcast transmitter may include a traffic information message generator, a pre-processor, a multiplexer, a data encoding and interleaving unit, a post-processor, a trellis encoder, and a transmitter.

[0017] The traffic information message generator may generate a traffic information message including status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information. The pre-processor may pre-process traffic information data including a traffic information message by encoding the traffic information data for at least one of error correction and error detection and by generating a traffic information data packet including the encoded traffic information data and known data. The multiplexer may multiplex the traffic information data packet with one or more main audio and video (AV) data packets. The data encoding and interleaving unit may add first parity data into the multiplexed data and interleave the multiplexed data having the parity data. The post-processor may post-process the interleaved data by coding only

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traffic information data included in the interleaved data with a coding rate of G/H , wherein G and H are positive integers and G is less than H . The trellis encoder having at least one memory and trellis-encoding the post-processed data, the at least one memory being initialized by initialization data when data outputted from the post-processor correspond to a beginning of a known data sequence. The data transmission unit may insert synchronization data into the trellis-encoded data, modulating the trellis-encoded data having the synchronization data, and the transmitting the modulated data.

In another aspect, a method of processing traffic data in a digital transmitter may include generating a traffic information message including status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information, generating at least one system information table required for decoding the traffic information message, and multiplexing the traffic information message and the system information table.

In another aspect, a digital broadcast transmitter may include a traffic information message generator, a system information generator, and a multiplexer.

[0018] The traffic information message generator may generate a traffic information message including status

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information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information. The system information generator may generate system information required for decoding a traffic information message. The multiplexer may multiplex the traffic information message and the system information.

In another aspect, a data structure may include system information required for decoding a traffic information message including status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information, the system information comprising a traffic information table which includes at least one of a traffic information application identifier, a service component identifier, and service information.

In another aspect, a method of processing traffic information data in a digital broadcast receiver may include receiving traffic information data including a traffic information message and system information, demultiplexing the traffic information message and the system information from the traffic information data, and decoding the traffic information message using the system information, thereby extracting status information, which includes

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information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information

In another aspect, a digital broadcast receiver may include a demodulator, a data demultiplexing and decoding unit, a data storage, and an application manager.

The demodulator may demodulate traffic information data including a traffic information message and system information and performing error correction to the demodulated data. The data demultiplexing and decoding unit may demultiplex the traffic information message and system information from the error-corrected data and decode the demultiplexed traffic information message using the system information. The data storage may store the system information and the decoded traffic information message. The application manager may provide a traffic information service to a user using the stored traffic information message by extracting status information, which includes information of current traffic congestion and predicted traffic congestion information, and location information corresponding to the status information.

[0019] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are

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intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiments of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0021] FIG. 1 illustrates a transmission format of traffic information according to an embodiment of the present invention;

[0022] FIG. 2a illustrates a syntax of TPEG-CTT messages;

[0023] FIG. 2b shows syntax of formats of components carrying congestion status information;

[0024] FIGS. 2c and 2d show syntax of a CTT component carrying CTT events and location information, respectively;

[0025] FIG. 2e shows syntax of a CTT component carrying additional information of congestion status information;

[0026] FIG. 3a illustrates a syntax of the traffic/congestion information included in the CTT status container;

[0027] FIGS. 3b through 3e illustrate syntaxes of the average link speed, the link travel time, the link delay, and

the congestion type included in the status component shown in FIG. 3a, respectively;

[0028] FIG. 4a illustrates a syntax of the traffic/congestion prediction information included in the CTT status container;

[0029] FIGS. 4b through 4d illustrate syntaxes of the predicted average link speed, the predicted link travel time, and the tendency information included in the status component shown in FIG. 4a, respectively;

[0030] FIG. 5a illustrates an example of a database storing the history of traffic status at each link for providing the traffic/congestion prediction information;

[0031] FIG. 5b illustrates an example of a graphical user interface configured to predict the average speed at a specific link using the database shown in FIG. 5a;

[0032] FIG. 6a shows syntax of a part of component frame that includes a common data table including information to which a plurality of components refers in common in accordance implementation;

[0033] FIG. 6b shows syntax of a common data table inserted in a component frame;

[0034] FIG. 6c shows syntax of a common data component template that is an entry of a common data table;

[0035] FIG. 6d illustrates a transfer format of a component frame organized according to syntaxes of FIGS. 6a to 6c;

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[0036] FIG. 7 illustrates a transfer format in a case in which a common data component element is organized and provided for components included in TPEG location container

[0037] FIG. 8 illustrates a block view showing a general structure of a digital broadcast transmitting system according to an embodiment of the present invention;

[0038] FIG. 9 illustrates a syntax structure of traffic information descriptors according to an embodiment of the present invention;

[0039] FIG. 10 illustrates an example of table that may include the traffic information descriptors of FIG. 9;

[0040] FIG. 11 illustrates a syntax structure of a virtual channel table wherein the traffic information descriptors of FIG. 9 are included according to an embodiment of the present invention;

[0041] FIG. 12 illustrates a block view showing a structure of a digital broadcast transmitting system according to a first embodiment of the present invention;

[0042] FIG. 13 illustrates an example of a detailed block view showing an E-VSB pre-processor of FIG. 12;

[0043] FIG. 14A and FIG. 14B each illustrates a data structure before and after a data deinterleaver of FIG. 12, respectively;

[0044] FIG. 15 illustrates a block view showing a structure of a digital broadcast transmitting system according to a second embodiment of the present invention;

[0045] FIG. 16 illustrates an example of a detailed block view showing an E-VSB pre-processor of FIG. 15;

[0046] FIG. 17 illustrates an example of a detailed block view showing an E-VSB post-processor of FIG. 15;

[0047] FIG. 18 illustrates a block view showing a structure of a digital broadcast transmitting system according to a third embodiment of the present invention;

[0048] FIG. 19 illustrates a block view of a digital broadcast receiving system according to an embodiment of the present invention;

[0049] FIG. 20 illustrates process steps of receiving traffic information data according to an embodiment of the present invention;

[0050] FIG. 21 illustrates a detailed view of a demodulator of FIG. 19 according to a first embodiment of the present invention; and

[0051] FIG. 22 illustrates a detailed view of a demodulator of FIG. 19 according to a second embodiment of the present invention.

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DETAILED DESCRIPTION OF EMBODIMENTS

[0052] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. In addition, although the terms used in the present invention are selected from generally known and used terms, some of the terms mentioned in the description of the present invention have been selected by the applicant at his or her discretion, the detailed meanings of which are described in relevant parts of the description herein. Furthermore, it is required that the present invention is understood, not simply by the actual terms used but by the meaning of each term lying within.

[0053] In the present invention, the known data refer to a set of data known in advance according to an agreement between a transmitting system and a receiving system. The main data refer to a set of data that can be received by a conventional receiving system. Both known data and main data may include video data and/or audio data. Also, in the present invention, the enhanced data may refer to data including information, such as a program execution file, stock information, traffic information, and so on. The enhanced data may also include video data and/or audio data. Such enhanced data may include traffic information, data for providing data service, system

information for ground (or terrestrial) wave broadcasting such as PSI and/or PSIP, system information for cable broadcasting such as out of band system information (OOB-SI), supplemental data configured of diverse Java language or HTML language for data services providing a wide range of applications, audio data, and video data. The enhanced data may also include various control software for controlling the receiver, and meta data that are configured of an XML language, for example, in order to provide diverse information to the user.

[0054] In the description of the present invention, traffic information data will be applied for the enhanced data, so as to be transmitted and received. A road searching service and a traffic information providing service according to the present invention may be applied to a variety of digital broadcast standards. Representative examples of the digital broadcast standards are a European Digital Audio Broadcasting (DAB) service based on the Eureka-147 [ETSI EN 300 401], a Digital Video Broadcasting-Terrestrial (DVB-T) service provided in Europe, a Digital Video Broadcasting-Handheld (DVB-H) service also provided in Europe, a Media Forward Link Only (FLO) service provided in the United States, and a Digital Multimedia Broadcasting (DMB) service that is provided in the Republic of Korea. The DMB service of the Republic of Korea is classified into a Terrestrial Digital Multimedia Broadcasting (T-DMB) service based on the Eureka-147 and a

Satellite Digital Multimedia Broadcasting (S-DMB) service using satellite communication.

[0055] Herein, the traffic information includes information on public transportation, congestion and travel time, road traffic, emergency events and situation, and so on. The traffic information also includes information associated with all types of transportation means including train, ship (or cruiser), airplane, and so on. Furthermore, the traffic information may also include information on factors that may influence traffic, such as travel information, information parking facilities, weather information, environmental pollution information, and so on. Most particularly, although the congestion and/or travel time (hereinafter referred to as "CTT") information is given as an example of the present invention, any other information type may be applied herein. Furthermore, as long as the term indicates a particular function, the terms used in the present invention are not limited only to the ones used in the description set forth herein.

[0056] The term "traffic status" is indicative of a road congestion status (*i.e.*, a flow status), however, it is not limited to the above-mentioned road congestion status and can be applied to similar examples as necessary. For the convenience of description and better understanding of the present invention, the term "traffic status" is referred to as

a Congestion and/or Travel Time Information (CTT) status. The above-mentioned CTT status includes CTT status information, and CTT status prediction information, additional information, and so on. The term "section" or "link" is indicative of a specific area of roads. However, it is not limited to the above-mentioned meanings and may be applied to other similar meanings as necessary.

[0057] The traffic information service according to the present invention is provided to the users by a receiver having only one or none of an electronic map and a GPS mounted therein in the form of at least one of a text, a voice, a graphic, a still image, and a motion picture. The traffic information data are configured and transmitted by traffic information message units. More specifically, the traffic information message is the smallest unit for transmitting the traffic information. Herein, information on a single traffic information application is included in a traffic information message. In the present invention, the term "Transport Protocol Expert Group (TPEG)" will be used on the traffic information for simplicity. Furthermore, as described above, as long as the term indicates a particular function, the terms used in the present invention are not limited only to the ones used in the description set forth herein.

[0058] The traffic information application corresponds to the highest hierarchy within an ISO/OSI protocol stack. Each

traffic information application is assigned with a unique identification number, which is referred to as an application identification (AID). Each time a new application is developed and created, a new application identification is assigned. For example, each of the congestion and/or travel time (CTT) information, the road traffic message (RTM), the public transport information (PTI), and so on, is a traffic information application that is given unique application identification. The traffic information data correspond to a stream form including various traffic information messages. Herein, the traffic information messages correspond to at least one application.

[0059] FIG. 1 illustrates an example of two traffic information applications (e.g., CTT and RTM) being included in a stream. Traffic information message generator(not shown in figure) generating a traffic information message can be a broadcast station. For simplicity of the description of the present invention, the traffic information message generator is referred to as a traffic information providing server. The traffic information message generator construct in a traffic information message unit traffic congestion information collected from various sources (e.g., operator input, or information received from another server or probe cars through a network).

