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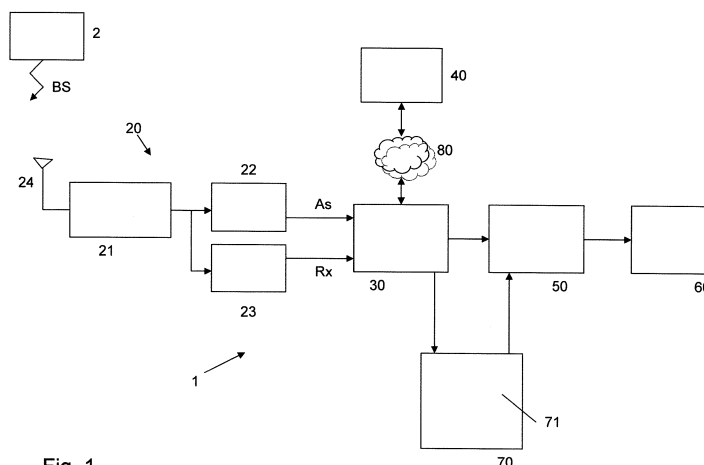
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(54) **Receiving apparatus and method of providing information associated with received broadcast signals**

(57) A receiving apparatus for receiving broadcast signals comprises a receiving device configured to receive broadcast signals, a recognition device configured to be coupled with an audio content analysis system and configured to perform an audio content recognition process together with the audio content analysis system, wherein the audio content recognition process is configured to capture audio signal samples transmitted with the broadcast signals repeatedly over time, to analyze the captured audio signal samples, and to provide analyzing data indicative of audio content of the analyzed audio signal samples, the recognition device further configured to extract multiple items of data from the analyzing data over time, a memory adapted to store therein a da-

database containing multiple items of data extracted over time and source information indicative of at least one broadcast station associated with the extracted items of data, an analyzing device which is configured to analyze a plurality of the multiple items of data stored in the database for at least one broadcast station associated with the analyzed items of data and to provide an analyzing result for the at least one broadcast station associated with the analyzed items of data, and an information providing device which is configured to provide information to a user based on the analyzing result for the at least one broadcast station associated with the analyzed items of data.



Description

[0001] The present invention is related to a receiving apparatus for receiving broadcast signals comprising a receiving device configured to receive broadcast signals, and to a method of providing information associated with received broadcast signals.

[0002] Broadcast signals transmitted by broadcast stations and which can be received by receivers, e.g. installed in a vehicle, often include several components multiplexed together upon transmission. For example, it is relatively common for a broadcast signal to include both an audio signal (either stereo or monophonic) and a RDS signal, where the RDS signal contains information such as the broadcast station name, program type, music information, artist information, and traffic information. These multiplexed broadcast signals are often transmitted from a base or broadcast station to individual receivers via frequency modulation ("FM"), where information is conveyed through variations of the frequency of the transmitted signal, or via amplitude modulation ("AM"), where information is conveyed through variations of the amplitude of the transmitted signal.

[0003] When a broadcast signal is received by a receiving device, it is typically demodulated by a demodulator circuit and passed to both audio circuitry and RDS receiver circuitry included in the receiving device. The audio circuitry can extract the audio portion of the signal (e.g., music or speech) and prepare it for playback through a speaker or other output device. The RDS receiver circuitry can extract the RDS portion of the signal and prepare it for processing by appropriate data processing circuitry. As an example, the data processing circuitry can display part or all of the extracted data to the user as text on a suitable user interface. For example, via the RDS portion a broadcast station can transmit content description for its broadcast station, such as announcing music type (like "pop music" or "classical music" or "talk"). It can also transmit some detailed description via radio text.

[0004] In multiple instances, RDS data is often too general. For example, it is not providing enough information for a user to actually understand the difference between several broadcast stations. For instance, many broadcast stations are labelling themselves as "pop music", wherein any further distinction is not available and cannot be determined from the RDS data. Moreover, RDS data is often inaccurate, because the content is often provided by the broadcast station for its own advertisement. Furthermore, content information support technologies are limited to specific broadcasting methods, e.g. RDS is only for FM broadcast stations, not on AM. These drawbacks are even more present in an automotive environment, such as in a vehicle where the driver has typically only limited time and attention available for searching for appropriate broadcast stations the driver likes to listen to without compromising driving safety.

[0005] JP 2001-186429 A discloses a digital broadcast

receiver that stores information denoting a broadcast schedule of programs having been acquired before without discarding the information and effectively utilizes the past information for future program retrieval. A storage section stores received information denoting broadcast schedules of past programs whose broadcast is finished without discarding the information. Then the past program is retrieved from information denoting the broadcast schedule of the past program whose broadcast has already been finished, the information denoting the broadcast schedule of the past program can effectively be utilized for the retrieval of a future program in the case of retrieving a program belonging to the same title or the series as that of the retrieved past program from the information denoting the broadcast schedule of a future program going to be broadcast from now.

[0006] JP 2006-190027 A discloses an information processing device which is configured to show music data by a music recognition means on a display in real time when the music data are included in a content of TV broadcasting and the like. A music data display system extracts information on a characteristic quantity by a characteristic quantity information extracting device from the music information included in a content of TV broadcasting and the like received by a tuner, and transmits the information on a characteristic quantity to a server through the Internet. The server recognizes the music by carrying out the matching of the information on a characteristic quantity and the music data included in a music information database, and transmits information on a music title, information on an artist, and the like corresponding to the music to the characteristic quantity information extracting device as the recognition result. The recognition result received by the characteristic quantity information extracting device is associated with the content including the original music information and recorded in a storage device. When the content recorded in the storage device is reproduced, the music is outputted from a speaker, and, at the same time, the recognition result is shown on a display.

[0007] It is an object of the present invention to provide a receiving apparatus for receiving broadcast signals and a method of providing information associated with received broadcast signals which is capable of reducing the drawbacks described above with respect to limited capabilities of RDS information and which can improve user operability of such receiving apparatus.

[0008] The present invention is related to a receiving apparatus for receiving broadcast signals and a method of providing information associated with received broadcast signals according to the independent claims.

[0009] According to an aspect of the invention, there is provided a receiving apparatus for receiving broadcast signals comprising a receiving device configured to receive broadcast signals, a recognition device configured to be coupled with an audio content analysis system and configured to perform an audio content recognition process together with the audio content analysis system,

wherein the audio content recognition process is configured to capture audio signal samples transmitted with the broadcast signals repeatedly over time, to analyze the captured audio signal samples, and to provide analyzing data indicative of audio content of the analyzed audio signal samples, the recognition device further configured to extract multiple items of data from the analyzing data over time, a memory adapted to store therein a database containing multiple items of data extracted over time and source information indicative of at least one broadcast station associated with the extracted items of data, an analyzing device which is configured to analyze a plurality of the multiple items of data stored in the database for at least one broadcast station associated with the analyzed items of data and to provide an analyzing result for the at least one broadcast station associated with the analyzed items of data, and an information providing device which is configured to provide information to a user based on the analyzing result for the at least one broadcast station associated with the analyzed items of data.

[0010] According to another aspect, there is disclosed a method of providing information associated with broadcast signals, for example received in a vehicle, the method comprising receiving broadcast signals with a receiving device, for example in a vehicle, performing an audio content recognition process which captures audio signal samples transmitted with the broadcast signals repeatedly over time, analyzes the captured audio signal samples, and provides analyzing data indicative of audio content of the analyzed audio signal samples, extracting multiple items of data from the analyzing data over time, storing in a database multiple items of data extracted over time and source information indicative of at least one broadcast station associated with the extracted items of data, analyzing a plurality of the multiple items of data stored in the database for at least one broadcast station associated with the analyzed items of data and providing an analyzing result for the at least one broadcast station associated with the analyzed items of data, and providing information to a user based on the analyzing result for the at least one broadcast station associated with the analyzed items of data.

[0011] According to another aspect, the invention also relates to a vehicle comprising a receiving apparatus according to the invention.

[0012] With the present invention, in principle, detailed information regarding the broadcast stations available for the receiving apparatus can be collected, processed and provided to the user, so that it becomes easy for the user to select preferred content of a particular broadcast station. The analyzing result provided by the analyzing device for one or more of the broadcast stations, which may be provided to the user, is a result of a real analysis, not of a broadcast station's own information and/or advertisement. For example, a broadcast station may submit an information like "non-stop best hits" over the RDS portion of the broadcast signals, however a real analysis

would show that in fact only some music content is broadcasted by that broadcast station, wherein in fact the station broadcasts a lot of talk in between, contrary to its transmitted RDS information "non-stop best hits". The invention provides the advantage that the typical or average actual content information for each received broadcast station may be communicated to the user, not only the information of, e.g., an individual song which is currently played by a broadcast station, the broadcast signals of which are currently received. The user can then easily select which broadcast station is actually matching his taste or mood for listening because of the provided typical or average actual content information about that broadcast station.

[0013] Advantageously, multiple or all available broadcasting technologies may be used in connection with the present invention, such as FM, AM, DAB, etc. There is no need to switch any broadcasting mode, since, in principle, audio signal samples transmitted with all available broadcasting technologies can be analyzed.

[0014] According to an embodiment, the recognition device is configured to perform the audio content recognition process with the audio content analysis system as a permanent background process when receiving the broadcast signals.

[0015] According to a further embodiment, the recognition device is configured to perform the audio content recognition process with the audio content analysis system for a plurality of broadcast stations, particularly for each available broadcast station.

[0016] In a potential implementation, the receiving device comprises a multiple tuner configuration and the recognition device is configured to perform the audio content recognition process using one of the multiple tuners which is not used for current content reproduction.

[0017] For example, the recognition device is configured to extract at least one of the following items of data: transmission frequency of the broadcast signals, broadcast station name, program name, content type, music artist name, music song genre, music song chart history, music year.

[0018] According to a further embodiment, the multiple items of data stored in the database each include at least one of the following: transmission frequency of broadcast signals, broadcast station name, program name, content type, music artist name, music song genre, music song chart history, music year.

[0019] According to an embodiment, the recognition device is configured to be coupled with the audio content analysis system which is remote from the receiving apparatus. For example, the recognition device is configured to be coupled with the audio content analysis system through a network connection, particularly through the Internet and/or a telecommunications network.

[0020] For example, as an audio content analysis system, there may be used a server provider system, as e.g. described in JP 2006-190027 A mentioned above, which recognizes the music contained in the captured audio

signal samples by analyzing (e.g. matching) of the captured audio signal samples and any music data included in a music information database, the server provider system has access to.

[0021] There are also other potential music analysis service systems available to be used as an audio content analysis system in connection with the present invention, such as the known "SHAZAM" music analysis service or similar. Such music analysis service systems can, e.g., identify songs based on short audio signal samples and internet databases. The "SHAZAM" music analysis service, on the one hand, is providing detailed information about the content, but it does not track the content history and it does not link the content to an audio source. Therefore, from this music analysis service alone, the user cannot understand which source (e.g. broadcast station) is playing his favourite type of music.

[0022] According to an embodiment, the recognition device is configured to capture the audio signal samples transmitted with the broadcast signals repeatedly over time and to send the captured audio signal samples to the audio content analysis system, whereas the audio content analysis system (such as "SHAZAM") is capable of analyzing the captured audio signal samples and providing the analyzing data indicative of audio content of the analyzed audio signal samples back to the recognition device. As such, the recognition device receives the analyzing data indicative of audio content of the analyzed audio signal samples from the audio content analysis system.

[0023] According to another embodiment, the receiving device is adapted to receive analyzing data indicative of analyzed audio content information associated with at least one broadcast station from a remote provider for storing in the database. In this embodiment, any information which is normally produced by the recognition device and the analyzing device can also be received from a remote provider, so that the database stored in the memory may be supplemented by the analyzing data from the remote provider.

[0024] According to a further embodiment, the analyzing device is configured to analyze the multiple items of data stored in the database by performing at least one of the following operations: calculate an average content from the multiple items of data per broadcasting station, calculate a ratio of music content versus speech content per broadcasting station, calculate a fraction of music content listed in a public chart listing, calculate a most frequent genre of music content per each broadcasting station.

[0025] The embodiments as described above with respect to the receiving apparatus can equally be applied in connection with the method according to the invention.

[0026] An embodiment according to the invention may additionally comprise storing information in the database which contains or is derived from RDS information transmitted with the broadcast signals. Thus, the contents of the database and the analyzing results can be supplemented by RDS information associated with the respective broadcast station.

mented by RDS information associated with the respective broadcast station.

[0027] According to an embodiment of the invention, the receiving apparatus according to the invention is an automotive receiving apparatus.

[0028] Aspects and embodiments of the invention will now be described with reference to the drawings, in which:

10 Fig. 1 shows a receiving apparatus for receiving broadcast signals according to an exemplary embodiment of the invention,

15 Fig. 2A shows an exemplary display of information, e.g. on a display screen, in the form of a broadcast station list with RDS content information as currently available in the prior art,

20 Fig. 2B shows an exemplary display of information, e.g. on a display screen, in the form of a broadcast station list with detailed content information according to an embodiment of the invention,

25 Fig. 3 shows a flowchart diagram of a method for providing information associated with received broadcast signals according to an embodiment of the invention,

30 Fig. 4 shows an example for interpretation of items of data and providing analyzing results for broadcast stations according to an embodiment of the invention.

35 **[0029]** Fig. 1 shows a receiving apparatus for receiving broadcast signals according to an exemplary embodiment of the invention in a schematic block diagram. In this embodiment, the receiving apparatus 1 is an automotive receiving apparatus, which may be installed in a vehicle, e.g., in a head unit thereof (not shown), receives broadcast signals BS which are broadcast from an exemplary broadcast station 2. The receiving apparatus 1 comprises a receiving device 20 which may be a conventional receiving device as known in the art. The exemplary receiving device 20 (another type thereof can also be used, e.g. when applied to another broadcasting technology) comprises an antenna 24 for receiving the broadcast signals BS, a demodulator 21, an audio circuitry 22 which can extract the audio portion As of the received signal (i.e., music or speech) and prepare it for playback through a speaker or other output device (not shown), and a RDS receiver circuitry 23 which can extract the RDS portion Rx of the received signal and prepare it for processing by appropriate data processing circuitry (not shown). It will be understood that, as used herein, the expression "coupled to" can be used to define either a direct or an indirect connection between elements. When it is referred herein to an installation of any part of

the receiving apparatus in a vehicle, it should be understood that the receiving apparatus or any part thereof may also be installed in other installation locations where the receiving apparatus may be used.

[0030] Particularly, the demodulator 21 can demodulate the received broadcast signal BS by a frequency determined by the station or frequency that is being tuned to. The demodulator 21 can be analog, digital, or a combination of the two. The output signal of demodulator 21 can be received by audio circuitry 22, which can extract and decode the audio portion As of the received signal and send it to a speaker circuitry. The output signal of demodulator 21 can also be received by RDS receiver circuitry 23 which can extract and decode the RDS portion Rx of the received signal and send it to any appropriate output circuitry. For instance, the extracted RDS data may be displayed to a user via any suitable display circuitry, or may be processed according to embodiments of the invention.

[0031] The apparatus 1 further comprises a recognition device 30 which is coupled with the receiving device 20 and, in this embodiment, receives the audio portions As output by the receiving device 20 (particularly output by the audio circuitry 22). Further, in this embodiment, it receives the RDS portions Rx output by the receiving device 20 (particularly output by the RDS receiver circuitry 23).

[0032] For example, the receiving device 20 comprises a multiple tuner configuration (not explicitly shown), which is known in the art, and the recognition device 30 is configured to perform an audio content recognition process, as described herein below, using one of the multiple tuners which is not used for current content reproduction.

[0033] The recognition device 30 is configured to be coupled with an audio content analysis system 40 (which may be remote from the automotive receiving apparatus 1, such as "SHAZAM" described above provided by a server computer, or may be installed in the vehicle, thus is "on-board"). For example, the recognition device 30 is coupled with the audio content analysis system 40 directly or via a network 80, such as the Internet and/or any other telecommunications network and/or a vehicle communications network bus, like the CAN-bus. To this end, the receiving apparatus 1, which may be installed in a vehicle, may use any known wired or wireless technology for communication with the audio content analysis system 40 either directly or over the network 80. According to other embodiments, the audio content analysis system 40 may also be implemented in the vehicle, e.g. in a portion of a head unit with appropriate memory capabilities, or may be a distributed system with parts thereof installed in the vehicle and other parts thereof provided on a remote server computer and accessible via the network 80.

[0034] According to another embodiment, the recognition device 30 may be implemented in the vehicle, e.g., by comprising one or more microprocessors, for example

installed in the head unit (not shown), wherein the one or more microprocessors have access to a database stored in a memory (e.g., located in the vehicle or on a remote server computer) which are part of or form the audio content analysis system 40. According to another embodiment, the recognition device 30 and the audio content analysis system 40 may both comprise respective one or more microprocessors, e.g. the recognition device 30 comprising a microprocessor installed in the vehicle and the audio content analysis system 40 comprising a microprocessor installed in a remote server computer, which microprocessors communicate with each other, e.g. over the network 80.

[0035] The recognition device 30, when coupled with the audio content analysis system 40, e.g. wirelessly, is configured to perform an audio content recognition process together with the audio content analysis system 40. For example, a microprocessor of the recognition device 30 provides commands and/or data to the audio content analysis system 40 (e.g. a database or a server computer) when performing the audio content recognition process, and receives data and/or commands therefrom. Alternatively or additionally, according to an embodiment, the audio content analysis system 40 (e.g. a microprocessor thereof) provides commands and/or data to the recognition device 30 which is configured to receive such commands and/or data for performing the audio content recognition process.

[0036] The audio content recognition process performed jointly by the recognition device 30 and the audio content analysis system 40 captures audio signal samples As (or audio clips) repeatedly over time, analyzes the captured audio signal samples As, and provides corresponding analyzing data indicative of audio content (such as music content) of the analyzed audio signal samples As repeatedly over time. For example, analyzing the captured audio signal samples may comprise comparing their audio content or parts thereof (such as the music itself) with entries in a database stored in or retrieved by the audio content analysis system 40.

[0037] For example, the analyzing data may contain information regarding music title, music artist name, and/or genre etc. of the respective analyzed audio signal sample. Moreover, the analyzing data may contain source information indicative of the broadcast station which is associated with the respective analyzed audio signal sample.

[0038] The recognition device 30 extracts multiple items of data from the analyzing data over time, which in this embodiment were received from the audio content analysis system 40. For example, the recognition device 30 extracts one or more of the following items of data from the received analyzing data: transmission frequency of the broadcast signals, broadcast station name, program name, content type, music artist name, music song genre, music song chart history, and/or music year.

[0039] According to an embodiment, the recognition device 30 is configured to capture multiple audio signal

samples As received from the audio circuitry 22 repeatedly over time. The audio content analysis system 40 analyzes the captured audio signal samples As and provides the analyzing data indicative of audio content of the analyzed audio signal samples to the recognition device 30.

[0040] The apparatus 1 further comprises a memory 70 adapted to store therein a database 71. This database 71 contains multiple items of data which were extracted by the recognition device 30 over time and source information (e.g. frequency) indicative of one or more broadcast stations (such as SWR1, Energy, etc. shown in Fig. 2B) which are associated with the extracted items of data.

[0041] For example, the multiple items of data stored in the database 71 are items of data which include a transmission frequency of broadcast signals, a broadcast station name, a program name, a content type, a music artist name, a music song genre, a music song chart history, and/or a music year.

[0042] The apparatus 1 further comprises an analyzing device 50 which analyzes a plurality of the multiple items of data stored in the database 71 for at least one broadcast station (such as SWR1 and/or Energy, etc., shown in Fig. 2B) which are associated with the analyzed items of data, and it provides an analyzing result for this broadcast station which is associated with the analyzed items of data (such as shown in Fig. 2B for SWR1, Energy, etc.). For example, the analyzing device may comprise a microprocessor, or may be implemented by using the same microprocessor(s) as the recognition device 30.

[0043] An information providing device 60, such as a display device and/or a loudspeaker or other information providing device, provides information to a user based on the analyzing result provided by the analyzing device 50, i.e. provides information based on the analyzing result for the one or more broadcast stations which are associated with the analyzed items of data (such as for SWR1, Energy, etc. shown in Fig. 2B). According to the embodiment of Fig. 2B, this information to the user can be provided or divided in multiple portions, such as for speech, music, top artists, etc.

[0044] Preferably, the recognition device 30 performs the audio content recognition process with the audio content analysis system 40 as a permanent background process when receiving the broadcast signals by the receiving device 20. Advantageously, the recognition device 30 performs the audio content recognition process with the audio content analysis system 40 for a plurality of broadcast stations 2, particularly for each available broadcast station, i.e. which can currently be received by the receiving device 20.

[0045] In an advantageous embodiment, a music analysis service of an audio content analysis system (like "SHAZAM", as mentioned above) could permanently run as a background process in any radio tuner of a receiving apparatus. It may permanently take short clips (or audio signal samples) of the content of each broadcast station (e.g. audio clips in a double tuner concept, similar to scan-

ning RDS information in the background). Then, the music analysis service may store music information together with the source information and track the history over time. As an analysis result, the analyzing device of the receiving apparatus could provide detailed information about each broadcast station.

[0046] The described music recognition process may be performed repeatedly for building up an information history. The database stored in the memory may serve to store the recognition result (in other words, items of data extracted from the analyzing data) for each broadcast station over a period time. The recognition results stored in the database may be analyzed and compared, and a typical and/or average content (not, e.g., a current song only) of each broadcast station may be determined.

[0047] Advantageously, the determined typical and/or average content information for each broadcast station may be communicated to the user, not only the currently playing song's information (such as is currently available from RDS data). Then the user can easily select which broadcast station is matching his taste or mood for listening.

[0048] Fig. 2A shows an exemplary display of information, e.g. on a display screen, in the form of a broadcast station list with RDS content information as currently available in the prior art. In a common use case, in current radio tuners, the user sees the currently playing song name and/or a station list, as depicted in Fig. 2A. If the user likes this song, or if the user wants to listen to a pop music station (like SWR1 shown in the first line of the list of Fig. 2A), the user switches to that broadcast station. But then, it may turn out that the user gets disappointed, because SWR1 is basically a talk radio station, and the played music was the only music played for a long time! The rest of the time turns out to be talk, not music, so that the user may get disappointed.

[0049] Fig. 2B shows an exemplary display of information, e.g. on a display screen, in the form of a broadcast station list with detailed content information according to an embodiment of the invention, which can avoid such a disappointment and help the user to select a better fitting broadcast station to listen to. Particularly, as shown in Fig. 2B, more detailed information is shown which has been determined over time according to actually broadcasted and analyzed audio signal samples (i.e. the broadcasted music itself) with particular items of data extracted from the analyzing data over time. For example, for the broadcast station SWR1 (first line of the list of Fig. 2B) different portions of an analyzing result as to, e.g., speech, music, top artists, have been determined according to the analyzed items of data stored in the database over time associated with the broadcast station SWR1. Thus, an additional benefit for the user is, for example, reduced driver's distraction, because the user is able to select a broadcast station which fits best for a long period of time as a result of the provided analyzing result with content history and up-to-date information, and therefore the user does not need to switch broadcast

stations very often.

[0050] Fig. 3 shows a flowchart diagram of a method for providing information associated with received broadcast signals according to an embodiment of the invention.

[0051] In step S1, a tuning step to the next broadcast station is performed, e.g. by actuating a switch by the user at the tuner interface. In step S2, a new station content snapshot ("SCS") is generated. That is, an audio content recognition process is started by the recognition device 30 for that broadcast station, with multiple items of data to be extracted from analyzing data over time and stored as SCS in the database 71 in the memory 70. As shown in Fig. 3, a SCS may contain multiple data fields, such as program name, content type, music artist name, etc. For example, the program name can be determined from an RDS data portion transmitted with the broadcast signals, or can simply be the frequency of the transmitted broadcast signals. In step S3, if such RDS information is available, the frequency can be overwritten by the corresponding RDS program station (PS).

[0052] In step S4, a short audio signal sample or audio clip for the broadcast station tuned in step S1 is captured as an input for the audio content recognition process. In step S5, the content type is analyzed. If the content type is speech (step S6), this is stored in the database 71 of memory 70 and the process goes on to step S10. If the content type is music, this is stored in the database 71 of memory 70 (step S7) and the process goes on to step S8 which sends the captured audio clip or audio signal sample to the audio content analysis system 40 (here designated as music info service), which may be installed in the vehicle ("on-board"), and/or on a server computer ("web server"), and/or may be formed by SHAZAM, as described above. In step S9, the analyzing data provided from the audio content analysis system 40 is received and items of data extracted therefrom (SCS data set containing items of data, such as content type, artist name, song genre, etc.) are stored in the database 71.

[0053] In step S10, it is determined whether a data set associated with the program name (i.e., frequency or RDS PS) is already stored in the database 71 ("RSP-DB"). If not, then a new radio station profile ("RSP") data set is created (step S11), i.e. a new data set which is associated with the broadcast station tuned in step S1. In this new RSP data set, the SCS data set with the items of data according to step S9 is stored. In any further iterations of the process as shown in Fig. 3, further SCS data sets with items of data according to step S9 will be added to the RSP data set. Thus, over time, a RSP data set contains multiple SCS data sets, thus building a data history associated with the broadcast station over time. A RSP data set may additionally contain some statistics calculated over the several stored SCS data sets, such as percent music versus speech, highest percent of music genre, top decades of music year, a music song chart history, etc. After step S11, the process returns to step S1.

[0054] If it is determined in step S10 that a RSP data

set for that broadcast station already exists, then the SCS data set with items of data according to step S9 is added to the related RSP data set for further statistical analysis (step S12). In step S13, the depth of the RSP data set ("RSP-depth") is increased by 1, and in step S14 the recent SCS data set is deleted, since it is now stored in the associated RSP data set for that broadcast station. Then, the process returns to step S1.

[0055] According to an embodiment, the receiving device 20 or recognition device 30 is adapted to receive analyzing data indicative of already analyzed audio content information associated with at least one broadcast station from a remote provider for storing in the database 71. According to the example of Fig. 3, the receiving device 20 or recognition device 30 may receive over the antenna 24 or network 80 an RSP data set and/or a SCS data set associated with a particular broadcast station from a remote provider (not shown), which may be supplemented in the database 71.

[0056] Fig. 4 shows an example for interpretation of items of data (such as stored with a SCS data set according to Fig. 3) for providing some statistics, and providing analyzing results for broadcast stations according to an embodiment of the invention.

[0057] In the left column, an example of a RSP data set is shown. In the mid column, an exemplary interpretation/calculation formula is listed for a respective RSP data set entry. The respective data fields of multiple RSP data sets, such as program name, content type, etc., are interpreted for statistical purposes according to this interpretation/calculation formula. In the right column, an example of a graphical user interface ("GUI"), here display, is shown.

[0058] For example, the multiple items of data stored in the database (in the above example, the multiple items of data of a RSP data set) are analyzed by performing at least one of the following operations: calculate an average content from the multiple items of data per broadcasting station, calculate a ratio of music content versus speech content per broadcasting station, calculate a fraction of music content listed in a public chart listing, calculate a most frequent genre of music content per each broadcasting station.

Claims

1. A receiving apparatus (1) for receiving broadcast signals, comprising:

- a receiving device (20) configured to receive broadcast signals (BS),
- a recognition device (30) configured to be coupled with an audio content analysis system (40) and configured to perform an audio content recognition process together with the audio content analysis system (40), wherein the audio content recognition process is configured to capture au-

- dio signal samples (As) transmitted with the broadcast signals repeatedly over time, to analyze the captured audio signal samples (As), and to provide analyzing data indicative of audio content of the analyzed audio signal samples (As), the recognition device (30) further configured to extract multiple items of data from the analyzing data over time,
 - a memory (70) adapted to store therein a database (71) containing the multiple items of data extracted over time and source information indicative of at least one broadcast station (SWR1, Energy) associated with the extracted items of data,
 - an analyzing device (50) which is configured to analyze a plurality of the multiple items of data stored in the database (71) for at least one broadcast station (SWR1, Energy) associated with the analyzed items of data and to provide an analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data, and
 - an information providing device (60) which is configured to provide information to a user based on the analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data.
2. The receiving apparatus according to claim 1, wherein the recognition device (30) is configured to perform the audio content recognition process with the audio content analysis system (40) as a permanent background process when receiving the broadcast signals.
 3. The receiving apparatus according to claim 1 or 2, wherein the recognition device (30) is configured to perform the audio content recognition process with the audio content analysis system (40) for a plurality of broadcast stations (SWR1, Energy), particularly for each broadcast station receivable by the receiving device (20).
 4. The receiving apparatus according to one of claims 1 to 3, wherein the receiving device (20) comprises a multiple tuner configuration, and the recognition device (30) is configured to perform the audio content recognition process using one of the multiple tuners which is not used for current content reproduction.
 5. The receiving apparatus according to one of claims 1 to 4, wherein the recognition device (30) is configured to extract at least one of the following items of data: transmission frequency of the broadcast signals, broadcast station name, program name, content type, music artist name, music song genre, music song chart history, music year.
 6. The receiving apparatus according to one of claims 1 to 5, wherein the multiple items of data stored in the database (71) each include at least one of the following: transmission frequency of broadcast signals, broadcast station name, program name, content type, music artist name, music song genre, music song chart history, music year.
 7. The receiving apparatus according to one of claims 1 to 6, wherein the recognition device (30) is configured to be coupled with the audio content analysis system (40) which is remote from the receiving apparatus (1).
 8. The receiving apparatus according to one of claims 1 to 7, wherein the recognition device (30) is configured to be coupled with the audio content analysis system (40) through a network (80), particularly through the Internet and/or a telecommunications network.
 9. The receiving apparatus according to one of claims 1 to 8, wherein the recognition device (30) is configured to capture the audio signal samples (As) transmitted with the broadcast signals repeatedly over time, and the audio content analysis system (40) is configured to analyze the captured audio signal samples and to provide the analyzing data indicative of audio content of the analyzed audio signal samples to the recognition device (30).
 10. The receiving apparatus according to one of claims 1 to 9, wherein the receiving device (20) or the recognition device (30) is adapted to receive analyzing data indicative of analyzed audio content information associated with at least one broadcast station (SWR1, Energy) from a remote provider for storing in the database (71).
 11. The receiving apparatus according to one of claims 1 to 10, wherein the analyzing device (50) is configured to analyze the multiple items of data stored in the database (71) by performing at least one of the following operations: calculate an average content from the multiple items of data per broadcasting station, calculate a ratio of music content versus speech content per broadcasting station, calculate a fraction of music content listed in a public chart listing, calculate a most frequent genre of music content per each broadcasting station.
 12. A method of providing information associated with broadcast signals, the method comprising:

- receiving broadcast signals (BS) with a receiving device (20),
 - performing an audio content recognition process which captures audio signal samples (As) transmitted with the broadcast signals (BS) repeatedly over time, analyzes the captured audio signal samples (As), and provides analyzing data indicative of audio content of the analyzed audio signal samples (As),
 - extracting multiple items of data from the analyzing data over time,
 - storing in a database (71) multiple items of data extracted over time and source information indicative of at least one broadcast station (SWR1, Energy) associated with the extracted items of data,
 - analyzing a plurality of the multiple items of data stored in the database (71) for at least one broadcast station (SWR1, Energy) associated with the analyzed items of data and providing an analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data, and
 - providing information to a user based on the analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data.
13. The method according to claim 12, wherein the method additionally comprises storing information in the database (71) which contains or is derived from RDS information (Rx) transmitted with the broadcast signals (BS).
14. A vehicle comprising a receiving apparatus (1) according to one of claims 1 to 11.

Amended claims in accordance with Rule 137(2) EPC.

1. A receiving apparatus (1) for receiving broadcast signals, comprising:
- a receiving device (20) configured to receive broadcast signals (BS),
 - a recognition device (30) configured to be coupled with an audio content analysis system (40) and configured to perform an audio content recognition process together with the audio content analysis system (40), wherein the audio content recognition process is configured to capture audio signal samples (As) transmitted with the broadcast signals repeatedly over time, to analyze the captured audio signal samples (As), and to provide analyzing data indicative of audio content of the analyzed audio signal samples (As), the recognition device (30) further configured to

extract multiple items of data from the analyzing data over time,

- a memory (70) adapted to store therein a database (71) containing the multiple items of data extracted over time building a data history, and source information indicative of at least one broadcast station (SWR1, Energy) associated with the extracted items of data,
- an analyzing device (50) which is configured to analyze a plurality of the multiple items of data stored in the database (71) for at least one broadcast station (SWR1, Energy) associated with the analyzed items of data and to provide an analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data, and
- an information providing device (60) which is configured to provide information to a user based on the analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data.

12. A method of providing information associated with broadcast signals, the method comprising:

- receiving broadcast signals (BS) with a receiving device (20),
- performing an audio content recognition process which captures audio signal samples (As) transmitted with the broadcast signals (BS) repeatedly over time, analyzes the captured audio signal samples (As), and provides analyzing data indicative of audio content of the analyzed audio signal samples (As),
- extracting multiple items of data from the analyzing data over time,
- storing in a database (71) multiple items of data extracted over time building a data history and source information indicative of at least one broadcast station (SWR1, Energy) associated with the extracted items of data,
- analyzing a plurality of the multiple items of data stored in the database (71) for at least one broadcast station (SWR1, Energy) associated with the analyzed items of data and providing an analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data, and
- providing information to a user based on the analyzing result for the at least one broadcast station (SWR1, Energy) associated with the analyzed items of data.

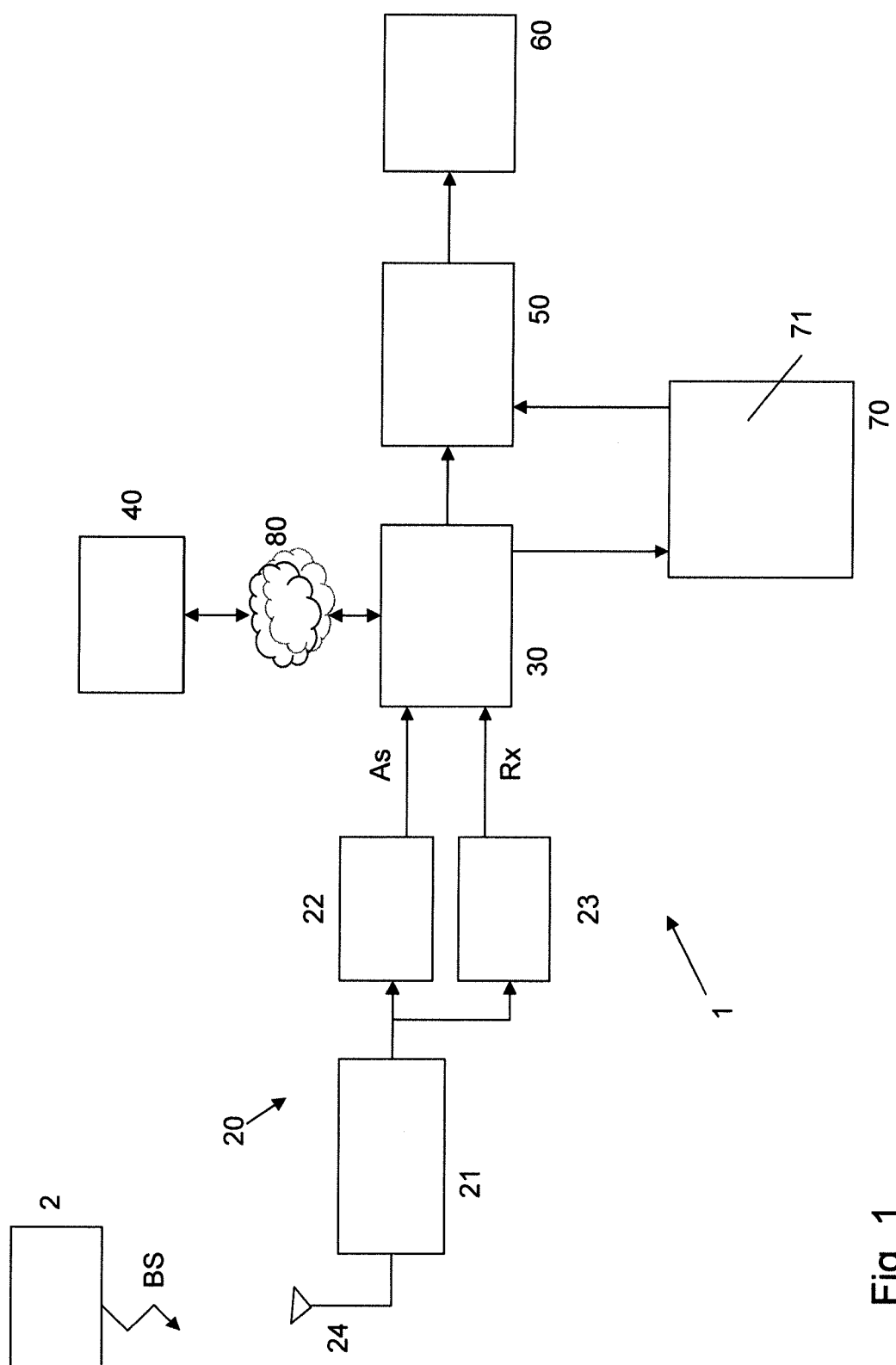


Fig. 1

Fig. 2A (Prior art)

Station list - FM	
SWR1 - POP MUSIC	
ENERGY - POP MUSIC	
DRADIO - CLASSICAL	
SWR2 - CLASSICAL	
KLASSIK - CLASSICAL	
BIG FM - ROCK MUSIC	

Fig. 2B

Station list - FM/AM/DAB	
SWR1 (FM) - <i>CLASSIC POP/ROCK</i> Speech: news every 60min, short moderation Music: 1960's-1980's guitar, folk, classic rock Top Artists: Dusty Springfield, Led Zeppelin, Sting, ...	
ENERGY (FM) - <i>LATEST POP/ROCK</i> Speech: news every 30min, short moderation, traffic info Music: 2000's mainstream charts Top Artists: Christina Aguilera, 50cent, PINK, ...	
DRADIO (DAB) - <i>SERIOUS CLASSICAL</i> Speech: news every 60min, extended moderation, talk Music: 1700's-1900's symphonic, religious Top Artists: Mozart, Bach, Chopin	

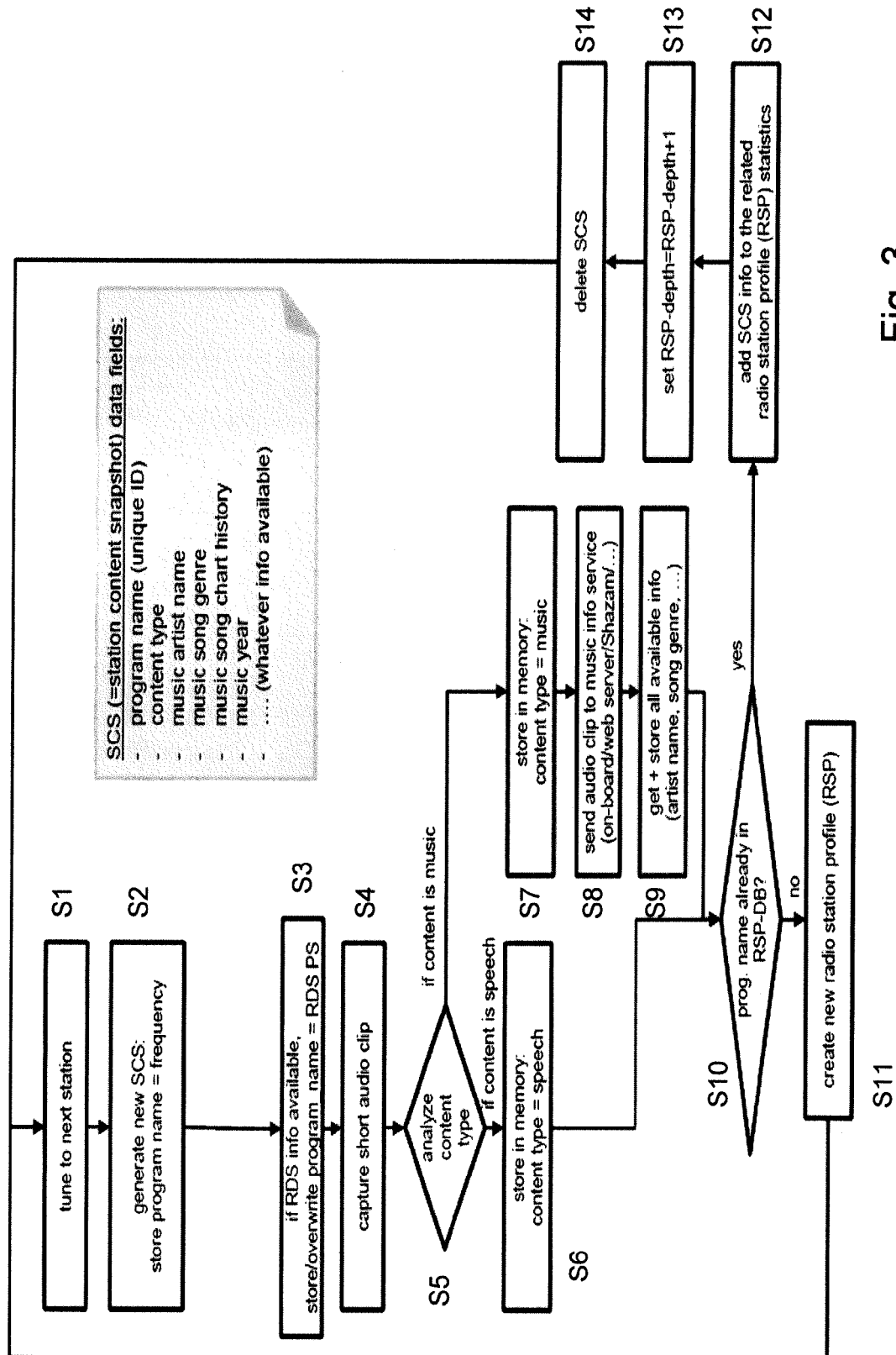


Fig. 3

Fig. 4

RSP (=radio station profile) data	interpretation / calculation formula	GUI example
program name	simply write the stored name	„SWR3“
content type, song chart history	- calculate ratio of music vs. speech - calculate % of top 10 chart songs	„mainly big hits music“ or „mainly balanced popularity music“ or „mainly speech“
music year, music genre	- calculate most frequent decade by each song's year - calculate most frequent genre	1960ies rock
music artist name	calculate 3 most frequent names and add „...“	Top artists: Pink Floyd, Rolling Stones, Queen,



EUROPEAN SEARCH REPORT

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EP 14 16 3387

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EPO FORM 1503 03.82 (P04C01)



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