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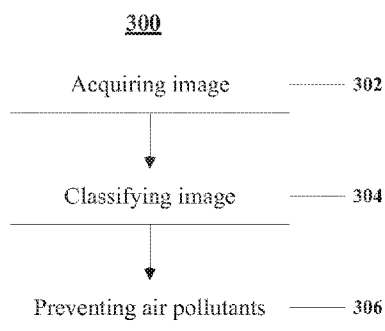


Fig. 3A

(57) Abstract: The present invention relates to a processing method and a processing apparatus, wherein the processing method comprising: acquiring an image including an environment ahead of a first vehicle; classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution; and preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image. The processing method and the processing apparatus can improve air quality inside the vehicle.



PROCESSING METHOD, PROCESSING APPARATUS, CONTROL DEVICE AND CLOUD SERVER

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TECHNICAL FIELD

The present invention relates to a field of a vehicle and particularly to a processing method, a processing apparatus, a control device and a cloud server.

BACKGROUND

Currently a vehicle usually uses an air quality sensor installed in the vehicle to measure air quality around the vehicle, and when it is measured that the air quality around the vehicle is not good, air intake of the air condition system of the vehicle is switched into an inner loop air intake to prevent pollutants outside the vehicle from flowing into a cabin of the vehicle.

The existed air quality control technology used in the vehicle takes reactive approach, by which some pollutants must have flowed into the cabin of the vehicle already. In many cases, it is very hard to clean the pollutants flowed into the cabin of the vehicle, especially VOC (Volatile Organic Compound) related pollutants.

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SUMMARY

Embodiments of the present invention provide a processing method, a processing apparatus, a control device and a cloud server, which can improve air quality inside a vehicle.

A processing method according to embodiments of the present invention comprises: acquiring an image including an environment ahead of a first vehicle; classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution; and

preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.

A processing method according to embodiments of the present invention comprises: re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution; and transmitting the updated machine learning model to vehicles.

A processing apparatus according to embodiments of the present invention comprises: an acquiring module for acquiring an image including an environment ahead of a first vehicle; a classifying module for classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution; and a switching module for preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.

A processing apparatus according to embodiments of the present invention comprises: a re-training module for re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution; and a transmitting module for transmitting the updated machine learning model to vehicles.

A control device according to embodiments of the present invention comprises: a processor; and a memory for storing executable instructions which cause, when executed, the processor to execute operations included in the above method.

A cloud server according to embodiments of the present invention comprises: a processor; and a memory for storing executable instructions which cause, when executed, the processor to execute operations included in the above method.

A computer readable medium according to embodiments of the present invention has thereon executable instructions for causing, when executed, a machine to execute operations included in the above method.

The above embodiments of the present invention uses the image including an environment ahead of the first vehicle and the machine learning model to determine whether there is air pollution around the first vehicle, which is not necessary to have the pollutants outside the first vehicle to flow into the cabin of the first vehicle. Thus, compared to the prior art, the above embodiments of the present invention can improve air quality inside a vehicle.

DESCRIPTION OF FIGURES

The above and other features and advantages of the present invention will become more apparent from the following detailed description made with reference to the accompanying drawings. In the drawings:

Fig. 1A illustrates an architecture diagram of an air quality control system according to an embodiment of the present invention;

Fig. 1B shows some examples of the second type image indicating air pollution;

Fig. 2 illustrates a flowchart of a method for air quality control according to an embodiment of the present invention;

Fig. 3A illustrates a flowchart of a processing method according to an embodiment of the present invention;

Fig. 3B illustrates a flowchart of a processing method according to an embodiment of the present invention;

Fig. 4A illustrates a flowchart of a processing apparatus according to an embodiment of the present invention;

Fig. 4B illustrates a flowchart of a processing apparatus according to an embodiment of the present invention;

Fig. 5 illustrates a flowchart of a control device according to an embodiment of the present invention; and

Fig. 6 illustrates a flowchart of a cloud server according to an embodiment of the present invention.

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DETAILED DESCRIPTION

Various embodiments are now described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more embodiments. However, it may be evident that such embodiment(s) can be practiced without these specific details.

Fig. 1A illustrates an architecture diagram of an air quality control system according to an embodiment of the present invention. As shown in Fig. 1A, the air quality control system 10 may include a plurality of vehicles 40 and a cloud server 80.

Any vehicle 40i of the plurality of vehicles 40 may include an air quality sensor 44, a camera 48 and a control device 52.

The air quality sensor 44 of the vehicle 40i may install on the vehicle 40i to measure continually air quality reading around the vehicle 40i.

The camera 48 of the vehicle 40i may install in or on the vehicle 40i to continually capture an image including an environment ahead of the vehicle 40i.

The control device 52 of the vehicle 40i may be coupled to the air quality sensor 44 and the camera 48 of the vehicle 40i via a wired or wireless communication, and connected to the cloud server 80 via a wireless communication. The control device 52 of the vehicle 40i may receive the air quality reading around the vehicle 40i from the air quality sensor 44 of the vehicle 40i and the image from the camera 48 of the vehicle 40i and transmit the air quality reading around the vehicle 40i and the image to the cloud server 80 if the air quality reading is larger than an air quality reading threshold. Further, the control device 52 of the vehicle 40i may classify the image

received from the camera 48 with a trained machine learning model (e.g., a neural network model, a Bayesian model, a support vector machine model, a decision tree model and the like) received from the cloud server 80, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution. Fig. 1B shows some examples of the second type image. If the image received from the camera 48 is classified into the second type image indicating air pollution, the control device 52 of the vehicle 40i may switch the air intake of the air condition system of the vehicle 40i into the inner loop air intake to prevent the air outside the vehicle 40i from entering into the vehicle 40i.

The cloud server 80 may receive the image and the air quality reading around the vehicle 40i from the control device 52 of the vehicle 40i, and store, in a sample image database, the received image in association with the received air quality reading. The cloud server 80 may re-train the trained machine learning model with the sample images stored in the sample image database to obtain an updated machine learning model, and transmit the updated machine learning model to the vehicle 40i.

Fig. 2 illustrates a flowchart of a method for air quality control according to an embodiment of the present invention. Here, it is assumed that the trained machine learning model for classifying an image into the first type image indicating no air pollution or the second type image indicating air pollution has been stored in the cloud server 80 and transmitted to the plurality of vehicles 40 by the cloud server 80.

As shown in Fig. 2, at block 202, the control device 52 of any vehicle 40i of the plurality of vehicles 40 may receive the image including an environment ahead of the vehicle 40i from the camera 48 of the vehicle 40i and the air quality reading around the vehicle 40i from the air quality sensor 44 of the vehicle 40i. Acquiring of the image by the camera 48 and measuring of the air quality reading by the air quality sensor 44 is basically in the same time.

At block 204, the control device 52 of the vehicle 40i may transmit the received image and the received air quality reading around the vehicle 40i to the cloud server

80 if the received air quality reading is larger than an air quality reading threshold. Here, if the received air quality reading is larger than the air quality reading threshold, it indicates that there is air pollution in the environment included in the received image.

5 At block 206, the control device 52 of the vehicle 40i may obtain values of particular parameters from the received image. The particular parameters are input parameters of the trained machine learning model received from the cloud server 80 and may include: a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number. For example, the value of the vehicle emission level may
10 correspond to an average of grey values of pixels of the received image. The value of the vehicle type may indicate a large type vehicle if an area of an interesting region including a vehicle extracted from the received image is larger than an area threshold and a small type vehicle if the area of the interesting region is less than the area threshold. The value of the vehicle clean level may correspond to an average of grey
15 values of pixels of an interesting region including a vehicle extracted from the received image.

At block 208, the control device 52 of the vehicle 40i may input the values of the particular parameters into the input parameters of the trained machine learning model to classify the received image with the trained machine learning model.

20 At block 210, if the received image is classified into the second type image indicating air pollution, the control device 52 of the vehicle 40i may switch the air intake of the air condition system of the vehicle 40i into the inner loop air intake to prevent the air outside the vehicle 40i from entering into the vehicle 40i.

At block 212, the control device 52 of the vehicle 40i may notify the driver of the
25 vehicle 40i that the air intake of the air condition system of the vehicle 40i is switched into the inner loop air intake.

At block 214, when receiving from the vehicle 40i the image including the environment ahead of the vehicle 40i and the air quality reading around the vehicle 40i, the cloud server 80 may store, the sample image database, the received image in
30 association with the received air quality reading.

At block 216, the cloud server 80 may check whether the number of the sample images stored in the sample image database is larger than a number threshold.

At block 218, if the check result at block 220 is confirmative, the cloud server 80 may re-train the trained machine learning model with the sample images stored in the sample image database. For example, the cloud server 80 may obtain values of the particular parameters (the particular parameters are input parameters of the trained machine learning model and may include: the vehicle emission level, the vehicle type, the vehicle clean level, and the license plate number) from each image of the sample images stored in the sample image database to acquire the values of the particular parameters for each image of the sample images. The cloud server 80 may weigh the value of the vehicle emission level for each image of the sample images based on the air quality reading stored in association with each image of the sample images, wherein the value of the vehicle emission level is weight more if the air quality reading is larger. The cloud server 80 may then input the values of the particular parameters for each image of the sample images into the input parameters of the trained machine learning model to perform re-training of the trained machine learning model, so that an updated machine learning model is obtained. The cloud server 80 may finally delete the sample images stored in the sample image database after the updated machine learning model is obtained.

At block 220, the cloud server 80 may store the updated machine learning model.

At block 222, the cloud server 80 may transmit the updated machine learning model to the vehicle 40i.

At block 224, after receiving the updated machine learning model from the cloud server 80, the control device 52 of the vehicle 40i may replace the trained machine learning model received previously from the cloud server 80 with the updated machine learning model.

The solution of the present embodiment uses the image including an environment ahead of a particular vehicle and the machine learning model to determine whether there is air pollution around the particular vehicle, which is not necessary to have the

pollutants outside the particular vehicle to flow into the cabin of the particular vehicle. Thus, compared to the prior art, the solution of the present embodiment can improve air quality inside a vehicle.

5 Other Modifications

Those skilled in the art will appreciate that in the above embodiment, the input parameters of the machine learning model include the vehicle emission level, the vehicle type, the vehicle clean level, and the license plate number, but the present invention is not so limited. In other embodiments of the present invention, the input parameters of the machine learning model may include only a part of the vehicle emission level, the vehicle type, the vehicle clean level, and the license plate number; or, the input parameters of the machine learning model may include other suitable parameter(s) and a part of the vehicle emission level, the vehicle type, the vehicle clean level, and the license plate number; or, the input parameters of the machine learning model may include other suitable parameters except for the vehicle emission level, the vehicle type, the vehicle clean level, and the license plate number.

Those skilled in the art will appreciate that in the above embodiment, the sample images and the air quality readings required for re-training the trained machine learning model by the cloud server 80 are provided by the plurality of vehicles 40, but the present invention is not so limited. In other embodiments of the present invention, the sample images and the air quality readings required for re-training the trained machine learning model by the cloud server 80 may be provided by other suitable devices except for the plurality of vehicles 40. For example, the other suitable devices may be roadside devices on roads and/or in toll stations.

Those skilled in the art will appreciate that in the above embodiment, a prerequisite for triggering re-training of the trained machine learning model is that the number of the sample images stored in the sample image database is larger than the number threshold, but the present invention is not so limited. In other embodiments of the present invention, the prerequisite for triggering re-training of the trained machine learning model may be other suitable prerequisite except that the number of the

sample images stored in the sample image database is larger than the number threshold.

Those skilled in the art will appreciate that in the above embodiment, the trained machine learning model used by the plurality of vehicles 40 is provided by the cloud server 80, but the present invention is not so limited. In other embodiments of the present invention, the trained machine learning model may be inputted in the plurality of vehicles 40 by the manufacturers of the plurality of vehicles 40.

Those skilled in the art will appreciate that in the above embodiment, the air outside the vehicle 40i is prevented from entering into the vehicle 40i by switching the air intake of the air condition system of the vehicle 40i into the inner loop air intake, but the present invention is not so limited. In other embodiments of the present invention, the air outside the vehicle 40i may also be prevented from entering into the vehicle 40i for example by shutting off the air condition system of the vehicle 40i.

Fig. 3A illustrates a flowchart of a processing method according to an embodiment of the present invention. The processing method 300 shown in Fig. 3A may be implemented by the control device 52 for example.

As shown in Fig. 3A, the processing method 300 may include, at block 302, acquiring an image including an environment ahead of a first vehicle.

The processing method 300 may also include, at block 304, classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution.

The processing method 300 may also include, at block 306, preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.

In a first aspect, the trained machine learning model may be received from a cloud server.

In a second aspect, block 306 may include: switching an air intake of an air condition system of the first vehicle into an inner loop air intake.

In a third aspect, the processing method 300 may further include: receiving a updated machine learning model from the cloud server; and replacing the trained machine learning model with the updated machine learning model.

In a fourth aspect, the processing method 300 may further include: obtaining air quality reading around the first vehicle at the time of acquiring of the acquired image; and transmitting the acquired image and the obtained air quality reading to the cloud server if the obtained air quality reading is larger than an air quality reading threshold.

In a fifth aspect, block 304 may include: obtaining values of a plurality of parameters from the acquired image, wherein the plurality of parameters are input parameters of the trained machine learning model; and performing classifying of the acquired image by inputting the values of the plurality of parameters into the input parameters of the trained machine learning model.

In a sixth aspect, the plurality of parameters may include a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

Fig. 3B illustrates a flowchart of a processing method according to an embodiment of the present invention. The processing method 350 shown in Fig. 3B may be implemented by the cloud server 80 for example.

As shown in Fig. 3B, the processing method 350 may include, at block 352, re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution.

The processing method 350 may also include, at block 354, transmitting the updated machine learning model to vehicles.

In a first aspect, the processing method 350 may further include: receiving, from any vehicle of the vehicles, an image including an environment ahead of the any vehicle and an air quality reading around the any vehicle; and storing, in the sample

image database, the received image in association with the received air quality reading.

In a second aspect, block 352 may include: obtaining values of a plurality of parameters from each of the sample images to acquire the values of the plurality of parameters for each of the sample images, wherein the plurality of parameters is input parameters of the trained machine learning model; weighting one or more of the values of the plurality of parameters for each of the sample images based on an air quality reading stored in association with each of the sample images; and performing re-training of the trained machine learning model by inputting the values of the plurality of parameters for each of the sample images into the input parameters of the trained machine learning model.

In a third aspect, the plurality of parameters may include a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

Fig. 4A illustrates a schematic diagram of a processing apparatus according to an embodiment of the present invention. The processing apparatus 400 shown in Fig. 4A may be implemented in software, hardware or a combination of software and hardware. The processing apparatus 400 may install in the control device 52 for example.

As shown in Fig. 4A, the processing apparatus 400 may include an acquiring module 402, a classifying module 404 and a preventing module 406. The acquiring module 402 is configured for acquiring an image including an environment ahead of a first vehicle. The classifying module 404 is configured for classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution. The preventing module 406 is configured for preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.

In a first aspect, the trained machine learning model may be received from a cloud server.

In a second aspect, the preventing module 406 may be further configured for switching an air intake of an air condition system of the first vehicle into an inner loop air intake.

In a third aspect, the processing apparatus 400 may further include: a receiving module for receiving a updated machine learning model from the cloud server; and a replacing module for replacing the trained machine learning model with the updated machine learning model.

In a fourth aspect, the processing apparatus 400 may further include: an first obtaining module for obtaining air quality reading around the first vehicle at the time of acquiring of the acquired image; and a transmitting module for transmitting the acquired image and the obtained air quality reading to the cloud server if the obtained air quality reading is larger than an air quality reading threshold.

In a fifth aspect, the classifying module 404 may include: an second obtaining module for obtaining values of a plurality of parameters from the acquired image, wherein the plurality of parameters are input parameters of the trained machine learning model; and a performing module for performing classifying of the acquired image by inputting the values of the plurality of parameters into the input parameters of the trained machine learning model.

In a sixth aspect, the plurality of parameters may include a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

Fig. 4B illustrates a schematic diagram of a processing apparatus according to an embodiment of the present invention. The processing apparatus 450 shown in Fig. 4B may be implemented in software, hardware or a combination of software and hardware. The processing apparatus 450 may install in the cloud server 80 for example.

As shown in Fig. 4B, the processing apparatus 450 may include a re-training module 452 and a transmitting module 454. The re-training module 452 is configured for re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine

learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution. The transmitting module
5 454 is configured for transmitting the updated machine learning model to vehicles.

In a first aspect, the processing apparatus 450 may further include: a receiving module for receiving, from any vehicle of the vehicles, an image including an environment ahead of the any vehicle and an air quality reading around the any vehicle; and a storing module for storing, in the sample image database, the received
10 image in association with the received air quality reading.

In a second aspect, the re-training module 452 may include: an obtaining module for obtaining values of a plurality of parameters from each of the sample images to acquire the values of the plurality of parameters for each of the sample images, wherein the plurality of parameters is input parameters of the trained machine
15 learning model; a weighting module for weighting one or more of the values of the plurality of parameters for each of the sample images based on an air quality reading stored in association with each of the sample images; and a performing module for performing re-training of the trained machine learning model by inputting the values of the plurality of parameters for each of the sample images into the input parameters
20 of the trained machine learning model.

In a third aspect, the plurality of parameters may include a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

Fig. 5 illustrates a schematic diagram of a control device according to an
25 embodiment of the present invention. As shown in Fig. 5, the control device 500 may include a processor 502 and a memory 504. The memory 504 may store executable instructions which cause, when executed, the processor 502 to execute operations included in the method 300.

30 Fig. 6 illustrates a schematic diagram of a cloud server according to an

embodiment of the present invention. As shown in Fig. 6, the cloud server 600 may include a processor 602 and a memory 604. The memory 604 may store executable instructions which cause, when executed, the processor 602 to execute operations included in the method 350.

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Embodiments of the present invention may provide a machine-readable medium storing thereon executable instructions which, when executed, cause a machine to execute the above methods.

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Other embodiments and modifications of this invention will be apparent to those having ordinary skill in the art upon consideration of the specification and practice of the invention disclosed herein. The specification and examples given should be considered exemplary only, and it is contemplated that the appended claims will cover any other such embodiments or modifications as fall within the true scope of the invention.

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CLAIMS

1. A processing method, comprising:
acquiring an image including an environment ahead of a first vehicle;
classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution; and
preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.
2. The method of claim 1, wherein the trained machine learning model is received from a cloud server.
3. The method of claim 1, wherein the preventing air pollutants outside the first vehicle from entering into the first vehicle comprising:
switching an air intake of an air condition system of the first vehicle into an inner loop air intake.
4. The method of claim 2, wherein further comprising:
receiving a updated machine learning model from the cloud server; and
replacing the trained machine learning model with the updated machine learning model.
5. The method of claim 2, wherein further comprising:
obtaining air quality reading around the first vehicle at the time of acquiring of the acquired image; and
transmitting the acquired image and the obtained air quality reading to the cloud server if the obtained air quality reading is larger than an air quality reading threshold.

6. The method of claim 1, wherein the classifying the acquired image with the trained machine learning model comprising:

obtaining values of a plurality of parameters from the acquired image, wherein the plurality of parameters are input parameters of the trained machine learning model; and

performing classifying of the acquired image by inputting the values of the plurality of parameters into the input parameters of the trained machine learning model.

7. The method of claim 6, wherein the plurality of parameters comprising: a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

8. A processing method, comprising:

re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution; and

transmitting the updated machine learning model to vehicles.

9. The method of claim 8, wherein further comprising:

receiving, from any vehicle of the vehicles, an image including an environment ahead of the any vehicle and an air quality reading around the any vehicle; and

storing, in the sample image database, the received image in association with the received air quality reading.

10. The method of claim 8, wherein the re-training a trained machine learning model comprising:

obtaining values of a plurality of parameters from each of the sample images to acquire the values of the plurality of parameters for each of the sample images, wherein the plurality of parameters is input parameters of the trained machine learning model;

weighting one or more of the values of the plurality of parameters for each of the sample images based on an air quality reading stored in association with each of the sample images; and

performing re-training of the trained machine learning model by inputting the values of the plurality of parameters for each of the sample images into the input parameters of the trained machine learning model.

11. The method of claim 10, wherein the plurality of parameters comprising: a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

12. A processing apparatus, comprising:

an acquiring module for acquiring an image including an environment ahead of a first vehicle;

a classifying module for classifying the acquired image with a trained machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution; and

a preventing module for preventing air pollutants outside the first vehicle from entering into the first vehicle when the acquired image is classified into the second type image.

13. The processing apparatus of claim 12, wherein the trained machine learning model is received from a cloud server.

14. The processing apparatus of claim 12, wherein the preventing module is

further configured for:

switching an air intake of an air condition system of the first vehicle into an inner loop air intake.

15. The processing apparatus of claim 13, wherein further comprising:

a receiving module for receiving a updated machine learning model from the cloud server; and

a replacing module for replacing the trained machine learning model with the updated machine learning model.

16. The processing apparatus of claim 13, wherein further comprising:

an first obtaining module for obtaining air quality reading around the first vehicle at the time of acquiring of the acquired image; and

a transmitting module for transmitting the acquired image and the obtained air quality reading to the cloud server if the obtained air quality reading is larger than an air quality reading threshold.

17. The processing apparatus of claim 12, wherein the classifying module comprising:

an second obtaining module for obtaining values of a plurality of parameters from the acquired image, wherein the plurality of parameters are input parameters of the trained machine learning model; and

a performing module for performing classifying of the acquired image by inputting the values of the plurality of parameters into the input parameters of the trained machine learning model.

18. The processing apparatus of claim 17, wherein the plurality of parameters comprising: a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

19. A processing apparatus, comprising:

a re-training module for re-training a trained machine learning model by using sample images including environments stored in a sample image database to obtain an updated machine learning model, wherein the trained machine learning model is used to classify an image into a first type image indicating no air pollution or a second type image indicating air pollution, and the sample images include first type images indicating no air pollution and second type images indicating air pollution; and

a transmitting module for transmitting the updated machine learning model to vehicles.

20. The processing apparatus of claim 19, wherein further comprising:

a receiving module for receiving, from any vehicle of the vehicles, an image including an environment ahead of the any vehicle and an air quality reading around the any vehicle; and

a storing module for storing, in the sample image database, the received image in association with the received air quality reading.

21. The processing apparatus of claim 19, wherein the re-training module comprising:

an obtaining module for obtaining values of a plurality of parameters from each of the sample images to acquire the values of the plurality of parameters for each of the sample images, wherein the plurality of parameters is input parameters of the trained machine learning model;

a weighting module for weighting one or more of the values of the plurality of parameters for each of the sample images based on an air quality reading stored in association with each of the sample images; and

a performing module for performing re-training of the trained machine learning model by inputting the values of the plurality of parameters for each of the sample images into the input parameters of the trained machine learning model.

22. The processing apparatus of claim 21, wherein the plurality of parameters comprising: a vehicle emission level, a vehicle type, a vehicle clean level, and a license plate number.

23. A control device, comprising:

a processor; and

a memory for storing executable instructions which cause, when executed, the processor to execute operations included in the method of any of claims 1-7.

24. A cloud server, comprising:

a processor; and

a memory for storing executable instructions which cause, when executed, the processor to execute operations included in the method of any of claims 8-11.

25. A machine readable medium having thereon executable instructions for causing, when executed, a machine to execute operations included in the method of any of claims 1-11.

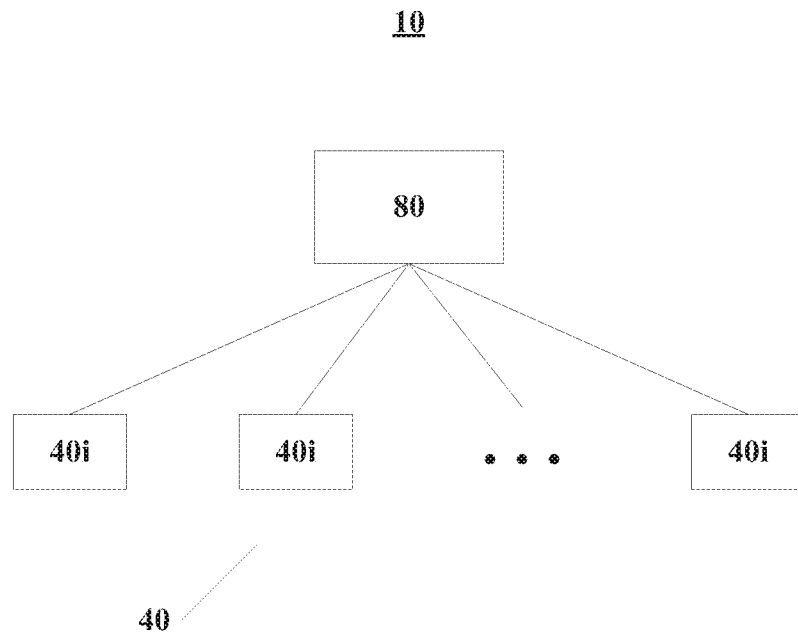


Fig. 1A



Fig. 1B

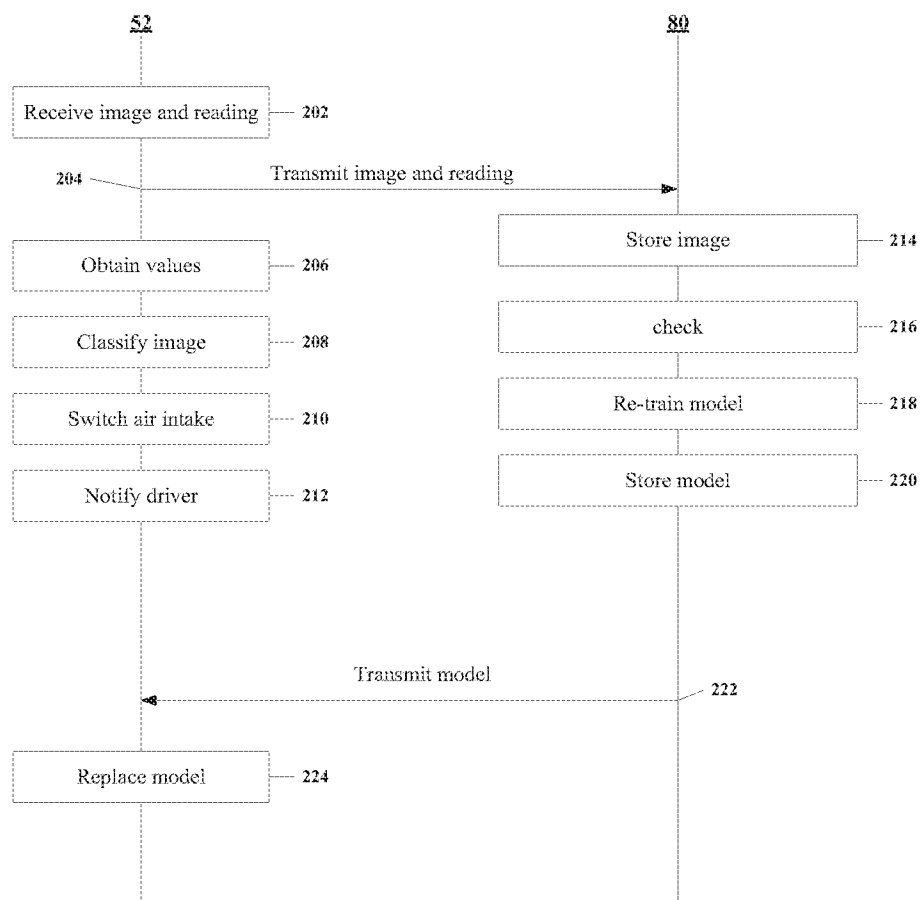


Fig. 2

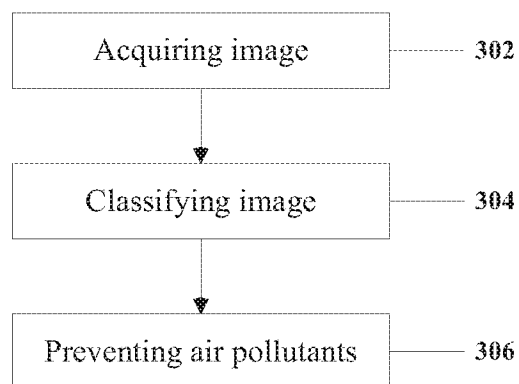
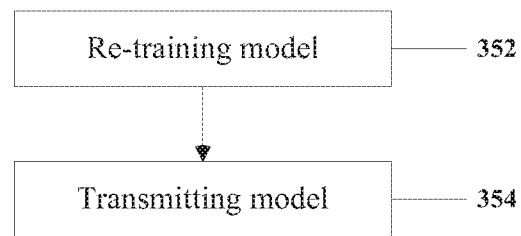
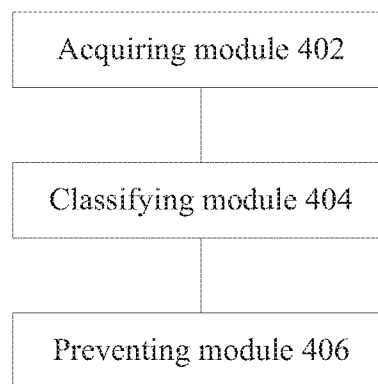
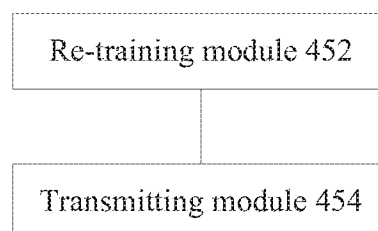
300

Fig. 3A

350**Fig. 3B**400**Fig. 4A**450**Fig. 4B**

500

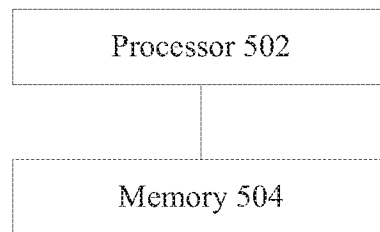


Fig. 5

600

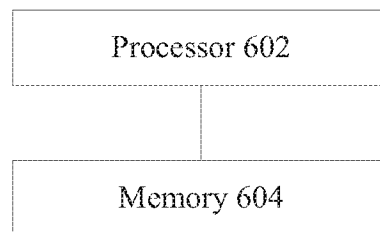


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/118946

A. CLASSIFICATION OF SUBJECT MATTER

G06K 9/20(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06K

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

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

CNKI,CNPAT,WPI,EPODOC:automobile,vehicle,image,picture,contamination,cloud,server,learning,training,model,air conditioning,air quality.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016232423 A1 (QUALCOMM INCORPORATED) 11 August 2016 (2016-08-11) description paragraphs [0016]-[0055], [0064]-[0065], figures 1-3	1-25
A	US 2017270368 A1 (ROBERT BOSCH GMBH) 21 September 2017 (2017-09-21) the whole document	1-25
A	WO 2015051959 A1 (ROBERT BOSCH GMBH) 16 April 2015 (2015-04-16) the whole document	1-25
A	US 2017166209 A1 (FORD GLOBAL TECHNOLOGIES, LLC.) 15 June 2017 (2017-06-15) the whole document	1-25

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

03 July 2018

Date of mailing of the international search report

25 July 2018

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2017/118946

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2016232423	A1	11 August 2016	EP	3256985	A1	20 December 2017
				KR	20170115544	A	17 October 2017
				JP	2018514011	A	31 May 2018
				CN	107209856	A	26 September 2017
				CA	2973212	A1	18 August 2016
				BR	112017017222	A2	03 April 2018
				WO	2016130294	A1	18 August 2016
US	2017270368	A1	21 September 2017	GB	2550032	A	08 November 2017
				GB	201703988	D0	26 April 2017
				DE	102016204206	A1	21 September 2017
				CN	107194409	A	22 September 2017
WO	2015051959	A1	16 April 2015	DE	102013220595	A1	16 April 2015
				CN	105593040	A	18 May 2016
US	2017166209	A1	15 June 2017	DE	102016223556	A1	14 June 2017
				CN	107031648	A	11 August 2017