

VEHICLE POSITION CONFIRMATION SYSTEM OF PARKING LOT USING IMAGING METHOD AND CONTROL METHOD THEREOF

TECHNICAL FIELD

[01] The present invention relates to a vehicle position confirmation system of a parking lot using an imaging method and a control method thereof, and more specifically, to a vehicle position confirmation system and a control method thereof, which can detect a position of a parked vehicle more efficiently using an image photographed by a camera installed at the top of an outdoor or ground parking lot.

BACKGROUND ART

[02] As the number of vehicles abruptly increases recently, parking facilities are running short greatly, and large buildings such as department stores, large shopping centers, hospitals and the like with a big floating population have a spacious parking facility providing a large number of parking spaces.

[03] As a large number of spacious parking lots are constructed, there are a lot of occasions in which a person does not correctly recognizes a place where his or her vehicle is parked and moves around in the large parking facility, and a problem of unnecessarily wasting time and increasing inconvenience has been raised.

[04] Accordingly, a method of sensing whether or not a vehicle is parked by installing a sensor on each of a plurality of parking surfaces in an underground parking lot and confirming a position where a vehicle is parked by recognizing the license plate of the parked vehicle using a camera installed on the ceiling of the underground parking lot has been developed.

[05] However, in the case of an outdoor or ground parking lot, although a sensor is attached on a parking surface, the recognition rate can be lowered significantly if the sensor is concealed by snow or heavy rain, and the sensor is inefficient from the aspect of maintenance since it could be out of order if water is gathered around the sensor.

[06] In addition, since the outdoor or ground parking lot does not have a ceiling and sensors are installed on the floor, movement of people is hindered, and people fall down frequently, and thus a vehicle position confirmation method developed for an underground parking lot cannot be applied.

[07] As described above, in the past, confirmation of a vehicle position in an outdoor or ground parking lot should rely on memory of a person, and an integrated management system is difficult to implement.

[08] Accordingly, development of a system capable of efficiently confirming a position of a parked vehicle in an outdoor or ground parking lot is required.

DISCLOSURE OF INVENTION

TECHNICAL PROBLEM

[09] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a user with a vehicle position confirmation system and a control method thereof, which can detect a position of a parked vehicle more efficiently using an image photographed by a camera installed at the top of an outdoor or ground parking lot.

[10] Specifically, an object of the present invention is to provide a user with a vehicle position confirmation system, which can photograph a lot of parking surfaces in a ground parking lot using a camera provided with a fisheye lens, and improve a vehicle detection rate and determine an accurate position of a vehicle by detecting the vehicle based on depth information calculated using an omnidirectional dual camera.

[11] In addition, another object of the present invention is to provide a user with a vehicle position confirmation system, which does not need to install a large number of cameras and separately install a CCTV since about twelve parking surfaces can be photographed by one omnidirectional dual camera and thus may economically and easily maintain and manage a parking lot and provide a security function using photographed images.

[12] Meanwhile, the technical problems to be solved in the present invention are not limited to those mentioned above, and

unmentioned other technical problems can be clearly understood by those skilled in the art from the following descriptions.

TECHNICAL SOLUTION

[13] To accomplish the above objects, according to one aspect of the present invention, there is provided a vehicle position confirmation system of a parking lot using an imaging method, the system including: a camera module installed at a top of the parking lot to photograph a plurality of parking surfaces partitioned in the parking lot; and an image analysis device for processing an image photographed by the camera module, in which the camera module includes: an omnidirectional camera for photographing a detection image of all directions; and a plate number recognition camera for photographing a license plate of a vehicle parked on the plurality of parking surfaces, and the image analysis device includes a sensing unit for determining whether or not a vehicle is parked on the plurality of parking surfaces using the detection image.

[14] In addition, the omnidirectional camera is an omnidirectional dual camera provided with a first fisheye lens for photographing a first detection image of all directions and a second fisheye lens for photographing a second detection image of all directions.

[15] In addition, the sensing unit may determine whether or not a vehicle is parked on the plurality of parking surfaces based on the first detection image and the second detection image.

[16] In addition, the image analysis device may further include: a position determination unit for measuring, if it is determined by the sensing unit that a vehicle is parked, a first distance between the parked vehicle and the omnidirectional dual camera using the first detection image and the second detection image, and determining a position where the vehicle is parked based on the measured distance; and a plate number recognition unit for extracting, if it is determined by the sensing unit that a vehicle is parked, information on a license plate of the parked vehicle using an image photographed by the plate number recognition camera.

[17] In addition, a factor related to a difference between the first detection image and the second detection image may be used for the measurement of the first distance of the position determination unit.

[18] In addition, the sensing unit may include: an area setting unit for setting an area of the plurality of parking surfaces photographed within the first detection image and the second detection image; a feature extraction unit for extracting a feature vector from each area of the plurality of parking surfaces set by the area setting unit; and a detection unit for

determining whether or not a vehicle is parked in the area of the plurality of parking surfaces using the feature vector.

[19] In addition, the image analysis device may further include a security module provided with a memory for storing the first detection image and the second detection image.

[20] In addition, the omnidirectional dual camera may further include: a first image sensor associated with the first fisheye lens; a second image sensor associated with the second fisheye lens; and a single image processing unit connected to the first image sensor and the second image sensor to process signals transmitted from the first image sensor and the second image sensor, in which the image processing unit may create the first detection image using a signal transmitted from the first image sensor and the second detection image using a signal transmitted from the second image sensor.

[21] In addition, the vehicle position confirmation system may further include a pole fixedly installed on a ground of the parking lot and installed with the camera module on a top, in which the camera module may be installed within a predetermined range of height from the ground.

[22] In addition, the vehicle position confirmation system may further include a full-empty parking indicator for outputting a preset indication related to whether or not a vehicle is parked on the plurality of parking surfaces, in which the image analysis

device may control output of the full-empty parking indicator according to determination of the sensing unit.

[23] According to another aspect of the present invention, there is provided a control method of a vehicle position confirmation system including a camera module installed at a top of a parking lot to photograph a plurality of parking surfaces partitioned in the parking lot; and an image analysis device for processing an image photographed by the camera module, the method including: a first step of photographing a first detection image of all directions and a second detection image of all directions using an omnidirectional dual camera; a second step of determining whether or not a vehicle is parked on the plurality of parking surfaces using the first detection image and the second detection image; a third step of measuring, if it is determined at the second step that a vehicle is parked, a first distance between the parked vehicle and the omnidirectional dual camera using the first detection image and the second detection image; a fourth step of determining a position where the vehicle is parked based on the measured distance; and a fifth step of extracting information on a license plate of the parked vehicle using a license plate of the parked vehicle photographed by a plate number recognition camera, in which the camera module is configured of the omnidirectional dual camera and the plate number recognition camera, and the omnidirectional dual camera is provided with a first fisheye lens for photographing the first

detection image and a second fisheye lens for photographing the second detection image.

ADVANTAGEOUS EFFECTS

[24] The present invention may provide a user with a vehicle position confirmation system and a control method thereof, which can detect a position of a parked vehicle more efficiently using an image photographed by a camera installed at the top of an outdoor or ground parking lot.

[25] Specifically, the present invention may provide a user with a vehicle position confirmation system, which can photograph a lot of parking surfaces in a ground parking lot using a camera provided with a fisheye lens, and improve a vehicle detection rate and determine an accurate position of a vehicle by detecting the vehicle based on depth information calculated using an omnidirectional dual camera.

[26] In addition, the present invention may provide a user with a vehicle position confirmation system, which does not need to install a large number of cameras and separately install a CCTV since about twelve parking surfaces can be photographed by one omnidirectional dual camera and thus may economically and easily maintain and manage a parking lot and provide a security function using photographed images.

[27] Meanwhile, the effects that can be obtained in the present invention are not limited to those mentioned above, and

unmentioned other effects can be clearly understood by those skilled in the art from the following descriptions.

BRIEF DESCRIPTION OF THE DRAWINGS

[28] Since the drawings accompanied in the specification of the present invention illustrate a preferred embodiment of the present invention and give a better understanding of the spirits of the present invention together with detailed descriptions of the present invention, the present invention should not be interpreted as being limited to the context described in the drawings.

[29] FIG. 1 is a view showing an example of a parking lot in which a vehicle position confirmation system of a parking lot using an imaging method of the present invention is implemented.

[30] FIG. 2 is a view showing an embodiment of the structure of a camera module that can be applied to the present invention.

[31] FIG. 3 is a view showing an embodiment of an omnidirectional dual camera that can be applied to the present invention.

[32] FIG. 4 is a view showing an example of a block diagram of a vehicle position confirmation system of a parking lot using an imaging method of the present invention.

[33] FIG. 5 is a flowchart illustrating a control method of a vehicle position confirmation system of a parking lot using an imaging method related to an example of the present invention.

[34] FIGS. 6 and 7 are views showing an embodiment of detection images photographed by an omnidirectional dual camera of the present invention.

DESCRIPTION OF SYMBOLS

2: Pole	10: Camera module
12: Omnidirectional dual camera	
16: Plate number recognition camera	
20: Vehicle detection area	22: Security image area
30: Parking surface	40: Vehicle
50: Image analysis device	60: Vehicle sensing module
61: Sensing unit	65: Position determination unit
66: Plate number recognition unit	
70: Security module	
100: Vehicle position confirmation system of parking lot using imaging method	

BEST MODE FOR CARRYING OUT THE INVENTION

[35] A vehicle position confirmation system of a parking lot using an imaging method according to an example of the present invention includes a camera module installed at the top of the parking lot to photograph a plurality of parking surfaces

partitioned in the parking lot, and an image analysis device for processing an image photographed by the camera module.

[36] The camera module is configured of an omnidirectional camera for photographing a detection image of all directions and a plate number recognition camera for photographing a license plate of a vehicle parked on the plurality of parking surfaces. The omnidirectional camera may use an omnidirectional dual camera provided with a first fisheye lens for photographing a first detection image of all directions and a second fisheye lens for photographing a second detection image of all directions.

[37] The image analysis device further includes a sensing unit for determining whether or not a vehicle is parked on the plurality of parking surfaces using the first detection image and the second detection image.

[38] Hereinafter, a preferred embodiment of the present invention will be described with reference to the drawings. In addition, the embodiment described hereinafter does not unduly limit the scope of the present invention disclosed in the claims, and the entire configuration described in this embodiment cannot be said as being indispensable as a means for solving the problems of the present invention.

[39] Although methods of confirming a position of a parked vehicle in an underground parking lot have been developed in the past, there is a problem in that a position of a vehicle is difficult to confirm in a ground parking lot.

[40] The present invention proposes a vehicle position confirmation system which can efficiently confirm a parked vehicle even in a ground parking lot using an omnidirectional dual camera.

[41] <Vehicle position confirmation system of parking lot using imaging method>

[42] Hereinafter, a vehicle position confirmation system of a parking lot using an imaging method proposed by the present invention will be described in detail with reference to the drawings.

[43] FIG. 1 is a view showing an example of a parking lot in which a vehicle position confirmation system of a parking lot using an imaging method of the present invention is implemented.

[44] Referring to FIG. 1, a vehicle position confirmation system 100 of a parking lot using an imaging method of the present invention can be applied to an outdoor parking lot in which a plurality of parking surfaces 30 is arranged configuring a plurality of columns. FIG. 1 shows part of a parking lot to which the present invention is applied, and a space for parking one vehicle 40 is provided on each parking surface 30.

[45] A camera module 10 is installed at the top of the parking lot to photograph the plurality of parking surfaces 30 partitioned in the parking lot and the vehicles 40 parked on the plurality of parking surfaces 30. Although a camera can be installed on the ceiling of a passage in an underground parking

lot, in a ground parking lot to which the present invention is applied, the camera module 10 cannot be installed in a passage of the parking lot like in the underground parking lot and generally can be installed on a pole 2 in an area where the parking surfaces 30 are arranged.

[46] The camera module 10 is configured of an omnidirectional dual camera 12 and a plate number recognition camera 16, and an installation structure of the camera module 10 is shown in FIG. 2.

[47] FIG. 2 is a view showing an embodiment of the structure of a camera module that can be applied to the present invention. The pole 2 is fixedly installed on the ground of a parking lot to which the present invention is applied and preferably fixed to the ground using bolts or fixedly inserted into the ground. A structure conventionally installed in a parking lot such as a street lamp or the like can be used as the pole 2, and a sufficiently high structure can be used so that the camera module 10 may photograph a wide area. Inside of the pole 2 may be formed to have an empty hole so that electric wires connected from the underground to supply power to the camera module 10 may pass through, and the pole 2 may be formed of a metallic material which is not corroded by rainwater or the like.

[48] A crossbar (not shown) parallel to the ground may be installed at the top of the pole 2, and the camera module 10 is installed on the crossbar so that the camera module 10 may be

installed at a position appropriate for photographing while minimizing modifications of an existing pole 2 installed in the parking lot. Inside of the crossbar may be formed to have an empty hole like the pole 2, and the crossbar is preferably formed of a metallic material.

[49] In addition, an illumination unit (not shown) for emitting light may be further installed at the top of the pole 2. Luminance by the illumination unit can be controlled by a separate controller, and such an illumination unit may provide an environment suitable for the camera module 10 to take images.

[50] As shown in FIG. 2, the camera module 10 may be installed at the top of the pole 2 and is preferably installed at a position three to five meters above the ground so that the camera module 10 may photograph approximately ten to fourteen parking surfaces 30. Since the camera module 10 is installed at a high position and detection of a vehicle and determination of a position thereof are performed through a method using an image photographed by the camera module 20, the present invention is appropriate to an outdoor or ground parking lot.

[51] The camera module 10 is configured of an omnidirectional dual camera 12 and a plate number recognition camera 16, and the omnidirectional dual camera 12 is shown in FIG. 3. FIG. 3 is a view showing an embodiment of an omnidirectional dual camera that can be applied to the present invention.

[52] Referring to FIG. 3, the omnidirectional dual camera 12 is implemented using a camera in which a fisheye lens is installed. If a fisheye lens having a wide angle of view is used, an image of an omnidirectional area (360°) around the omnidirectional dual camera 12 can be photographed.

[53] Since it is difficult to photograph approximately twelve parking surfaces 30 using one camera when a general camera is used, the present invention uses a camera provided with a fisheye lens in order to secure a large number of parking surfaces 30 even at a comparatively low height. Furthermore, the present invention is to overcome a recognition distance or restrictions according to a use environment by using a binocular camera of a type of stereo.

[54] A first fisheye lens 14a for photographing a first detection image of all directions and a second fisheye lens 14b for photographing a second detection image of all directions are installed in the omnidirectional dual camera 12. The first fisheye lens 14a operates in association with a first image sensor, and the second fisheye lens 14b operates in association with a second image sensor. The first image sensor and the second image sensor are connected to an image processing unit. Like this, although two lenses and two image sensors are installed in the omnidirectional dual camera 12 applied to the present invention, only one image processing unit is installed.

[55] The image processing unit processes signals transmitted from the first image sensor and the second image sensor. The image processing unit creates the first detection image of all directions using a signal transmitted from the first image sensor and the second detection image of all directions using a signal transmitted from the second image sensor.

[56] The detection image photographed by the omnidirectional dual camera 12 can be converted into an image free from distortions of each area by adjusting a distance ratio according to long distance or short distance. Forward mapping performed through application of a correction factor and interpolation accompanied thereto can be used as a method of correcting distorted image information, and inverse mapping, which is a method of assuming a corrected image in advance and looking for points of a distorted image matching to the points of the corrected image, also can be used.

[57] Meanwhile, referring to FIG. 1 again, the omnidirectional dual camera 12 photographs images around a place where the omnidirectional dual camera 12 is installed. The area photographed by the omnidirectional dual camera 12 includes a vehicle detection area 20 and a security image area 22 of the parking lot.

[58] The vehicle detection area 20 includes parking surfaces 30 around a column where the omnidirectional dual camera 12 is installed, and one omnidirectional dual camera 12 may

photograph a vehicle detection area 20 including twelve parking surfaces 30, approximately. The security image area 22 includes an area wider than the vehicle detection area 20.

[59] The plate number recognition camera 16 photographs a license plate of a vehicle 40 parked on a parking surface 30. The plate number recognition camera 16 may use a speed dome camera of two megapixels or more and may photograph a license plate of a vehicle illegally stopping or parking in a restricted parking zone by performing panning, tilting and zooming operations.

[60] A License Plate Recognition (LPR) camera can be used as the plate number recognition camera 16. The LPR camera is provided with a tilting device capable of tilting in the x-axis, y-axis and z-axis directions. Such an LPR camera has a configuration capable of photographing zoom-in or zoom-out images of a vehicle by rotating the camera at predetermined x and y coordinates.

[61] The omnidirectional dual camera 12 and the plate number recognition camera 16 are connected to an image analysis device 50. The image analysis device 50 will be described in detail with reference to FIG. 4.

[62] FIG. 4 is a view showing an example of a block diagram of a vehicle position confirmation system of a parking lot using an imaging method of the present invention.

[63] Referring to FIG. 4, the omnidirectional dual camera 12 and the plate number recognition camera 16 installed in the parking lot are wiredly or wirelessly connected to the image analysis device 50. The first detection image and the second detection image created by the omnidirectional dual camera 12 and a license plate image created by the plate number recognition camera 16 are transmitted to the image analysis device 50.

[64] The image analysis device 50 is largely configured of a vehicle sensing module 60 and a security module 70, and the vehicle sensing module 60 may include a sensing unit 61, a position determination unit 65 and a plate number recognition unit 66.

[65] The sensing unit 61 receives the first detection image and the second detection image from the omnidirectional dual camera 12 and determines whether or not a vehicle 40 is parked on a plurality of parking surfaces 30 using the first detection image and the second detection image. The sensing unit 61 includes an area setting unit 62, a feature extraction unit 63 and a detection unit 64.

[66] The area setting unit 62 sets an area of parking surfaces 30, which is an area where a vehicle 40 is parked, within the detection images. A vehicle 40 parked in the area of the parking surfaces 30 set by the area setting unit 62 can be photographed, and the feature extraction unit 63 extracts a feature vector from the area of the parking surfaces 30 set by

the area setting unit 62. The detection unit 64 determines whether or not a vehicle 40 is parked in the area of the parking surfaces 30 by determining whether or not the feature vector corresponds to a vehicle 40.

[67] Here, the feature vector can be extracted from the detection image using a vehicle recognition algorithm for recognizing a vehicle 40. Any one of the Scale-Invariant Feature Transform (SIFT), Speeded Up Robust Features (SURF), Histogram of Oriented Gradients (HOG), Haar-like features and Gabor filter can be used as the vehicle recognition algorithm.

[68] The feature vector extracted by the vehicle recognition algorithm may be compared with previously stored learning data. Since the learning data includes a feature vector of a general vehicle image, it is possible to determine whether or not an object photographed in the area of the parking surfaces of a surveillance image is a vehicle and recognize the vehicle.

[69] Meanwhile, the position determination unit 65 and the plate number recognition unit 66 operate in response to the determination of the sensing unit 61 on whether or not a vehicle 40 is parked, and it performs operation when the sensing unit 61 determines that a vehicle 40 is parked on the parking surface 30.

[70] The position determination unit 65 measures a distance between the parked vehicle and the omnidirectional dual camera (depth information) using the first detection image and the second detection image. At this point, the position

determination unit 65 may measure a distance between the parked vehicle and the omnidirectional dual camera using a factor related to a difference between the first detection image and the second detection image.

[71] In addition, the position determination unit 65 may determine a position where the vehicle is parked in the parking lot based on the measured distance.

[72] The plate number recognition unit 66 receives an image photographed by the plate number recognition camera and extracts information on the plate number of the vehicle using the received image. To recognize characters, first, one of three methods of detecting a license plate position of a vehicle can be executed. The first one is detecting a feature region of the license plate from a photographed image using vertical and horizontal edge information. The second one is detecting a position of the license plate of the vehicle by analyzing scan data. The third one is correctly detecting the license plate of the vehicle by directly searching for numerals and characters.

[73] If a position of the license plate of the vehicle is detected, character recognition (consonants of Korean characters + numerals) by template matching and character recognition (vowels of Korean characters) by structural features are performed, and an internal recognition algorithm specifically classifies features such as numerals, characters (consonants and vowels) and the like and reconfirms the recognized characters to

reduce misrecognition, and thus errors can be minimized when the characters are decoded.

[74] The security module 70 is provided with a memory 71 for storing the first detection image and the second detection image, and the detection images stored in the memory 71 may be set to be accessible when a problem related to security occurs in a parking facility to which the present invention is applied.

[75] The memory 71 provided in the security module 70 may include at least one type of storage media among a flash memory type medium, a hard disk type medium, a multimedia card micro type medium, a card type memory (e.g., SD or XD memory or the like), a Random Access Memory (RAM), a Static Random Access Memory (SRAM), a Read-Only Memory (ROM), an Electrically Erasable Programmable Read-Only Memory (EEPROM), a Programmable Read-Only Memory (PROM), a magnetic memory, a magnetic disk, and an optical disk.

[76] Meanwhile, a full-empty parking indicator (not shown) for displaying whether or not vehicles 40 are parked on a plurality of parking surfaces 30 can be installed in a parking lot to which the present invention is applied.

[77] The full-empty parking indicator outputs an indication for easily informing drivers entering the parking lot of whether or not an available parking space remains. The indication may include a visual output related to a preset color or an auditory

output for providing a voice related to whether or not the parking lot is full.

[78] At this point, the image analysis device 50 may control output of the full-empty parking indicator according to determination of the sensing unit 61 on the parking surfaces 30. For example, if it is determined that vehicles 40 are parked on all the parking spaces 30, the full-empty parking indicator may output an indication of 'Parking Space Full', and if it is determined that there are available parking surfaces 30 for parking vehicles 40, the full-empty parking indicator may output an indication of 'Parking Space Available'. In addition, the full-empty parking indicator may be configured to individually indicate whether or not a vehicle 40 is parked on each parking surface 30.

[79] <Control method of vehicle position confirmation system of parking lot using imaging method>

[80] Hereinafter, a control method of a vehicle position confirmation system of a parking lot using an imaging method configured as described above will be described in detail.

[81] FIG. 5 is a flowchart illustrating a control method of a vehicle position confirmation system of a parking lot using an imaging method related to an example of the present invention.

[82] First, a first detection image of all directions and a second detection image of all directions are photographed using the omnidirectional dual camera 12, and the sensing unit 61

determines whether or not vehicles 40 are parked on a plurality of parking surfaces 30 of the parking lot using the first detection image and the second detection image(step S10).

[83] The detection image photographed by the omnidirectional dual camera 12 has a distorted aspect ratio, and it is preferable that the detection image is restored to a standard image by adjusting the aspect ratio. Specifically, the detection image is divided into equal angle split images of three channels partitioned by equal angles of 120° at the center of the screen, and the center portion of an omnidirectional image is classified as a center portion image of one channel. In this case, since the rectangular area of one channel at the center is restored, an image partially overlapped with the three channels of the equal angle split images may be generated. A standard image expressed as partitioned images generated by adjusting the aspect ratio and partitioning an image into four channels is compressed as a monitoring image while maintaining the four channels as they are and transmitted to the image processing unit 50. Here, the partitioned images of four channels are illustrative, and the number of partitioned images does not make any problem as long as it does not depart from the objects of the present invention.

[84] Abrupt changes in illumination caused by changes of the weather or the sun may make it difficult for a monocular camera to recognize a vehicle, and the present invention may

detect a vehicle based on depth information measured by the omnidirectional dual camera 12. A method using an IR LED or an IR Band Pass Filter can be used at night when illumination is poor.

[85] Furthermore, the present invention calculates disparity only in a line setting area, not a dense parity, and may determine whether or not a vehicle is parked by determining the line disparity feature.

[86] Subsequently, if it is determined at step S10 that a vehicle 30 is parked on any one or more parking surfaces among a plurality of parking surfaces 30, the position determination unit 65 measures a distance between the parked vehicle 30 and the omnidirectional dial camera 12 using the first detection image and the second detection image (step S20).

[87] FIGS. 6 and 7 will be described first to specifically describe measurement of distance of the position determination unit 65. FIGS. 6 and 7 are views showing an embodiment of detection images photographed by an omnidirectional dual camera of the present invention.

[88] Due to the difference between the first fisheye lens 14a and the second fisheye lens 14b of the omnidirectional dual camera 12, as shown in FIGS. 6 and 7, there is a difference between the first detection image and the second detection image. The position determination unit 65 may measure a distance to the parked vehicle 40 using a factor related to the difference

between first detection image and the second detection image. Stereo matching may be used for measurement of the position determination unit 65.

[89] Referring to FIG. 5 again, the position determination unit 65 determines a position where the vehicle is parked based on the distance measured at step S20 (step S30), and the plate number recognition unit 66 extracts information on the plate number of the parked vehicle using the license plate of the parked vehicle photographed by the plate number recognition camera 16 (step S30).

[90] The license plate information and the position information of the vehicle can be stored in the memory of the image analysis device 50, and the information can be provided to the vehicle owner through a predetermined method.

[91] Meanwhile, the present invention can be implemented as a computer-readable code in a computer-readable recording medium. The computer-readable recording medium includes all kinds of recording devices for storing data that can be read by a computer system. Examples of the computer-readable recording medium are ROM, RAM, CD-ROM, a magnetic tape, a floppy disk, an optical data storage device and the like, and, in addition, a medium implemented in the form of a carrier wave (e.g., transmission through the Internet) is also included. In addition, the computer-readable recording medium may be distributed in computer systems connected through a network, and a code that can be read

by a computer in a distributed manner can be stored and executed therein. In addition, functional programs, codes and code segments for implementing the present invention can be easily inferred by programmers in the art.

[92] The apparatus and method having described so far may not be limited to the configurations and methods of the described embodiments, but the whole or parts of the embodiments may be selectively combined so as to implement various modifications.

[CLAIMS]

1. A vehicle position confirmation system of a parking lot using an imaging method, the system comprising:

a camera module installed at a top of the parking lot to
5 photograph a plurality of parking surfaces partitioned in the parking lot; and

an image analysis device for processing an image photographed by the camera module, wherein

the camera module includes:

10 an omnidirectional camera for photographing a detection image of all directions; and

a plate number recognition camera for photographing a license plate of a vehicle parked on the plurality of parking surfaces, and

15 the image analysis device includes a sensing unit for determining whether or not a vehicle is parked on the plurality of parking surfaces using the detection image.

2. The system according to claim 1, wherein the
20 omnidirectional camera is an omnidirectional dual camera provided with a first fisheye lens for photographing a first detection image of all directions and a second fisheye lens for photographing a second detection image of all directions.

3. The system according to claim 2, wherein the sensing unit determines whether or not a vehicle is parked on the plurality of parking surfaces based on the first detection image and the second detection image.

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4. The system according to claim 3, wherein the image analysis device further includes:

a position determination unit for measuring, if it is determined by the sensing unit that a vehicle is parked, a first distance between the parked vehicle and the omnidirectional dual camera using the first detection image and the second detection image, and determining a position where the vehicle is parked based on the measured distance; and

a plate number recognition unit for extracting, if it is determined by the sensing unit that a vehicle is parked, information on a license plate of the parked vehicle using an image photographed by the plate number recognition camera.

5. The system according to claim 4, wherein a factor related to a difference between the first detection image and the second detection image is used for the measurement of the first distance of the position determination unit.

6. The system according to claim 3, wherein the sensing unit includes:

an area setting unit for setting an area of the plurality of parking surfaces photographed within the first detection image and the second detection image;

a feature extraction unit for extracting a feature vector
5 from each area of the plurality of parking surfaces set by the area setting unit; and

a detection unit for determining whether or not a vehicle is parked in the area of the plurality of parking surfaces using the feature vector.

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7. The system according to claim 3, wherein the image analysis device further includes a security module provided with a memory for storing the first detection image and the second detection image.

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8. The system according to claim 3, wherein the omnidirectional dual camera further includes:

a first image sensor associated with the first fisheye lens;

a second image sensor associated with the second fisheye

20 lens; and

a single image processing unit connected to the first image sensor and the second image sensor to process signals transmitted from the first image sensor and the second image sensor, wherein

the image processing unit creates the first detection image

25 using a signal transmitted from the first image sensor and the

second detection image using a signal transmitted from the second image sensor.

9. The system according to claim 1, further comprising a pole fixedly installed on a ground of the parking lot and installed with the camera module on a top, wherein the camera module is installed within a predetermined range of height from the ground.

10. The system according to claim 1, further comprising a full-empty parking indicator for outputting a preset indication related to whether or not a vehicle is parked on the plurality of parking surfaces, wherein the image analysis device controls output of the full-empty parking indicator according to determination of the sensing unit.

11. A control method of a vehicle position confirmation system including a camera module installed at a top of a parking lot to photograph a plurality of parking surfaces partitioned in the parking lot; and an image analysis device for processing an image photographed by the camera module, the method comprising:

a first step of photographing a first detection image of all directions and a second detection image of all directions using an omnidirectional dual camera;

a second step of determining whether or not a vehicle is parked on the plurality of parking surfaces using the first detection image and the second detection image;

a third step of measuring, if it is determined at the second
5 step that a vehicle is parked, a first distance between the parked vehicle and the omnidirectional dual camera using the first detection image and the second detection image;

a fourth step of determining a position where the vehicle is parked based on the measured distance; and

10 a fifth step of extracting information on a license plate of the parked vehicle using a license plate of the parked vehicle photographed by a plate number recognition camera, wherein

the camera module is configured of the omnidirectional dual camera and the plate number recognition camera, and

15 the omnidirectional dual camera is provided with a first fisheye lens for photographing the first detection image and a second fisheye lens for photographing the second detection image.