CLAIMS

1. A method for detecting an on-duty state of a driver, comprising:

determining that a vehicle-mounted image acquisition device is not blocked;

extracting a face image from an image acquired by the vehicle-mounted image acquisition device when a vehicle is in a starting state, wherein the vehicle-mounted image acquisition device is mounted on the vehicle and is at least configured to acquire an image of a driving position region of the vehicle; and

in response to the case that no face image is extracted from the acquired image, determining that the driver is off duty.

2. The method according to claim 1, further comprising:

in response to the case that a face image is extracted from the acquired image, determining whether the features of the face image extracted from the image match the features of a pre-stored face image of the driver; and

in response to the case that the features of the face image extracted from the acquired image do not match the features of the pre-stored face image of the driver, determining that the driver is off duty.

3. The method according to claim 2, wherein in response to the case that the features of the face image extracted from the acquired image does not match the features of the pre-stored face image of the driver, determining that the driver is off duty comprises:

in response to the case that the face images extracted from the acquired image comprise a plurality of face images, selecting, from the plurality of face images, a face image in the driving position region in the acquired image; and

in response to the case that the features of the selected face image do not match the features of the pre-stored face image of the driver, determining that the driver is off duty~~.~~,

~~4. The method according to claim 2 or 3,~~ wherein the method further ~~comprising~~comprises:

in response to the case that the features of the face image extracted from the acquired image match the features of the pre-stored face image of the driver, determining that the driver is on duty.

~~5~~4. The method according to claim ~~4~~3, wherein in response to the case that the features of the face image extracted from the acquired image match the features of the pre-stored face image of the driver, determining that the driver is on duty comprises:

in response to the case that the face images extracted from the acquired image comprise a plurality of face images, selecting, from the plurality of face images, a face image in the driving position region in the acquired image; and

in response to the case that the features of the selected face image match the features of the pre-stored face image of the driver, determining that the driver is on duty.

~~6~~5. The method according to any one of claims 1 to ~~5~~4, further comprising:

in response to the case that a duration during which the driver is continuously off duty exceeds a first set duration, sending first warning information.

~~7~~6. The method according to claim ~~6~~5, wherein after sending the first warning information, the method further comprises:

after determining that the driver is on duty, stopping sending the first warning information.

~~8~~7. The method according to any one of claims 1 to ~~7~~6, further comprising:

locally saving the image acquired by the vehicle-mounted image acquisition device when the driver is in an off-duty state, or uploading same to the cloud.

~~9~~8. The method according to any one of claims 2 to ~~7~~6, wherein the face image of the driver is pre-stored by using the following operations:

after authentication succeeds on a mobile terminal, uploading the face image of the driver to a cloud server by means of the mobile terminal and saving the face image in the cloud server; and

after the face image of the driver saved in the cloud server and related to the vehicle is updated, sending, by the cloud server, the updated face image of the driver related to the vehicle to the vehicle after the vehicle establishes a connection with the cloud server.

~~10~~9. The method according to any one of claims 2 to ~~7~~6, wherein the face image of the driver is pre-stored by using the following operations:

in the case that the vehicle is in the starting state but does not travel, after the authentication succeeds, acquiring the face image of the driver by means of the vehicle-mounted image acquisition device and saving same.

~~11~~10. The method according to any one of claims 1 to ~~10~~9, wherein determining that the vehicle-mounted image acquisition device is not blocked comprises:

determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in a blocked state.

~~12~~11. The method according to claim ~~11~~10, wherein determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state comprises:

determining an average brightness of the image according to the acquired image; and

in response to a duration during which the average brightness of the image is less than a first brightness threshold being greater than or equal to a second set duration, or a duration during which the average brightness of the image is greater than a second brightness threshold being greater than or equal to the second set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein

the first brightness threshold is less than the second brightness threshold.

~~13~~12. The method according to claim ~~11~~10, wherein determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state further comprises:

determining that an average brightness of the acquired image is greater than or equal to a

first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold; and

in response to a duration during which a ratio of a foreground area of the acquired image to an effective area of the acquired image is greater than a set value being greater than or equal to a third set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to an area of the acquired image.

~~14~~13. The method according to claim ~~11~~10, wherein determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state further comprises:

determining that an average brightness of the acquired image is greater than or equal to a first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold;

determining that a ratio of a foreground area of the acquired image to an effective area of the acquired image is less than or equal to a set value, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to an area of the acquired image; and

in response to a duration during which a number of contours in the acquired image is less than a set number being greater than or equal to a fourth set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein the number of contours is a number of target contours obtained by performing contour detection on the acquired image.

~~15~~14. The method according to claim ~~11~~10, wherein determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state further comprises:

determining that an average brightness of the acquired image is greater than or

equal to a first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold;

determining that a ratio of a foreground area of the acquired image to an effective area of the acquired image is less than or equal to a set value, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to an area of the acquired image; and

in response to a number of contours in the acquired image being greater than or equal to a set number, determining that the vehicle-mounted image acquisition device is in an unblocked state, wherein

the number of contours is a number of target contours obtained by performing contour detection on the acquired image.

~~16~~15. The method according to any one of claims ~~13~~ 12 to ~~15~~14, wherein the effective area of the acquired image is preset according to relative positions of the vehicle-mounted image acquisition device and a light supplementing lamp, and the light supplementing lamp is configured to supplement light for a region where the vehicle-mounted image acquisition device performs image acquisition.

~~17. The method according to any one of claims 1 to 16, wherein the vehicle-mounted image acquisition device is an infrared camera.~~

~~18~~16. The method according to any one of claims ~~11~~ 10 to ~~17~~15, wherein in the case that the vehicle-mounted image acquisition device is determined to be in the blocked state, the method further comprises:

in response to a duration during which the vehicle-mounted image acquisition device is continuously in the blocked state being greater than a fifth set duration, sending second warning information.

~~19~~17. The method according to claim ~~18~~16, wherein after sending the second warning information, the method further comprises:

after determining that the vehicle-mounted image acquisition device is in the unblocked state, stopping sending the second warning information.

~~20. The method according to any one of claims 1 to 19, wherein the starting state of the vehicle comprises that a traveling speed of the vehicle is greater than a set speed.~~

~~21~~18. An apparatus for detecting an on-duty state of a driver, comprising a first processing module, an extracting module, and a second processing module, wherein

the first processing module is configured to determine that a vehicle-mounted image acquisition device is not blocked;

the extracting module is configured to extract a face image from an image acquired by the vehicle-mounted image acquisition device when a vehicle is in a starting state, wherein the vehicle-mounted image acquisition device is mounted on the vehicle and is at least configured to acquire an image of the driving position region of the vehicle; and

the second processing module is configured to: in response to the case that no face image is extracted from the acquired image, determine that the driver is off duty.

~~22. The apparatus according to claim 21, wherein the second processing module is further configured to:~~

~~in response to the case that a face image is extracted from the acquired image, determine whether the features of the face image extracted from the image match the features of a pre-stored face image of the driver; and~~

~~in response to the case that the features of the face image extracted from the acquired image do not match the features of the pre-stored face image of the driver, determine that the driver is off duty.~~

~~23. The method according to claim 22, wherein the second processing module is configured to: in response to the case that the features of the face image extracted from the acquired image do not match the features of the pre-stored face image of the driver, determine that the driver is off duty, comprising:~~

~~in response to the case that the face images extracted from the acquired image comprise a plurality of face images, selecting, from the plurality of face images, a face~~

~~image in the driving position region in the acquired image; and in response to the case that the features of the selected face image do not match the features of the pre-stored face image of the driver, determining that the driver is off duty.~~

~~24. The apparatus according to claim 22 or 23, wherein the second processing module is further configured to:~~

~~in response to the case that the features of the face image extracted from the acquired image match the features of the pre-stored face image of the driver, determine that the driver is on duty.~~

~~25. The apparatus according to claim 24, wherein the second processing module is configured to: in response to the case that the features of the face image extracted from the acquired image match the features of the pre-stored face image of the driver, determine that the driver is on duty, comprising:~~

~~in response to the case that the face images extracted from the acquired image comprise a plurality of face images, selecting, from the plurality of face images, a face image in the driving position region in the acquired image; and in response to the case that the features of the selected face image match the features of the pre-stored face image of the driver, determining that the driver is on duty.~~

~~26. The apparatus according to any one of claims 21 to 25, wherein the second processing module is further configured to send, in response to the case that a duration during which the driver is continuously off duty exceeds a first set duration, first warning information.~~

~~27. The apparatus according to claim 26, wherein the second processing module is further configured to stop sending the first warning information after sending the first warning information and after determining that the driver is on duty.~~

~~28. The apparatus according to any one of claims 21 to 27, wherein the second processing module is further configured to locally save the image acquired by the vehicle-mounted image acquisition device when the driver is in an off-duty state, or upload same to the cloud.~~

~~29. The apparatus according to any one of claims 22 to 27, wherein the first processing module is further configured to pre-store the face image of the driver by using the following operations:~~

~~after authentication succeeds on a mobile terminal, uploading the face image of the driver to a cloud server by means of the mobile terminal and saving the face image in the cloud server; and~~

~~after the face image of the driver saved in the cloud server and related to the vehicle is updated, sending, by the cloud server, the updated face image of the driver related to the vehicle to the vehicle after the vehicle establishes a connection with the cloud server.~~

~~30. The apparatus according to any one of claims 22 to 27, wherein the first processing module is further configured to pre-store the face image of the driver by using the following operations:~~

~~in the case that the vehicle is in the starting state but does not travel, after the authentication succeeds, acquiring the face image of the driver by means of the vehicle-mounted image acquisition device and saving same.~~

~~31. The apparatus according to any one of claims 21 to 30, wherein the first processing module is configured to determine that the vehicle-mounted image acquisition device is not blocked, comprising:~~

~~determining, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in a blocked state.~~

~~32. The apparatus according to claim 31, wherein the first processing module is configured to determine, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state, comprising:~~

~~determining an average brightness of the image according to the acquired image; and in response to a duration during which the average brightness of the image is less than a first brightness threshold being greater than or equal to a second set duration, or a~~

duration during which the average brightness of the image is greater than a second brightness threshold being greater than or equal to the second set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein the first brightness threshold is less than the second brightness threshold.

33. The apparatus according to claim 31, wherein the first processing module is configured to determine, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state, further comprising:

determining that an average brightness of the acquired image is greater than or equal to a first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold; and

in response to a duration during which a ratio of a foreground area of the acquired image to an effective area of the acquired image is greater than a set value being greater than or equal to a third set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to an area of the acquired image.

34. The apparatus according to claim 31, wherein the first processing module is configured to determine, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state, further comprising:

determining that an average brightness of the acquired image is greater than or equal to a first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold;

determining that a ratio of a foreground area of the acquired image to an effective area of the acquired image is less than or equal to a set value, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to an area of the acquired image; and

in response to a duration during which a number of contours in the acquired image is less

than a set number being greater than or equal to a fourth set duration, determining that the vehicle-mounted image acquisition device is in the blocked state, wherein the number of contours is a number of target contours obtained by performing contour detection on the acquired image.

35. The apparatus according to claim 31, wherein the first processing module is configured to determine, according to the image acquired by the vehicle-mounted image acquisition device when the vehicle is in the starting state, whether the vehicle-mounted image acquisition device is in the blocked state, further comprising:

determining that an average brightness of the acquired image is greater than or equal to a first brightness threshold, and is less than or equal to a second brightness threshold, wherein the first brightness threshold is less than the second brightness threshold;

determining that a ratio of a foreground area of the acquired image to an effective area of the acquired image is less than or equal to a set value, wherein the foreground area represents an area of a foreground portion of an image recognized from the acquired image, and the effective area is preset and is less than or equal to the area of an acquired image; and

in response to a number of contours in the acquired image being greater than or equal to a set number, determining that the vehicle-mounted image acquisition device is in an unblocked state, wherein

the number of contours is a number of target contours obtained by performing contour detection on the acquired image.

36. The apparatus according to any one of claims 33 to 35, wherein the effective area of the acquired image is preset according to relative positions of the vehicle-mounted image acquisition device and a light supplementing lamp, and the light supplementing lamp is configured to supplement light for a region where the vehicle-mounted image acquisition device performs image acquisition.

37. The apparatus according to any one of claims 21 to 36, wherein the vehicle-mounted image

~~acquisition device is an infrared camera.~~

~~38. The apparatus according to claims 31 to 37, wherein the first processing module is further configured to send, in the case that the vehicle-mounted image acquisition device is determined to be in the blocked state, second warning information in response to a duration during which the vehicle-mounted image acquisition device is continuously in the blocked state being greater than a fifth set duration.~~

~~39. The apparatus according to claim 38, wherein the first processing module is further configured to stop sending the second warning information after sending the second warning information and after determining that the vehicle-mounted image acquisition device is in the unblocked state.~~

~~40. The apparatus according to any one of claims 21 to 39, wherein the starting state of the vehicle comprises that a traveling speed of the vehicle is greater than a set speed.~~

~~41~~19. An electronic device, comprising a processor and a memory configured to store a computer program runnable on the processor, wherein

the processor is configured to execute, when the computer program is run, the method according to any one of claims 1 to ~~20~~17.

~~42~~20. A computer storage medium having a computer program stored thereon, wherein when the computer program is executed by a processor, the method according to any one of claims 1 to ~~20~~ 17 is implemented.

~~43. A computer program product, wherein the computer program product comprises computer executable instructions; and after the computer executable instructions are executed, the method according to any one of claims 1 to 20 can be implemented.~~