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(54) **Broadcast receiver, comprising a tuner, a sensor and a controller, for selecting a broadcast station, using environmental data, provided by the sensor.**

(57) A broadcast receiver is herein described. In accordance with one example of the present invention, the receiver includes a tuner for receiving broadcast signals. The tuner can be tuned to a carrier frequency of the broadcast signal and is configured to provide a quality signal of the tuned-in broadcast signal. The receiver further includes a controller configured to set the carrier frequency the tuner is tuned to and at least one sensor configured to provide environmental data pertaining to

the environment in which the receiver is operated. A database is provided for storing the values of the quality signals and the corresponding environmental data during operation of the receiver, and the controller is configured to select at least one broadcast signal associated with a broadcast station based on a current set of environmental data, as well as on the data and quality values stored in the database.

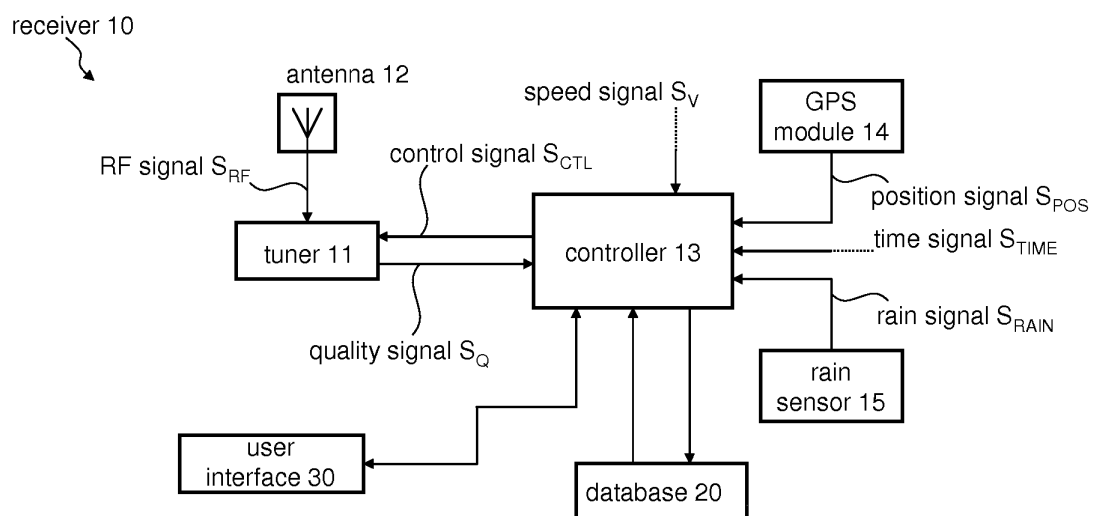


FIG. 1 automotive audio receiver

Description

BACKGROUND

1. Field of Technology

[0001] The present invention relates to radio or television receivers and particularly to an "intelligent" selection of the broadcast station to which the receiver is tuned.

2. Related Art

[0002] Particularly when receiving signals from radio or television broadcast stations using portable receivers (e.g., automobile radios), the number of stations that provide sufficient signal strength (or a sufficient signal-to-noise ratio) to allow a proper demodulation and reproduction of the broadcast audio or video signal may vary significantly. The geographic location, time of day or the weather conditions may have a particular impact on the signal-to-noise ratio of a broadcast signal. As a consequence, available radio or television stations that can be received (with sufficient quality) may vary, dependent on various factors. The user has to scan the frequency bands of interest manually or semi-automatically to find an appropriate broadcast station that provides a broadcast signal of sufficient quality.

[0003] Known receivers may include two or more RF tuners, one of which usually operates a foreground tuner for demodulating the currently tuned RF signal to obtain the respective audio signal to be reproduced via the loudspeakers of the audio system. A background tuner may be configured to continuously scan the frequency bands of interest and to store the frequencies of the broadcast signals of those broadcast stations that can be received with sufficient quality. The stored broadcast stations may be offered to the user of the system in different ways. The "background scanning", however, requires a separate tuner. Although some efforts have been made to improve the usability of radio and TV receivers, a need for easy-to-use receivers still remains.

SUMMARY

[0004] A broadcast receiver is herein described. In accordance with one example of the present invention, the receiver includes a tuner for receiving broadcast signals. The tuner can be tuned to a carrier frequency of the broadcast signal and is configured to provide a quality signal of the tuned-in broadcast signal. The receiver further includes a controller configured to set the carrier frequency the tuner is tuned to and at least one sensor configured to provide environmental data pertaining to the environment in which the receiver is operated. A database is provided for storing the values of the quality signals and the corresponding environmental data during operation of the receiver, and the controller is configured to select at least one broadcast signal associated with a

broadcast station based on a current set of environmental data, as well as on the data and quality values stored in the database.

5 BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The invention can be better understood with reference to the following description and drawings. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like reference numerals designate corresponding parts. In the drawings:

- 15 FIG. 1 is a block diagram illustrating an automobile audio receiver in accordance with one exemplary embodiment of the invention;
- FIG. 2 illustrates one exemplary database structure used in the example of FIG. 1.

20 DETAILED DESCRIPTION

[0006] The use and application of the present invention is illustrated below, taking an AM radio broadcast receiver as an example. However, other examples of the invention may be used with any other type of receiver.

[0007] AM radio signals are usually broadcast in the short-wave, medium-wave and the long-wave bands. Particularly short-wave and medium-wave radio signals behave differently during the day and night. During the day, medium-wave signals travel as ground waves, diffracting around the curve of the earth over a distance of up to a few hundred kilometers from the signal transmitter. However, after sunset, changes in the ionosphere cause medium-wave signals to travel as sky waves, enabling radio broadcast stations to be heard much farther from their points of origin than is normal during the day. It can generally be said that the signal strength of a received signal depends on the time of day. AM transmitters often use directional antennas. As a consequence, the signal strength of a received signal also depends on the location of the receiver. The weather conditions may also have a significant impact on the quality of the radio signal arriving at the receiver. In automobile applications, the speed and direction of the car may also be relevant factors that have an impact on the quality of the radio signal.

[0008] As mentioned above, a receiver may include a foreground tuner and a background tuner. The foreground tuner is used to demodulate the received radio broadcast signal, while the background tuner continuously scans the frequency band(s) of interest for radio stations that provide radio broadcast signals of sufficient quality to be reproduced by the audio system. In such systems, a list of receivable broadcast stations is held in the memory of the receiver. The need for two separate tuners is one major disadvantage of such systems.

[0009] An improved audio system may comprise a receiver that is able to "collect" data from various sensors,

wherein the collected data are relevant to the quality and availability of radio broadcast signals transmitted by respective radio broadcast stations. As mentioned above, the data may include information about the geographic location of the receiver, the time of day, the weather conditions, the speed and direction of the receiver (or the automobile in which the receiver is integrated), etc. Appropriate sensors may thus include a positioning sensor such as a GPS (global positioning system) module for obtaining the geographic location, a clock or a time-signal receiver for obtaining the time of day, a rain sensor for obtaining information about the weather, etc. A speed signal may be tapped, e.g., at the powertrain control unit of a car, and the direction may also be obtained, e.g., from a GPS module or an electronic compass. Optical sensors may also be used to detect whether it is day or night or whether it is sunny or cloudy. Other sensors may be used additionally or alternatively to the sensors mentioned above. All the collected data are linked with the corresponding signal strength or signal quality of the currently received signal and are stored as reference data in a database that may reside in the memory of the receiver.

[0010] It should be noted that in telecommunications, and particularly in the field of radio transmission, the term *signal strength* usually refers to the magnitude of the electrical field (measured in, e.g., dBmV/m) at the receiver's location. As a synonym, the term *received signal level* is also used. In the present discussion, however, any signal representing the signal quality may be used instead of the signal strength.

[0011] During use of the receiver, the amount of collected data grows and the system is able to "learn" in which environmental conditions (i.e., time of day, geographic location, weather conditions, speed and direction, etc.) the receiver is able to receive certain broadcast stations with sufficient signal strength (i.e., with a signal strength exceeding a given limit). As a result, the system is able to "predict" the broadcast stations that provide sufficient signal strength to allow an audio and/or video reproduction of sufficient quality. The "prediction" is thereby made on the basis of the currently measured data and the reference data stored in the database.

[0012] FIG. 1 is a block diagram illustrating automobile audio receiver 10 in accordance with one exemplary embodiment of the present invention. The receiver includes tuner 11, which is coupled with antenna 12 and configured to receive RF broadcast signal S_{RF} therefrom. Tuner 11 can be tuned to a carrier frequency of RF broadcast signal S_{RF} to demodulate RF signal S_{RF} and to provide a respective (demodulated) baseband or intermediate frequency (IF) signal S_{DEM} . Baseband signal S_{DEM} may represent an audio signal that can be further processed in any common manner, e.g., supplied to an audio amplifier that generates respective loudspeaker signals. The carrier frequency of RF signal S_{RF} , to which tuner 11 is tuned, may be set by controller 13 using control signal S_{CTL} . Signal S_{CTL} may, inter alia, be set in accord-

ance with a user input made via user interface 30.

[0013] Controller 13 is further configured to collect various environmental data using appropriate sensors. Such environmental data may be, inter alia, the geographic position represented by position signal S_{POS} , the time of the day represented by time signal S_{TIME} , the weather condition represented by rain signal S_{RAIN} or the speed of the automobile represented by speed signal S_V . Sensor signals S_{POS} , S_{TIME} , S_{RAIN} , S_V , etc., may be provided by any appropriate sensor. In the present example, GPS module 14 is used to obtain position signal S_{POS} , which may include geographic coordinates. Furthermore, a commonly used rain sensor 15 may be employed to generate rain signal S_{RAIN} . The sources of time signal S_{TIME} and speed signal S_V are not shown in the example of FIG. 4. However, the speed signal may be tapped at the powertrain control unit, which is present in all modern cars, and the time signal may be retrieved from a clock or a time-signal transmitter.

[0014] The information retrieved from the sensor data is stored in database 20, which may reside in the memory included in or coupled to controller 13. FIG. 2 illustrates an exemplary database structure. During use of the system, a new data set may be generated regularly or when significant changes are detected in the data retrieved from the sensors (represented by signals S_{POS} , S_{TIME} , S_{RAIN} , etc.). Each data set includes the environmental data obtained from the sensors and a quality value associated with the broadcast signal to which tuner 11 is tuned. By collecting data, the system is able to learn which broadcast stations are best received at which environmental conditions, and a prediction may be performed that suggests to the user a broadcast station that fits to the currently measured environmental conditions. Automatic station selection may be triggered by the user via user interface 30, thus tuning the tuner to the broadcast station that best fits the currently detected environmental conditions. In this context, "best fit" may mean, for example, that the broadcast station that provides the best signal quality for the environmental condition currently measured and represented by the sensor signals (e.g., S_{POS} , S_{TIME} , S_{RAIN} , etc.) is selected.

[0015] Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

[0016] Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the processes, machines, manufactures, compositions of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present invention, processes, machines, manufactures, compositions of matter, means, methods and steps, presently existing or later to be developed, that substantially perform the same function or substantially achieve the same

result as the corresponding embodiments described herein may be utilized according to the present invention. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufactures, compositions of matter, means, methods and steps.

Claims

1. A broadcast receiver including:

a tuner for receiving a broadcast signal, the tuner being tuned to a carrier frequency of the broadcast signal and configured to provide a quality signal of the broadcast signal tuned in;
a controller configured to set the carrier frequency to which the tuner is tuned;
at least one sensor configured to provide environmental data pertaining to the environment in which the receiver is operated; and
a database for storing the values of the quality signal and the corresponding environmental data during operation of the receiver;
wherein the controller is configured to select at least one broadcast signal associated with a broadcast station based on a current set of environmental data and on the data and quality values stored in the database.

2. The broadcast receiver of claim 1, wherein the environmental data includes information about at least one of the following: the geographic position of the receiver, the time of day, the weather conditions, the speed at which the receiver is moving or the moving direction of the receiver.

3. The broadcast receiver of claim 2, wherein the geographic position is obtained by a GPS receiver module.

4. The broadcast receiver of claim 2, wherein the weather conditions are obtained using a rain sensor.

5. The broadcast receiver of one of the claims 1 to 4, further including a user interface configured to allow user interaction that triggers the switchover from the current broadcast station to which the tuner is tuned to the broadcast station selected by the controller based on a current set of environmental data and on the data and quality values stored in the database.

6. The broadcast receiver of one of the claims 1 to 5 wherein the tuner is configured to receive AM or FM broadcast signals including audio signals.

7. The broadcast receiver of one of the claims 1 to 6 wherein the tuner is configured to receive broadcast

signals including video signals.

8. The broadcast receiver of one of the claims 1 to 9, wherein the database resides in a memory included in the broadcast receiver.

9. The broadcast receiver of one of the claims 1 to 8, wherein the controller is configured to perform a prediction to suggest to the user a broadcast station that fits to the currently measured set of environmental data.

10. The broadcast receiver of one of the claims 1 to 9, wherein the controller is configured to generate a new set of environmental data and quality values regularly or when significant changes are detected in the data retrieved from the sensor(s).

11. The broadcast receiver of one of the claims 1 to 10 wherein the controller is configured to receive, via the user interface, a user input in response to which an automatic station selection is triggered, thus tuning the tuner to the broadcast station that best fits the currently measured set of environmental data.

12. The broadcast receiver of one of the claims 1 to 11 wherein the controller is configured to offer the user, via the user interface, a list of broadcast stations, which can be received with sufficient quality at the currently measured set of environmental data, to allow selection by the user.

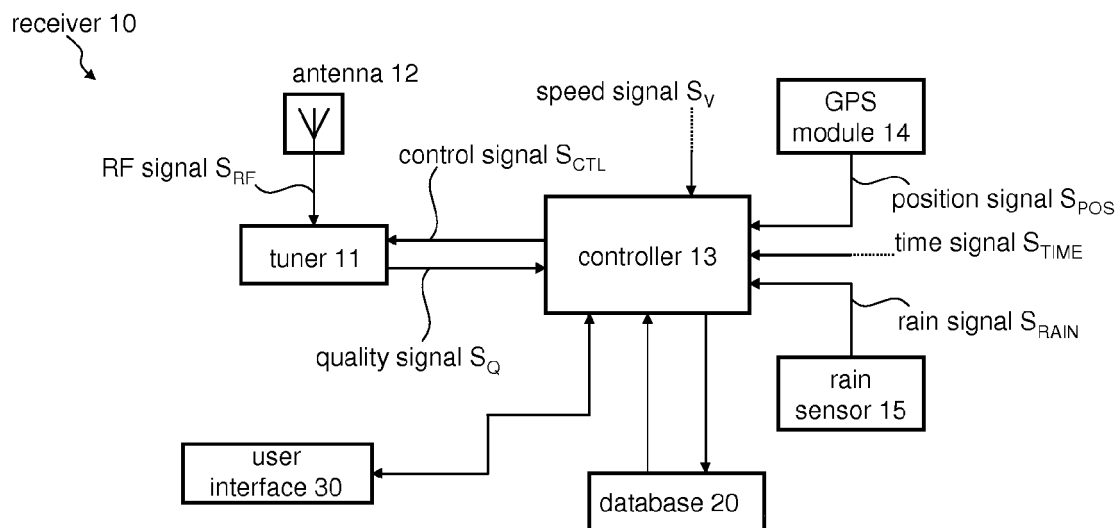


FIG. 1 automotive audio receiver

	geo-coordinates	time HH:MM	raining yes/no	speed km/h	
data set 1					
data set 2					
⋮	⋮	⋮	⋮	⋮	

FIG. 2



EUROPEAN SEARCH REPORT

 Application Number
 EP 13 17 3872

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 August 2013	Examiner De Haan, Aldert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 August 2013	Examiner De Haan, Aldert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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