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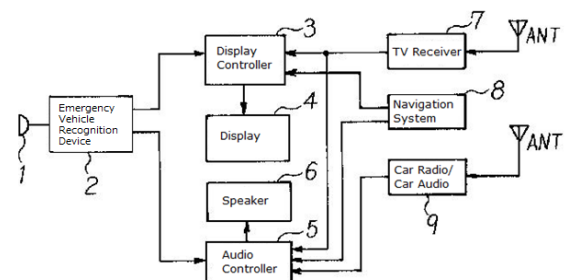
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(54) **[Title of the Invention] Emergency Vehicle Detection and Alert Device and Location Display Device**

(57) [Abstract]

[Purpose] To notify a driver of an approaching emergency vehicle even when the windows of the vehicle are closed and the volume of the car stereo, etc., is turned up.

[Constitution] Signals from a microphone 1 are inputted to an emergency vehicle recognition device 2, which detects the sound of an emergency vehicle siren and outputs signals to a display controller 3 and audio controller 5. When the display controller 3 receives a signal from the emergency vehicle recognition device 2, it generates alert screen image signals from a built-in image signal generator and displays an alert screen on a display 4. The audio controller 5 generates an alert announcement from a built-in speech synthesizer and operates a speaker 6.



[Claims]

[Claim 1]

An emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; an emergency vehicle recognition device that recognizes that signals outputted from the microphone are those of the sound of an emergency vehicle siren; and a display controller that controls the display in a vehicle or an audio controller that controls a speaker in a vehicle, wherein the emergency vehicle detection and alert device is configured to give priority to an approaching emergency vehicle alert operation on the display or speaker in the vehicle when an emergency vehicle approaches.

[Claim 2]

An emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; an emergency vehicle recognition device that recognizes that signals outputted from the microphone are those of the sound of an emergency vehicle siren; and an audio controller that controls a speaker in a vehicle, wherein the emergency vehicle detection and alert device is configured to temporarily stop the operation of a sound reproduction device such as a radio or car audio system when the emergency vehicle recognition device confirms the sound of an emergency vehicle siren while the sound reproduction device is operating, and starts up the amplifier of the sound reproduction system and inputs the sound signals of the emergency vehicle siren to the amplifier of the sound reproduction system to output the sound signals from a speaker in the vehicle when the sound reproduction system is not in operation.

[Claim 3]

An emergency vehicle detection and alert device comprising: a microphone with omni-directional detection; a recognition device that has a ROM memory with the sound patterns of emergency vehicle sirens and that compares signals outputted from the microphone with the patterns stored in the memory and outputs a signal only when the siren sound of an emergency vehicle has been recognized; and a false recognition preventing device that has a memory that stores patterns of input signals in RAM, and that inputs signals outputted from the recognition device, that stores the signal pattern in the RAM, that compares the next inputted signal pattern, and that outputs a mute signal to reduce the volume of in-car speakers such as a car audio system, etc. when the same pattern has been inputted a predetermined number of times.

[Claim 4]

An emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; and a recognition device that has a ROM memory with siren sound patterns by type of emergency vehicle and that identifies a type of emergency vehicle by comparing signals outputted from the microphone with the patterns stored in the memory, wherein the emergency vehicle detection and alert device is configured to display a type of emergency vehicle on a display unit based on signals from the recognition device, or announce the type of emergency vehicle by audio announcement.

[Claim 5]

An emergency vehicle detection and alert device comprising: a plurality of microphones that detect the sound of emergency vehicle sirens; a bearing calculating unit that inputs signals

from the microphones and calculates the bearing of the emergency vehicle; an emergency vehicle recognition device that inputs signals from the microphones and recognizes that inputted signals are those of the sound of an emergency vehicle; a display unit that displays the bearing of an emergency vehicle; a display controller that controls the display unit; and an audio announcement unit that generates audio signals, wherein the emergency vehicle detection and alert device is configured to display the bearing of an emergency vehicle and notify the driver via a speaker when an emergency vehicle approaches.

[Claim 6]

The emergency vehicle detection and alert device according to claim 5, wherein the ever-changing location of the emergency vehicle is displayed.

[Claim 7]

The emergency vehicle detection and alert device according to claim 5, wherein the location of the emergency vehicle is displayed on a location indicator built into the dashboard of the vehicle when an emergency vehicle approaches.

[Claim 8]

The emergency vehicle detection and alert device according to claim 7, wherein the ever-changing location of the emergency vehicle is displayed.

[Claim 9]

The emergency vehicle detection and alert device according to claim 7 or 8, wherein lamps light up or flash to display the location of the emergency vehicle.

[Claim 10]

An emergency vehicle detection and alert device comprising: a plurality of microphones that detect the sound of emergency vehicle sirens; an emergency vehicle recognition device that inputs signals from the microphones and recognizes that inputted signals are those of the sound of an emergency vehicle; a bearing calculating unit that inputs signals from the microphones and calculates the bearing of the emergency vehicle; a distance calculating unit that calculates the distance between an emergency vehicle and the vehicle from the level of signals inputted from the microphones; a display showing the bearing and distance of an emergency vehicle or a speech synthesizer that provides voice notification, wherein the emergency vehicle detection and alert device is configured to display the orientation and distance of an emergency vehicle on the display or the driver is alerted to the situation via the speaker when an emergency vehicle approaches.

[Claim 11]

The emergency vehicle detection and alert device according to claim 10, wherein the ever-changing location of the emergency vehicle is displayed.

[Claim 12]

The emergency vehicle detection and alert device according to claim 10, wherein the alert method changes when the distance between the emergency vehicle and the vehicle is close or far.

[Claim 13]

The emergency vehicle detection and alert device according to claim 12, wherein the display on the location indicator is combined with speaker sounds.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Applicability]

The present invention relates to a safety device for operating an automobile, and more specifically, to an emergency vehicle detection and alert device and a location display device that alerts the driver of an approaching emergency vehicle while driving.

[0002]

[Prior Art]

Drivers of automobiles have long judged the approach of an emergency vehicle using their ears. Therefore, when listening to a car stereo with the volume turned up high, the driver may not notice the approach of an emergency vehicle, resulting in an accident or blocking of the emergency vehicle.

[0003]

[Problem to Be Solved by the Invention]

Therefore, in view of these circumstances, it is an object of the present invention to provide an emergency vehicle detection and alert device that detects the approach of an emergency vehicle using a microphone and recognition device, temporarily stops the car stereo or other audio equipment, plays the siren or announces the approach of an emergency vehicle on the speakers, or displays the type, bearing, and/or distance of the emergency vehicle on the indicator or display.

[0004]

[Means for Solving the Problem]

The present invention is an emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; an emergency vehicle recognition device that recognizes that signals outputted from the microphone are those of the sound of an emergency vehicle siren; and a display controller that controls the display in a vehicle or an audio controller that controls a speaker in a vehicle, wherein the emergency vehicle detection and alert device is configured to give priority to an approaching emergency vehicle alert operation on the display or speaker in the vehicle when an emergency vehicle approaches.

[0005]

The present invention is also an emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; an emergency vehicle

recognition device that recognizes that signals outputted from the microphone are those of the sound of an emergency vehicle siren; and an audio controller that controls a speaker in a vehicle, wherein the emergency vehicle detection and alert device is configured to temporarily stop the operation of a sound reproduction device such as a radio or car audio system when the emergency vehicle recognition device confirms the sound of an emergency vehicle siren while the sound reproduction device is operating, and starts up the amplifier of the sound reproduction system and inputs the sound signals of the emergency vehicle siren to the amplifier of the sound reproduction system to output the sound signals from a speaker in the vehicle when the sound reproduction system is not in operation.

[0006]

The present invention is also an emergency vehicle detection and alert device comprising: a microphone with omni-directional detection; a recognition device that has a ROM memory with the sound patterns of emergency vehicle sirens and that compares signals outputted from the microphone with the patterns stored in the memory and outputs a signal only when the siren sound of an emergency vehicle has been recognized; and a false recognition preventing device that has a memory that stores patterns of input signals in RAM, and that inputs signals outputted from the recognition device, that stores the signal pattern in the RAM, that compares the next inputted signal pattern, and that outputs a mute signal to reduce the volume of in-car speakers such as a car audio system, etc. when the same pattern has been inputted a predetermined number of times.

[0007]

The present invention is also an emergency vehicle detection and alert device comprising: a microphone that detects the sound of emergency vehicle sirens; and a recognition device that has a ROM memory with siren sound patterns by type of emergency vehicle and that identifies a type of emergency vehicle by comparing signals outputted from the microphone with the patterns stored in the memory, wherein the emergency vehicle detection and alert device is configured to display a type of emergency vehicle on a display unit based on signals from the recognition device, or announce the type of emergency vehicle by audio announcement.

[0008]

The present invention is also an emergency vehicle detection and alert device comprising: a plurality of microphones that detect the sound of emergency vehicle sirens; a bearing calculating unit that inputs signals from the microphones and calculates the bearing of the emergency vehicle; an emergency vehicle recognition device that inputs signals from the microphones and recognizes that inputted signals are those of the sound of an emergency vehicle; a display unit that displays the bearing of an emergency vehicle; a display controller that controls the display unit; and an audio announcement unit that generates audio signals, wherein the emergency vehicle detection and alert device is configured to display the bearing of an emergency vehicle and notify the driver via a speaker when an emergency vehicle approaches.

[0009]

In an emergency vehicle detection and alert device described above, when an emergency vehicle approaches, the location of the emergency vehicle is displayed on a location indicator built into the dashboard of the vehicle.

[0010]

In an emergency vehicle detection and alert device described above, the ever-changing location of the emergency vehicle is displayed.

[0011]

In an emergency vehicle detection and alert device described above, lamps light up or flash to display the location of the emergency vehicle.

[0012]

The present invention is also an emergency vehicle detection and alert device comprising: a plurality of microphones that detect the sound of emergency vehicle sirens; an emergency vehicle recognition device that inputs signals from the microphones and recognizes that inputted signals are those of the sound of an emergency vehicle; a bearing calculating unit that inputs signals from the microphones and calculates the bearing of the emergency vehicle; a distance calculating unit that calculates the distance between an emergency vehicle and the vehicle from the level of signals inputted from the microphones; a display showing the bearing and distance of an emergency vehicle or a speech synthesizer that provides voice notification, wherein the emergency vehicle detection and alert device is configured to display the orientation and distance of an emergency vehicle on the display or the driver is alerted to the situation via the speaker when an emergency vehicle approaches.

[0013]

In the emergency vehicle detection and alert device described above, the ever-changing location of the emergency vehicle is displayed.

[0014]

In the emergency vehicle detection and alert device described above, the alert method changes when the distance between the emergency vehicle and the vehicle is close or far.

[0015]

In the emergency vehicle detection and alert device described above, the display on the location indicator is combined with speaker sounds.

[0016]

[Operation]

The microphone for detecting the sound of an emergency vehicle siren is usually located outside the vehicle so that the siren sound can be inputted without being impeded, for example, by the sound of the car stereo in the cabin, etc. Because the frequency and intermittency of emergency vehicle siren sounds vary by the type of vehicle, these patterns can be stored in memory and compared with inputted signals to distinguish them from other noises and to also identify the type of emergency vehicle.

[0017]

The bearing of an emergency vehicle can be calculated by arranging microphones that detect the siren sound in different positions on the vehicle and performing calculations on the inputted signals. The distance of an emergency vehicle can be calculated based on the level of the inputted microphone signals.

[0018]

The driver is alerted to the information obtained in this way by voice over the speakers of the car stereo system. The information is also displayed for the driver using a location indicator on the dashboard or a display such as a television.

[0019]

[Examples]

Examples of the present invention will now be described with reference the drawings. Fig. 1 is a block diagram showing the emergency vehicle detection and alert device in a first example of the present invention. In the figure, 1 is a microphone located outside the car. Signals outputted from the microphone 1 are inputted to an emergency vehicle recognition device 2. The emergency vehicle recognition device 2 has a memory that stores the sound patterns of emergency vehicle sirens and an arithmetic circuit that compares inputted signals with the patterns in the memory. When the inputted signals match a pattern in the memory, a signal is outputted to a display controller 3 and an audio controller 5. The display controller 3 usually receives video signals from a television receiver 7 or car navigation system 8 and outputs those signals to a display 4 to display images. When signals are inputted from the emergency vehicle recognition device 2, the display controller 3 generates alert screen video signals using its built-in video signal generator and outputs the signals to the display 4 to display an alert screen.

[0020]

The audio controller 5 usually receives audio signals from the television receiver 7, navigation system 8, or audio equipment 9, and these signals operate a speaker 6. When signals are inputted from the emergency vehicle recognition device 2, the audio controller 5 generates an alert announcement using the built-in speech synthesizer and these signals operate a speaker 6.

[0021]

In this configuration, when an emergency vehicle approaches, the sound of the siren is recognized using the microphone 1 and the emergency vehicle recognition device 2, and an alert screen is displayed on the display 4 by signals from the emergency vehicle recognition device 2. In addition, an alert is announced over the speaker 6. Thus, even when the volume of the sound equipment is turned up, the driver is able to reliably recognize the approach of an emergency vehicle. When the emergency vehicle moves away from the car and the sound of a siren is no longer detected, the emergency vehicle recognition device no longer outputs signals and the television receiver 7, etc., returns to normal operation.

[0022]

Fig. 2 is a block diagram showing the emergency vehicle detection and alert device in a second example of the present invention. In the figure, 1 is an omni-directional microphone located outside the car. Signals outputted from the microphone 1 are inputted to the emergency vehicle recognition device 2. The emergency vehicle recognition device 2 has a memory that stores the sound patterns of emergency vehicle sirens, and an arithmetic circuit that compares inputted signals with the patterns in the memory and outputs a detection signal to the audio controller 5 when the inputted signals match a pattern in the memory. The audio controller 5 receives the detection signal from the emergency vehicle recognition device 2 and audio signals from the microphone 1, and outputs them to the audio equipment 9 to start up the amplifier, activate the amplifier input switch, and output the audio signals from the microphone 1 to the audio equipment 9.

[0023]

In this configuration, the speaker 6 is usually operated by audio signals from audio equipment (car radio/car audio) 9. When an emergency vehicle approaches, the sound of a siren is recognized using the microphone 1 and emergency vehicle recognition device 2, and the emergency vehicle recognition device 2 outputs a detection signal to the audio controller 5. The audio controller 5 switches the amplifier input of the audio equipment 9 to the audio signals from the microphone 1, and the sound of the emergency vehicle siren is played on the speaker 6. If the audio equipment 9 is switched off, the audio equipment 9 is switched on by the signals from the audio controller 5 and the sound of the emergency vehicle siren is played. When the emergency vehicle moves away from the car and the siren sound is no longer detected, the emergency vehicle recognition device 2 outputs a stop signal and the audio equipment 9 returns to its original state.

[0024]

Fig. 3 is a block diagram showing the emergency vehicle detection and alert device in a third example of the present invention. The microphone 1 is an omni-directional detection microphone located outside the car. Signals outputted from the microphone 1 are inputted to a preamplifier 10. The preamplifier 10 consists of a filter bank 10b with narrow bandwidth filters arranged in parallel to match the frequencies of various sirens, an analog-to-digital converter 10c, and an interface 10d that converts the inputted audio signal into digital signals and outputs them to the recognition device 2. The recognition device 2 consists of interface 2b, CPU 2a, RAM 2d, ROM 2e, interface 2c, and memory 2f that contains siren sound patterns for each type of emergency vehicle in ROM. If inputted signals match a pattern in the memory 2f, a signal is outputted to a false recognition prevention device 11. The false recognition prevention device 11 consists of an arithmetic device 11a, RAM 11b, and a mute signal generation circuit 11c. The inputted signal pattern is stored in the RAM, and the next inputted signal pattern is compared with the pattern stored in the RAM. When the same pattern is inputted a predetermined number of times, a mute signal is outputted to the audio equipment 9. When a mute signal is inputted, the audio equipment 9 lowers the volume of the speaker 6 or mutes the speaker 6.

[0025]

In this configuration, the speaker 6 is usually operated by audio signals from the audio equipment (car radio/car audio) 9. When an emergency vehicle approaches, if the sound of a siren is recognized by the microphone 1 and the emergency vehicle recognition device 2, the inputted siren sound pattern is outputted to the false recognition device 11. When the same

siren sound pattern has been inputted a predetermined number of times, the false recognition prevention device 11 outputs a mute signal to the audio equipment 9, so that even if the driver is in the cabin listening to the car audio system, etc. at a high volume, the approach of an emergency vehicle can be reliably recognized. The siren sound is compared and confirmed multiple times, eliminating false recognition. When the emergency vehicle moves away from the car and the siren sound is no longer detected, the mute signal stops and the audio equipment 9 returns to its original state.

[0026]

Fig. 4 is a pair of block diagrams showing the emergency vehicle detection and alert device in a fourth example of the present invention. Here, 1 is an omni-directional detection microphone located outside the car. Signals outputted from the microphone 1 are inputted to a preamplifier 10. The preamplifier 10 consists of an amplifier 10a, a filter bank 10b with narrow bandwidth filters arranged in parallel to match the frequencies of various sirens, an analog-to-digital converter 10c, and an interface 10d that converts the inputted audio signals into digital signals and output them to the recognition device 2. The recognition device 2 consists of interface 2b, CPU 2a, RAM 2d, ROM 2e, interface 2c, and memory 2f that contains siren sound patterns for each type of emergency vehicle in ROM. If inputted signals match a pattern in the memory 2f, a signal indicating the type of emergency vehicle is outputted to a speech synthesizer 12 and a display controller 13. The speech synthesizer 12 generates voice signals to inform the driver of the type of emergency vehicle based on the inputted signal and activates the speaker 6. The display controller 13 turns on a lamp on the vehicle type indicator 14 based on the inputted signal. The vehicle type indicator 14 is located on the dashboard and, as shown in Fig. 4 (b), has a panel marked with the types of emergency vehicles and lamps installed below it.

[0027]

In this configuration, when an emergency vehicle approaches, the type of emergency vehicle siren sound is identified by the microphone 1 and the emergency vehicle recognition device 2, and the type of emergency vehicle is displayed on the vehicle type indicator 14 and announced over the speaker 6.

[0028]

Fig. 5 (a) is a block diagram showing the emergency vehicle detection and alert device in a fifth example of the present invention. Here, 1 is a microphone placed outside the car that outputs four-channel signals. The signals outputted from the microphone 1 are inputted to the preamplifier 10. The preamplifier 10 consists of a four-channel filter bank, an analog-to-digital converter, and an interface that converts the inputted audio signals into digital signals and outputs them to the emergency vehicle recognition device 2 and a bearing calculating unit 15. The recognition device 2 consists of an interface, a CPU, a RAM, a ROM, an interface, and a memory containing siren sound patterns of emergency vehicles in ROM, and compares the inputted signals to the patterns in the memory. When there is a match, the siren sound pattern is outputted to the bearing calculating unit 15. The bearing calculating unit 15 calculates the bearing of the emergency vehicle relative to the car itself from the output of the four-channel preamplifier 10. In other words, signals inputted from two microphones are used to calculate the sound intensity (sound energy per unit area per unit time) in the direction of the central axis of the two microphones, and the vector direction (sound wave traveling direction) is obtained from the sound intensity of the two orthogonal axes. When a signal indicating that the sound is that of the siren of an emergency vehicle is inputted from the emergency vehicle recognition device 2, the bearing calculating unit 15 outputs a signal

indicating the orientation to the display controller 13 and the speech synthesizer 12. The display controller 13 turns on an LED in the location indicator 16 based on the inputted signal. The location indicator 16 is arranged on the dashboard as shown in Fig. 5 (b). As shown in Fig. 5 (c), LEDs indicating the bearing of the emergency vehicle are placed around the mark indicating the car itself, and the LED corresponding to the bearing of the emergency vehicle flashes. The speech synthesizer 12 generates audio signals that inform the driver of the bearing of the emergency vehicle based on the inputted signal and activates the speaker 6.

[0029]

In this configuration, when an emergency vehicle approaches, the bearing of the emergency vehicle is displayed on the location indicator 16 once the sound of an emergency vehicle siren has been identified by the microphone 1 and the emergency vehicle recognition device 2, and an announcement is made such as "distant right" or "rear left" over the speaker 6. These operations are repeated on a fixed cycle, and the changing status of the emergency vehicle is made known as its position changes from moment to moment.

[0030]

Fig. 6 is a pair of block diagrams showing the emergency vehicle detection and alert device in a sixth example of the present invention. Here, 1 is a microphone placed outside the car that outputs four-channel signals. The signals outputted from microphone 1 are inputted to the preamplifier 10. The preamplifier 10 consists of a four-channel filter bank, an analog-to-digital converter, and an interface that converts inputted audio signals into digital signals and outputs them to the emergency vehicle recognition device 2, the bearing calculating unit 15, and an input level processing unit 17. The recognition device 2 consists of an interface, a CPU, a RAM, a ROM, an interface, and a memory that contains siren sound patterns of emergency vehicles in ROM. Inputted signals are compared with patterns in the memory, and if there is a match, a signal indicating that it is the siren sound of an emergency vehicle is outputted to the display controller 13 and the speech synthesizer 12. The bearing calculating unit 15 calculates the bearing of the emergency vehicle relative to the car itself from the output of the four-channel preamplifier 10 and outputs a signal indicating the bearing to the display controller 13 and the speech synthesizer 12. The input level processing unit 17 calculates the distance between the car itself and the emergency vehicle based on the strength of the input level from four microphones and outputs a signal indicating the distance to the display controller 13 and the speech synthesizer 12. When a signal indicating that it is the siren sound of an emergency vehicle is inputted from the emergency vehicle recognition device 2, the display controller 13 outputs a signal to display the emergency vehicle location on the location indicator 18 based on signals from the bearing calculating unit 15 and the input level processing unit 17. As shown in Fig. 6 (b), the location indicator 18 has a circular LCD surface that depicts the car in the center. The location indicator 18 flashes the location of the emergency vehicle at the location corresponding to the inputted signals. In addition, the location indicator 18 flashes at a faster rate as the emergency vehicle approaches. The speech synthesizer 12 generates audio signals that inform the driver of the bearing and distance of the emergency vehicle based on the inputted signals and activates the speaker 6. The speech synthesizer 12 announces that an emergency vehicle is approaching at a predetermined distance and provides driving instructions.

[0031]

In this configuration, when an emergency vehicle approaches, the sound of the emergency vehicle siren is identified using the microphone 1 and the emergency vehicle recognition device 2, and the location of the emergency vehicle is displayed on the location indicator 18

and announced over the speaker 6. These operations are repeated over a fixed cycle, and the driver is informed of the changing situation as the location of the emergency vehicle changes from moment to moment. The driver is also informed of the situation before it becomes dangerous, eliminating the risk of a misjudgment by the driver.

[0032]

[Effect of the Invention]

The emergency vehicle detection and alert device and location display device in the present invention reliably inform the driver of the location of an approaching emergency vehicle even when the windows are closed and the volume of the car stereo, etc., is turned up high, thus avoiding accidents and other problems.

[Brief Description of the Drawings]

[Fig. 1] Fig. 1 is a block diagram showing the emergency vehicle detection and alert device in a first example of the present invention.

[Fig. 2] Fig. 2 is a block diagram showing the emergency vehicle detection and alert device in a second example of the present invention.

[Fig. 3] Fig. 3 is a block diagram showing the emergency vehicle detection and alert device in a third example of the present invention.

[Fig. 4] Fig. 4 (a) is a block diagram showing the emergency vehicle detection and alert device in a fourth example of the present invention, and Fig. 4 (b) shows the vehicle type indicator in the emergency vehicle detection and alert device.

[Fig. 5] Fig. 5 (a) is a block diagram showing the emergency vehicle detection and alert device in a fifth example of the present invention, Fig. 5 (b) shows the location indicator and speaker arrangement of the emergency vehicle detection and alert device, and Fig. 5 (c) is an enlarged view of the location indicator in the emergency vehicle detection and alert device.

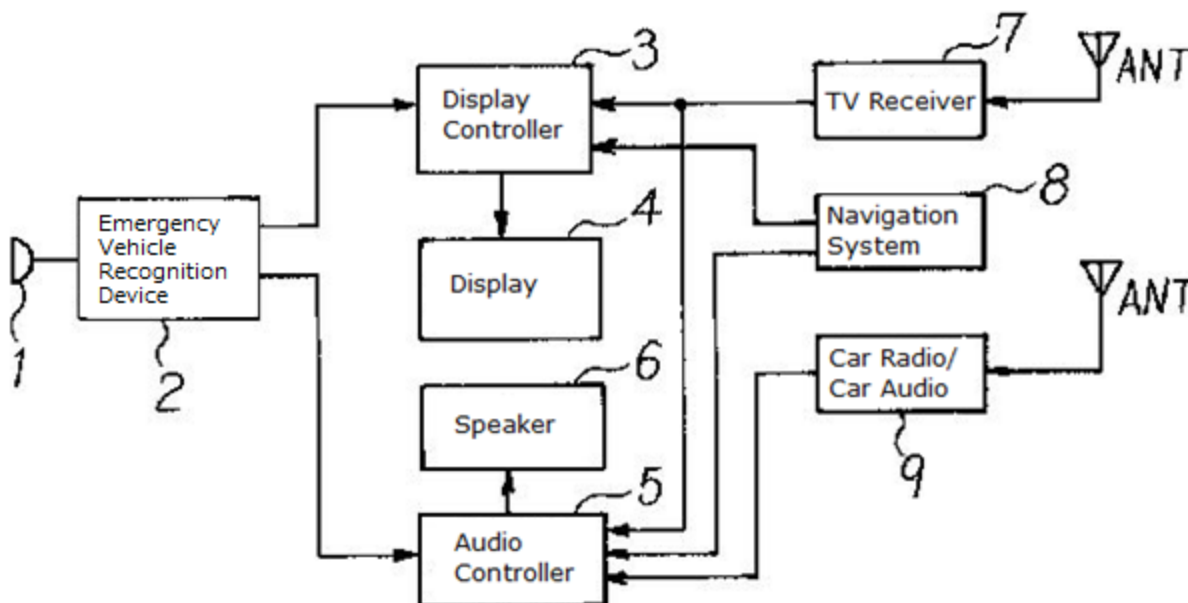
[Fig. 6] Fig. 6 (a) is a block diagram showing the emergency vehicle detection and alert device in a sixth example of the present invention, and Fig. 6 (b) shows the location indicator in the emergency vehicle detection and alert device.

[Reference List]

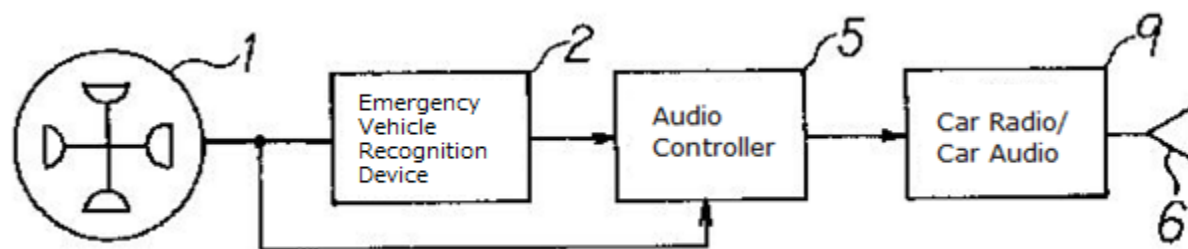
- 1: Microphone
- 2: Emergency vehicle recognition device
- 3: Display controller
- 4: Display
- 5: Audio controller
- 6: Speaker
- 7: TV receiver
- 8: Navigation system
- 9: Audio equipment
- 10: Preamplifier
- 11: False recognition prevention device
- 12: Speech synthesizer
- 13: Display controller

- 14: Vehicle type indicator
- 15: Bearing calculating unit
- 16: Location indicator
- 17: Input level processing unit
- 18: Location indicator

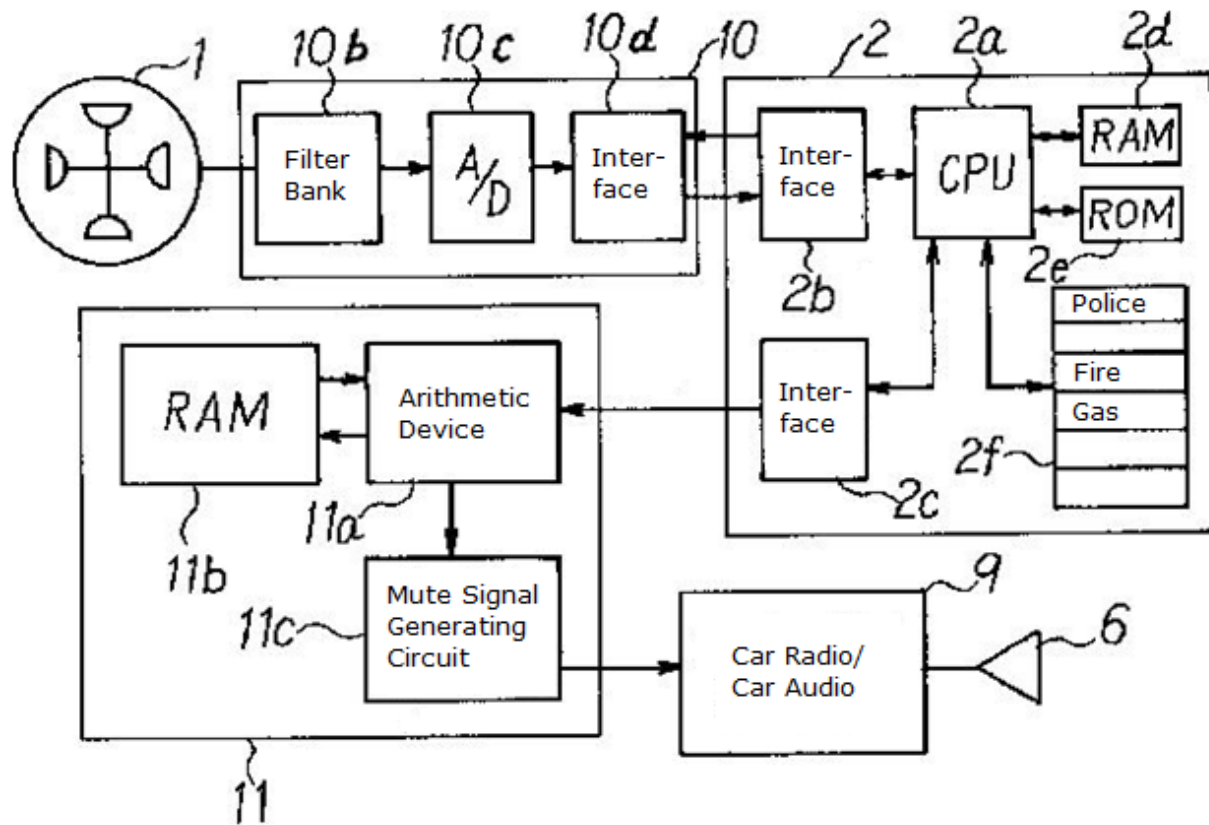
[Fig. 1]



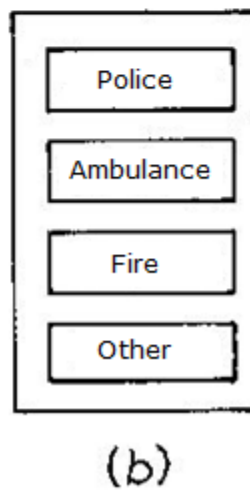
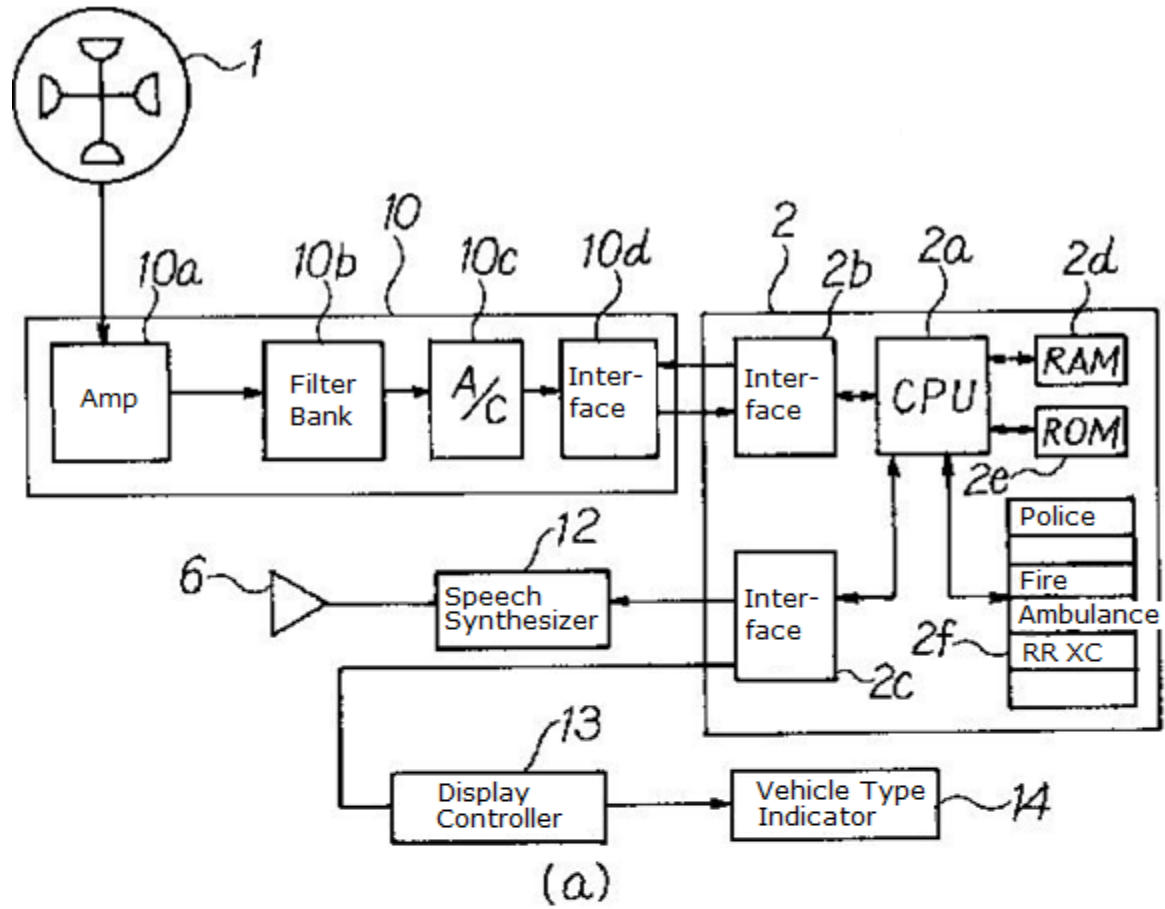
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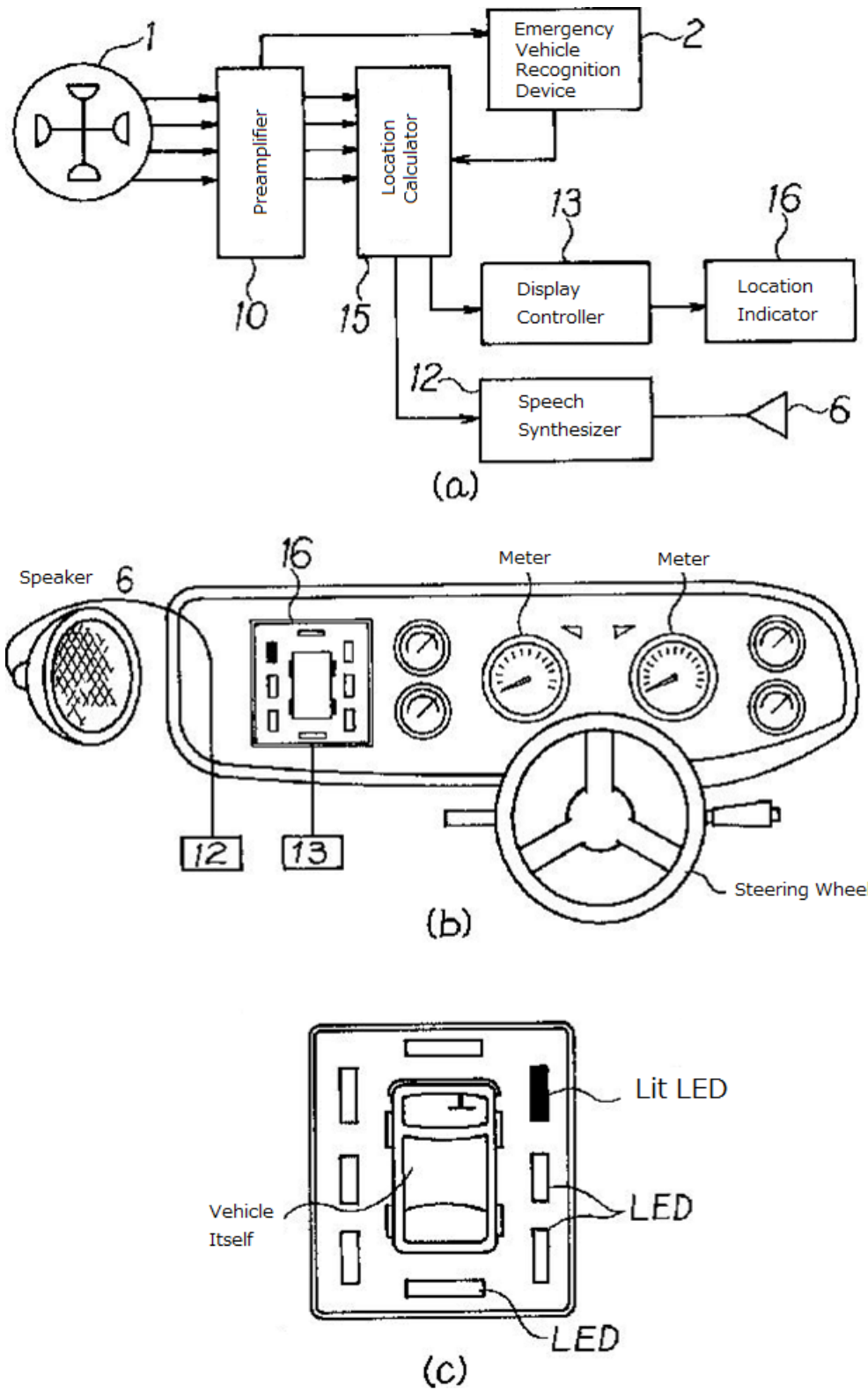
[Fig. 3]



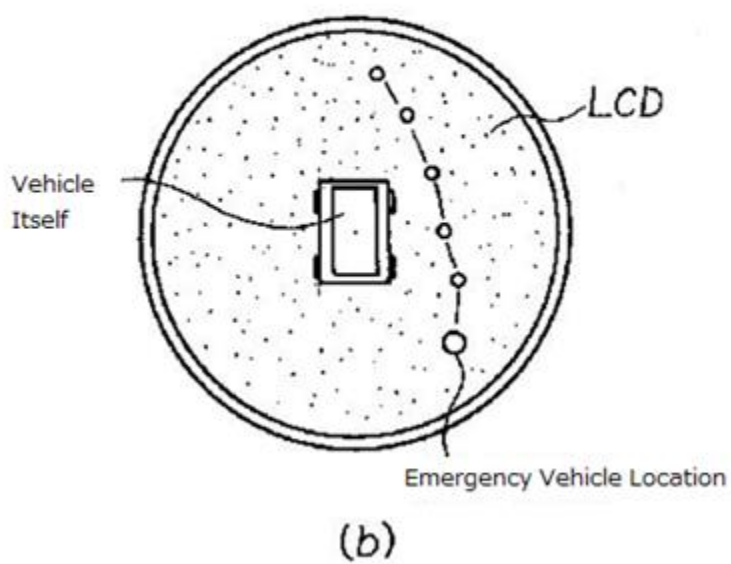
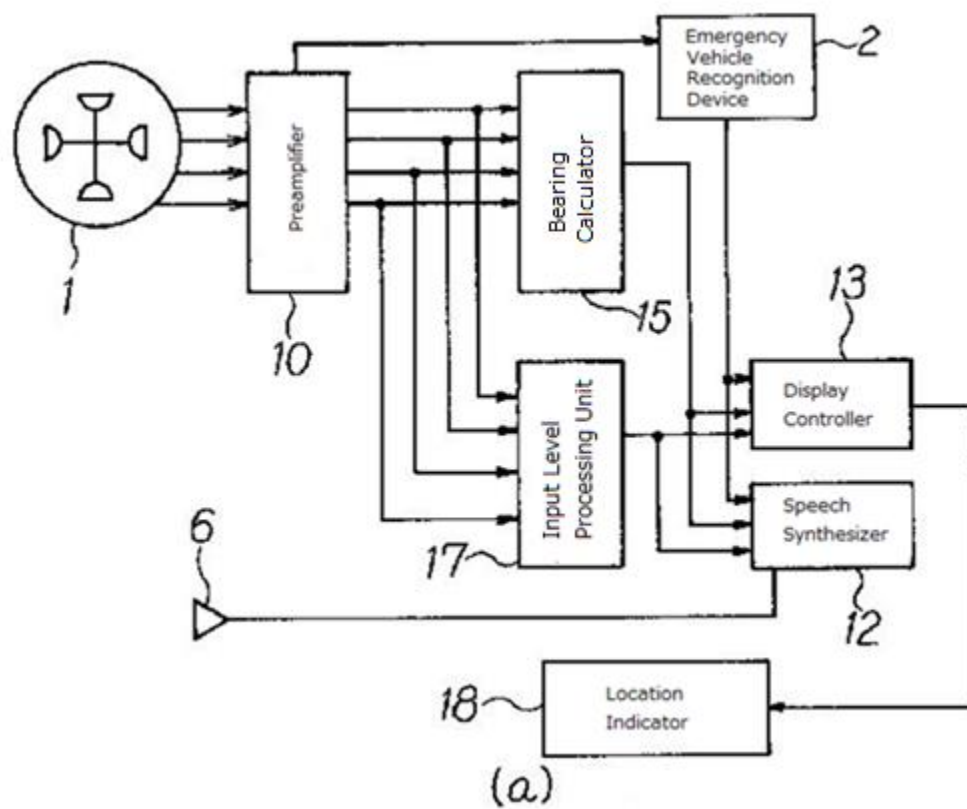
[Fig. 4]



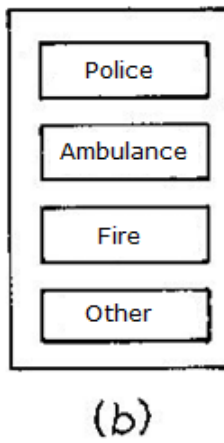
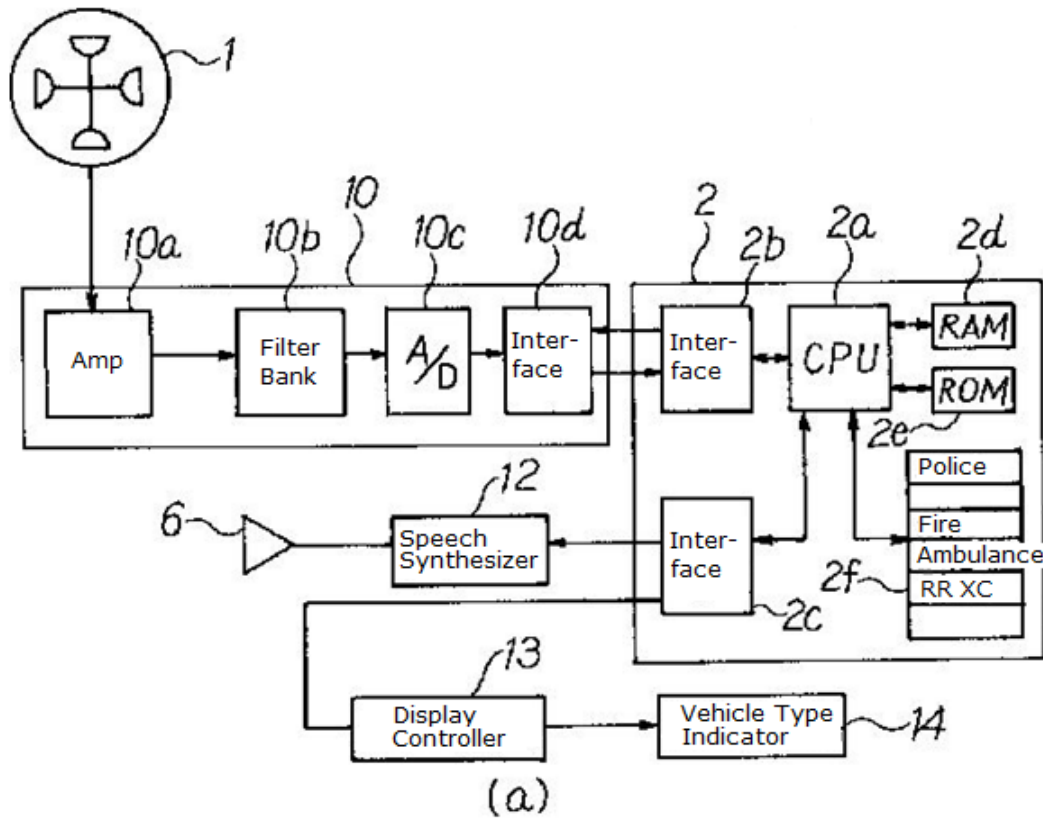
[Fig. 5]



[Fig. 6]



[Procedural Amendments]
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[Procedural Amendment 1]
[Name of Amended Document] Drawings
[Name of Amended Item] Fig. 4
[Method of Amendment] Revision
[Amendment Details]
[Fig. 4]



Continued from front page

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TRANSLATION CERTIFICATION

Date: September 2, 2024

To whom it may concern:

I, Frank McGee, a translator fluent in the Japanese and English languages, on behalf of Morningside, do solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of the document(s) listed below in a form that best reflects the intention and meaning of the original text.

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A handwritten signature in blue ink, appearing to read "Frank McGee", written over a horizontal line.

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